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Cost Methodology for the Final Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations

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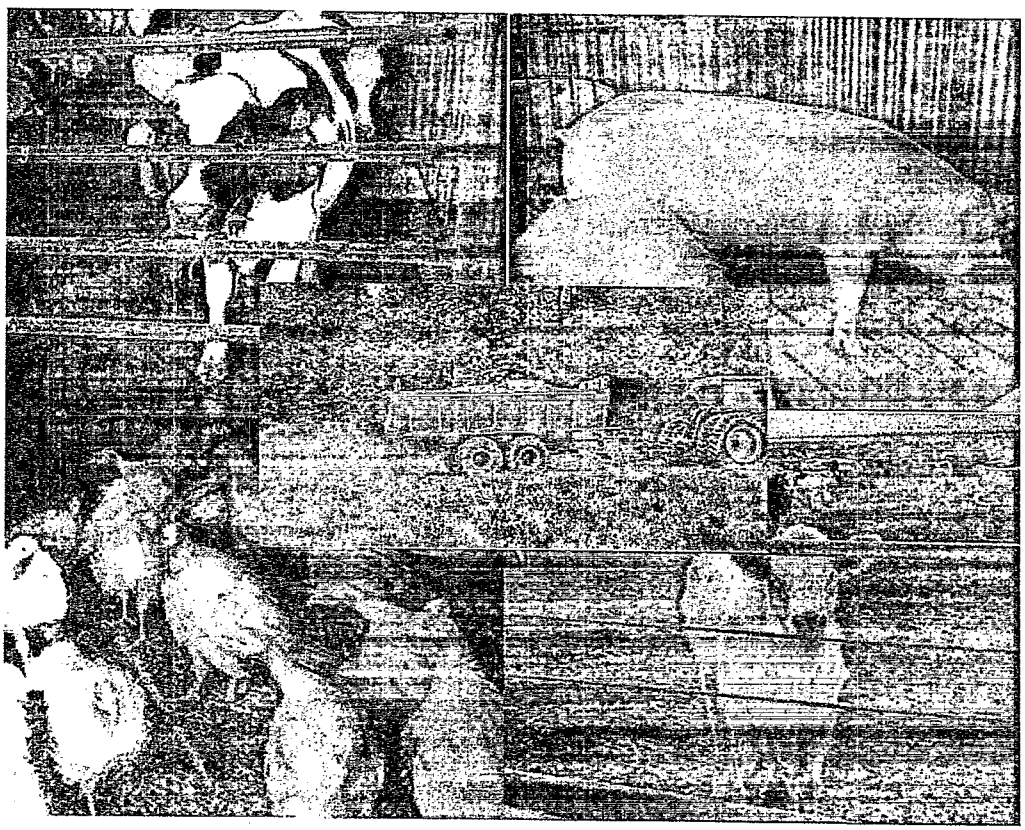

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Cost Methodology for the Final Revisions to the National Pollutant Discharge Elimination System Regulation and the Effluent Guidelines for Concentrated Animal Feeding Operations

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1.0 INTRODUCTION

Section 301(d) of the Clean Water Act (CWA) directs EPA to periodically review and revise, if necessary, effluent limitations guidelines and standards promulgated under CWA Sections 301, 304, and 306. Concentrated animal feeding operations (CAFOs) have been identified as a major source of nutrients impairing surface water and ground water in the United States; therefore, EPA is revising the existing effluent guidelines for CAFOs.

For beef, dairy, heifer, veal, swine, chicken, and turkey animal feeding operations, EPA collected data on the amount of manure and wastewater produced, the pollution control and management practices in place, and current land-application practices at the operations. Based on these data, EPA identified new regulatory requirements to be imposed on concentrated animal feeding operations (CAFOs) through revision of the effluent guidelines and standards. This report describes the methodology used to estimate engineering compliance costs (in 1997 dollars) associated with installing and operating the various technologies and practices that make up the 10 regulatory options considered for beef, dairy, heifer, veal, swine, chicken, and turkey operations. The technologies described in this report were used to estimate compliance costs, but are not necessarily mandated by the rule. In practice, a facility may choose a different waste management system to meet the requirements of the rule.

Section 1.1 describes the regulatory options considered for CAFOs, Section 1.2 discusses the development of model farms used to determine compliance costs for each option, Section 1.3 defines key terms used throughout this report, and Section 1.4 presents the overall organization of the report.

1.1 Regulatory Options

EPA considered the following 10 regulatory options for CAFOs. These options are described below:

1 Zero discharge from a facility designed, maintained, and operated to hold manure, litter, and other process wastewater, including direct precipitation and runoff from a 25-year, 24-hour rainfall event. This option includes implementation of feedlot best management practices, including stormwater diversions; lagoon and pond depth markers; periodic inspections; nitrogen-based agronomic application rates; elimination of manure application within 100 feet of any surface water, tile drain inlet, or sinkhole; mortality-handling, nutrient management planning, and recordkeeping guidelines.

1A The same elements as Option 1, with the addition of storage capacity for the chronic storm event (10-year, 10-day storm) above any capacity necessary to hold manure, litter, and other process wastewater, including direct participation and runoff from a 25-year, 24-hour rainfall event.

2 The same elements as Option 1, except nitrogen-based agronomic application rates are replaced by phosphorus-based agronomic application rates when dictated by site-specific conditions.

3A/3B The same elements as Option 2, plus Option 3A facility costs include an assessment of the ground water's hydrologic link to surface water; Option 3B facility costs include ground water monitoring, concrete pads, synthetically lined lagoons and/or synthetically lined storage ponds.

3C/3D The same elements as Option 2, plus permeability standards for lagoons and storage ponds, which may include costs for synthetically lined lagoons and ponds.

4 The same elements as Option 2, plus costs for additional surface water monitoring.

5 For swine, poultry, and veal operations only, the same elements as Option 2, but is based on zero discharge with no overflow under any circumstances (i.e., total confinement and covered storage).

5A For beef, dairy, and heifer operations only, the same elements as Option 2, plus implementation of a drier manure management system (i.e., composting).

6 For the large swine and dairy operations only, the same elements as Option 2, plus implementation of anaerobic digestion with energy recovery.

7 The same elements as Option 2, plus timing restrictions on land application of animal waste to frozen, snow-covered, or saturated ground.

EPA also conducted several sensitivity analyses, described in Section 8.

EPA selected Option 2 as BAT for all CAFOs and as New Source Performance Standards (NSPS) for beef feedlots, dairies, and heifer operations. EPA selected Option 5 as NSPS for swine, poultry, and veal operations or containment for 100-year storm (see the Technical Development Document for additional information).

To determine the cost of complying with each option, EPA developed model farms that form the basis of the cost estimate for each type of operation under the regulatory options. The waste management technologies that make up the model farms are based primarily on the animal type and the types of waste managed. Waste management practices determine the amount of manure waste and wastewater generated that are used to size and cost various technologies or practices. Where differences in production practices (such as the finishing versus farrowing phases of swine production) or waste management practices (such as under-house pits versus lagoons) are significantly different within an animal sector, EPA developed additional model farms to better reflect costs incurred by each type of operation. Ultimately, EPA developed more than 15,000 model farms to reflect the variability in production, waste management, farm size, crop land availability, and regional and climatic differences. Table 1.1-1 presents the technologies and practices that are included for each option.

The types of operations used to model beef, dairy, heifer, swine, chicken, turkey, and veal facilities are summarized below:

- Beef feedlots and heifer operations house cattle on drylots. The manure that is deposited in the drylot is periodically scraped and stockpiled on site or is transported to cropland on or off site. It is handled as a solid material. Runoff from the feedlot operation is collected and stored in a waste storage pond with capacity for the 25-year, 24-hour rainfall and 180 days of storage. Runoff is treated in a sedimentation basin before going to the storage pond.

Table 1.1-1

Summary of Regulatory Options

Technology or Practice	Options									
	1	1A	2	3A/ 3B	3C/ 3D	4	5	5A	6	7
Feedlot best management practices (BMPs), including stormwater diversions, covered storage for dry poultry litter, lagoon/pond depth markers, periodic inspections, and recordkeeping.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mortality-handling requirements (e.g., rendering, composting).[a]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Nutrient management planning and recordkeeping (sample soils once every 3 years, sample manure twice per year).	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Land application limited to nitrogen-based agronomic application rates.	✓	✓								
Land application limited to phosphorus-based agronomic application rates where dictated by site-specific conditions, and nitrogen-based application elsewhere.			✓	✓	✓	✓	✓	✓	✓	✓
No manure application within 100 feet of any surface water, tile drain inlet, or sinkhole.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ground water requirements, including assessment of hydrologic link, monitoring wells (4 per facility), sampling, impermeable pads under storage, impermeable lagoon/pond liners, and temporary/modified storage during upgrade.				✓						
Ground water requirements including performance based standards for lagoons.					✓					
Additional capacity for 10-year, 10-day chronic storm event.		✓								
Surface-water monitoring requirement (4 total grab samples upstream and downstream of both feedlot and land application areas, 12x/yr; one composite sample collected 1x/yr at stockpile and surface impoundments. Samples are analyzed for nitrogen, phosphorus, and total suspended solids.).						✓				
Drier manure technology basis (covered lagoons for veal, swine (option 5), and layers (option 5) and composting[b] for beef feedlots, dairies, heifer, and veal operations). Retrofit to high-rise houses for swine and wet layer operations under option 5A.							✓	✓		
Anaerobic digestion.									✓	
Timing requirements for land application (resulting in regional variation in storage periods).										✓

[a]There are no additional compliance costs expected for beef feedlots, dairies, and heifer and veal operations related to mortality-handling requirements.
[b]Composting is included in Options 1 through 4 and Option 7 when expected to be the least costly method of handling manure.

- Dairies with flush barns house the milking cows (both lactating and dry) in freestall barns that are flushed twice daily while the cows are being milked. The cows are milked in separate parlors that are flushed between milkings. Flush water and manure is collected in a central collection system and transported to an on-site anaerobic lagoon, with capacity for the 25-year 24-hour rainfall and 180 days of storage. The wastewater is treated in a solids separator before going to the lagoon.

  Immature animals (i.e., heifers and calves) are housed on drylots. The manure that is deposited in the drylot is periodically scraped and stockpiled on site or is transported to cropland on or off site. It is handled as a solid material. Runoff from the drylot is routed directly to the lagoon.

- Dairies with scrape barns house the milking cows (both lactating and dry) in freestall barns that are scraped daily. The scraped manure is stored on site or is transported to cropland on or off site. The cows are milked in separate parlors that are hosed down between milkings. Parlor hose water and manure is collected in a central collection system and transported to an on-site anaerobic lagoon with capacity for the 25-year, 24-hour rainfall event and 180 days of storage. Wastewater is treated in a solids separator before going to the lagoon.

  Immature animals (i.e., heifers and calves) are housed on drylots. Their manure is handled as described under flush barns above.

- Veal operations house the veal calves in confinement barns that are flushed daily. The flush water and manure is collected and stored in a central collection system, usually a lagoon or a pit under the barn, until it is transported to cropland on or off site. Storage lagoons are sized to hold 180 days of storage.

- Farrow-to-finish swine operations house swine in total confinement barns. Farrow-to-finish operations include all common production phases including farrowing, nursery, and finishing (final production). Manure from these operations is stored in a pit under the house, flushed to an on-site anaerobic lagoon with capacity for direct precipitation from the 25-year, 24-hour rainfall event, or flushed to an evaporative lagoon.

- Grow/finish operations house swine in total confinement barns. Grow/finish operations specialize in the finishing phase. Manure from these operations is stored in a pit under the house, flushed to an on-site anaerobic lagoon with capacity for direct precipitation from the 25-year, 24-hour rainfall event, or flushed to an evaporative lagoon.

- Broilers are housed in total confinement barns on the floor where droppings are mixed with bedding such as wood shavings to form litter.

Litter close to drinking water forms a dry cake that is removed between flocks. The rest of the litter in a broiler house is removed periodically (usually every 1 to 3 years) from the barns.

- Layers are confined in cages in high-rise housing or shallow pit flush housing. In a high-rise house, the layer cages are suspended over a bottom story, where the manure is deposited and stored. In shallow pit flush housing, a single layer of cages is suspended over a shallow pit. Manure drops directly into the pit, where it is flushed periodically to an on-site anaerobic lagoon using recycled lagoon water.

- Turkeys, like broilers, are raised in total confinement barns on the floor where droppings are mixed with bedding such as wood shavings to form litter. Litter close to drinking water forms a cake that is removed between flocks. The rest of the litter in a broiler house is removed periodically (usually every 1 to 3 years) from the barns.

Each model farm is analyzed under three possible land availability scenarios, named Category 1, Category 2, and Category 3. Operations in Category 1 have sufficient cropland to land apply all of their manure and waste, and therefore have no transportation costs. Operations in Category 2 have some cropland. Therefore, Category 2 operations land apply a portion of their manure and waste and transport the remainder off site. Operations in Category 3 have no cropland, and therefore transport all of their manure and waste off site. Note that some operations are Category 1 when applying manure and wastewater on a nitrogen-based rate, but may become Category 2 operations when applying manure and wastewater on a phosphorus-based rate.

Each model farm is located in one of five geographic regions. These regions were developed by EPA from data received from the Economic Research Service (ERS) of USDA. ERS has developed 10 agricultural regions of the country for use in grouping economic information. EPA originally planned to model costs using these 10 regions. However, the National Agricultural Statistics Service (NASS) required certain ERS regions to be combined in order to meet disclosure criteria for both economic data and census data. Therefore, the 10 ERS regions were condensed into the five regions used in this model based on similarities in animal production and manure handling techniques across adjacent regions. Figure 1.1-1 presents the states that are contained within each of the five modeled regions.

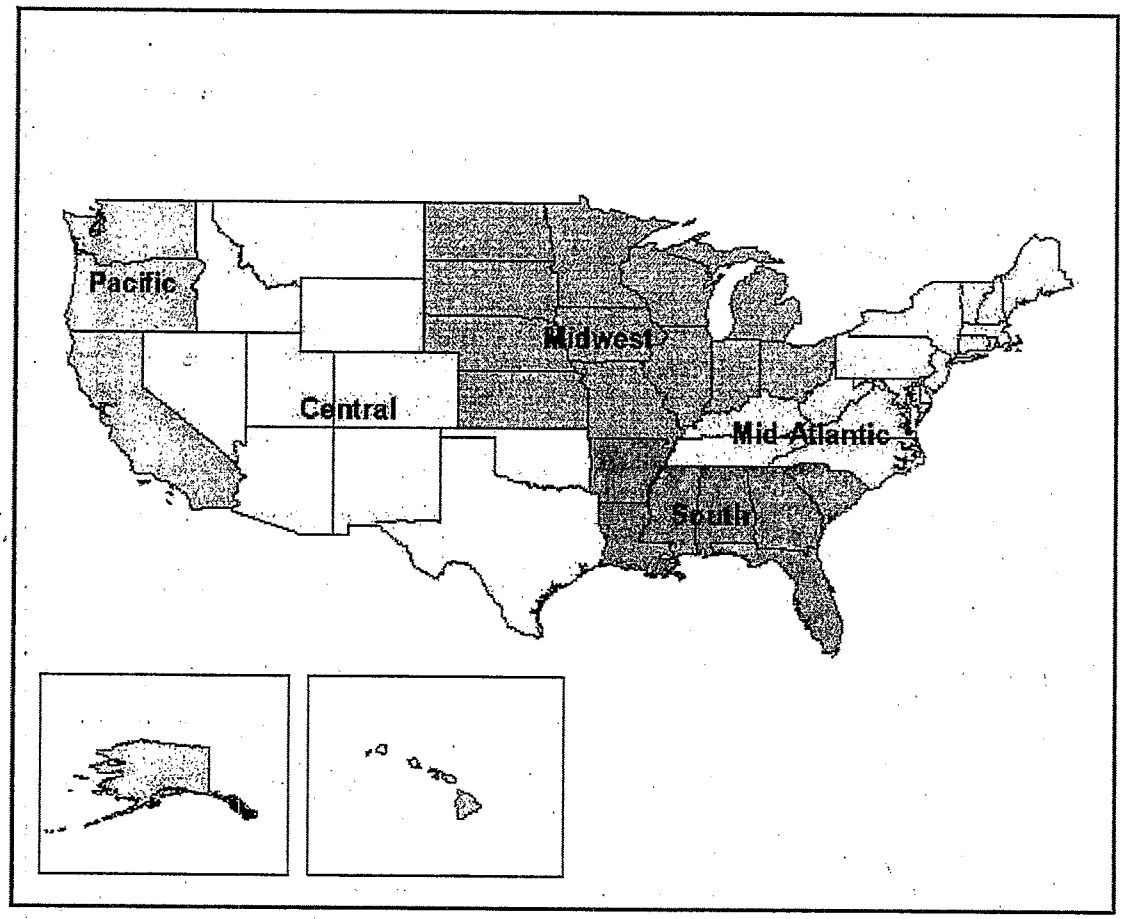

Figure 1.1-1. Animal Feeding Operation (AFO) Production Regions

1.2 Model Farm Descriptions

For each regulatory option, EPA estimated the costs to install, operate, and maintain specific techniques and practices. EPA traditionally develops either *facility-specific* or *model facility* costs. Given the amount and type of information that is available for the beef, dairy, swine, poultry, and veal industries, EPA has chosen a model-facility approach to estimate compliance costs. Model facilities, or model farms, are defined by the size of the operation, regional location, and/or waste management practices. The development of each model farm, as well as the number of facilities by model farm, are described in more detail below. All model farms reflect Medium or Large CAFOs.

1.2.1 Beef Feedlots and Heifer Operations

EPA developed one type of model farm to represent medium- and large-sized beef feedlots and heifer operations in the United States. The parameters describing the beef and heifer model farm were developed from information from USDA, data collected during site visits to beef feedlots across the country, meetings with USDA extension agents, the National Cattlemen's Beef Association, and the National Milk Producers Federation, and discussions with the Professional Heifer Growers Association. A description of the various components that make up the model farm is presented below, with the sources of the information used to develop that piece of the model farm referenced.

Housing

The vast majority of beef feedlots and heifer operations in the United States house the cattle on drylots (USDA APHIS, 1995). Some smaller operations use confinement barns at beef feedlots. However, since the majority of operations, including most new ones, use open lots, EPA used drylots as the housing for the beef model farm. Some operations raise the heifers on pasture, but because this regulation addresses only confined operations, the heifer model farm accounts only for animals housed on drylots. The size of the drylot is calculated using animal space requirements suggested by Midwest Plan Service (MWPS, 1995).

Waste Management System

Based on site visits, the drylot is the main area where waste is produced at beef feedlots and heifer operations. Waste from the drylot includes solid manure, which has dried on the drylot, and runoff, which is produced from precipitation that falls on the drylot and open feed areas.

Most beef operations in the United States divert runoff from the drylot to a storage pond (USDA APHIS, 1995a). Heifer operations typically operate like beef feedlots (Cady, R, 2000). As such, EPA assumed that runoff from the drylot is channeled to a storage pond at both beef and heifer operations. Some operations use a solids separator (typically an earthen basin) to remove solids from the waste stream prior to the runoff entering the pond. Solid waste from the drylot is often mounded on the drylot to provide topography for the cattle and is later moved from the drylot for transportation off site or land application on site (USDA APHIS, 1995a).

The beef and heifer model farm was developed following these typical characteristics of beef feedlots and heifer operations. Figure 1.2.1-1 presents the waste management system used as part of the beef and heifer model farm.

Region

Data from site visits indicate that beef feedlots in varying regions of the country have different characteristics. These differences are primarily related to climate. For example, a beef feedlot in the Midwest region receives a greater amount of rainfall annually than a beef feedlot in the Central region; therefore, the Midwest feedlot produces a greater volume of runoff to be contained and managed. Because operating characteristics may change between regions to accommodate these climatological differences, beef feedlots are modeled in five diverse regions of the United States: Central, Mid-Atlantic, Midwest, Pacific, and South, as described in Section 1.1. Data from USDA indicate that heifer operations are located in similar areas as beef feedlots and would have similar characteristics as the beef feedlots.

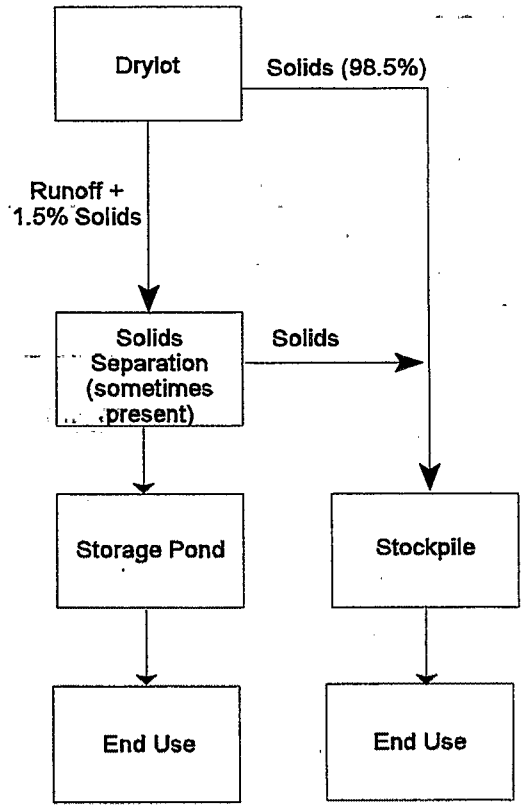

Figure 1.2.1-1. Beef and Heifer Model Farm Waste Management System

1.2.2 Dairies

EPA developed two model farms to represent medium- and large-sized dairies in the United States: a flush dairy and a hose/scrape dairy. These types of farms were identified as the predominant type of dairy in the United States based on data collected from site visits and NAHMS. EPA developed the parameters describing the dairy model farms are developed from information from USDA, 1997 Agricultural Census data, data collected during site visits to dairy farms across the country, meetings with USDA extension agents, and meetings with the National Milk Producers Federation and Western United Dairymen. A description of the various

components that make up the model farms is presented below, with the sources of the information used to develop each piece of the model farm.

Housing

To determine the type of housing used at the model farm, the type of animals on the farm were considered. In addition to the mature dairy herd (including lactating, dry, and close-up cows), there are often other animals on site at the dairy, including calves and heifers. The number of immature animals (i.e., calves and heifers) at the dairy is proportional to the number of mature cows in the herd, but further depends on the farm's management. For example, the dairy may house virtually no immature animals on site and obtain their replacement heifers from off-site operations, or the dairy could have close to a 1:1 ratio of immature animals to mature animals. Site visits suggest the trend that the largest dairy managers want to focus on milk production only, and prefer not to keep heifers on site.

Typically, according to Census of Agriculture data, for dairies greater than 200 milking cows, the number of calves and heifers on site equals approximately 60 percent of the mature dairy (milking) cows (USDA, 1997). EPA assumes that there are an equal number of calves and heifers on site (30 percent each) at the dairy model farms. Based on this information, the number of calves on site is estimated to be 30 percent of the number of mature cows on site, as are the number of heifers on site, for the dairy model farm. The percentage of bulls is typically small (USDA, 1997), as most dairies do not keep them on site. For this reason, EPA assumed that their impact on the model farm waste management system is insignificant, and did not consider bulls in the dairy model farm.

The most common types of housing for mature cows include freestall barns, tie stalls/stanchions, pasture, drylots, and combinations of these (Stull, C.E., et. al. eds. 1998). Based on site visits, most medium- to large-sized dairies (>200 mature dairy cows) house their mature dairy cows in freestall barns; therefore, it is assumed that mature dairy cows are housed in freestall barns for the dairy model.

The most common types of calf and heifer housing are drylots, multiple animal pens, and pasture (USDA APHIS, 1996a). Based on site visits, most medium- to large-sized facilities use drylots to house their heifers and calves; therefore, it is assumed that calves are housed in hutches on drylots and heifers are housed in groups on drylots at dairies described in the model. EPA calculated the size of the drylot for the model farm using animal space requirements suggested by Midwest Plan Service (MWPS, 1995).

Waste Management Systems

Waste is generated in two main areas at dairies: the milking parlor and the housing areas. Waste from the milking parlor includes manure and wash water from cleaning the equipment and the parlor after each milking. Waste from the confinement barns includes bedding and manure for all barns, and wash water if the barns are flushed for cleaning. Waste generated from the drylots includes manure and runoff from any precipitation that falls on the drylot.

Based on site visits, most dairies transport their wastewater from the parlor and flush barns to a lagoon for storage and treatment. Some dairies use a solids separator (either gravity or mechanical) to remove larger solids prior to the wastewater entering the lagoon. Solids are removed from the separator frequently to prevent buildup in the separator, and they are stockpiled on site. Solid waste scraped from a barn is typically stacked on the feedlot for storage for later use or transport. Solid waste on the drylot is often mounded on the drylot for the cows and is later moved for transport or land application. Wastewater in the lagoon is held in storage for later use, typically as fertilizer on cropland either on or off site. Figure 1.2.2-1 presents the waste management systems used for model dairy farm.

The amount of waste generated at a dairy depends on how the operation cleans the barn and parlor on a daily basis. Some dairies clean the parlor and barns by flushing the waste (a flush dairy); others use less water, hosing down the parlor and scraping the manure from the barns (a hose/scrape dairy). EPA estimated the percentage of total dairies that operate as a flush dairy or a hose/scrape dairy using USDA data (USDA APHIS, 1996a) and described in Section 4.3.2 of

this report. Both flush and hose/scrape dairy systems are modeled separately as two model facilities.

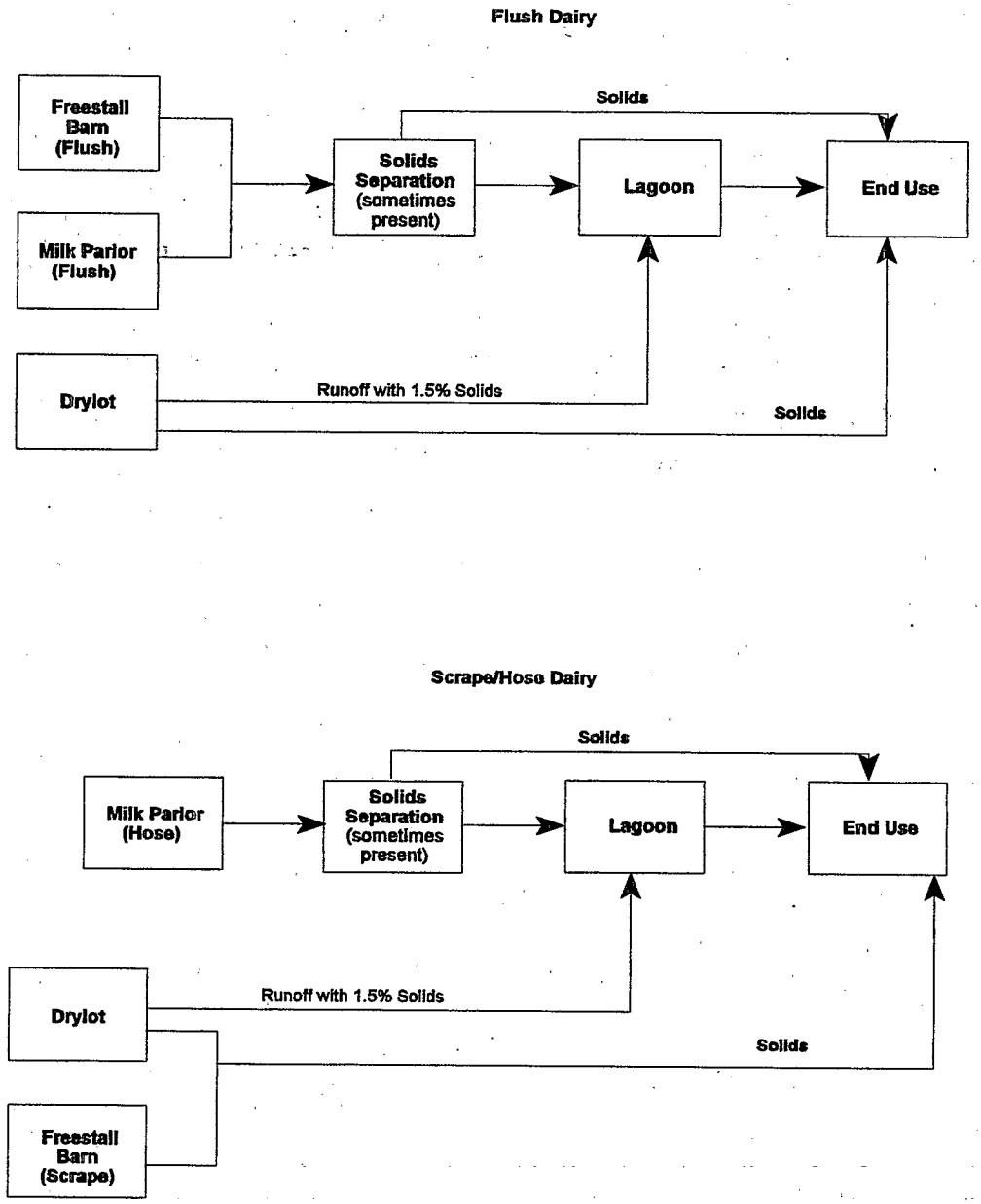

Figure 1.2.2-1. Dairy Model Farm Waste Management Systems

Region

Data from site visits indicate that dairies in varying regions of the country have different characteristics. These differences are primarily related to climate. For example, a dairy in the Pacific region receives a greater amount of rainfall annually than a dairy in the Central region; therefore, the Pacific dairy produces a higher amount of runoff to be contained and managed. Because operating characteristics may change between regions, dairies are modeled in five distinct regions of the United States: Central, Mid-Atlantic, Midwest, Pacific, and South, as described in Section 1.1.

1.2.3 Veal Operations

EPA developed one model farm to represent medium- and large-sized veal operations in the United States. The parameters describing the veal model farm are developed from information collected during site visits to veal operations in Indiana and discussions with the American Veal Association. A description of the various components that make up the model farm is presented below, with the sources of the information used to develop that piece of the model farm referenced.

Housing

Veal calves are generally grouped by age in environmentally controlled buildings. The majority of veal operations in the United States utilize individual stalls or pens with slotted floors, which allow for efficient removal of waste (Wilson, 1995). Because this type of housing is the predominant type of housing used in the veal-producing industry, individual stalls in an environmentally controlled building is designated as the housing for the veal model farm.

Waste Management Systems

Based on site visits, the only significant source of waste at veal operations is from the veal confinement areas. Veal feces are very fluid; therefore, manure is typically handled in a liquid waste management system. Manure and waste that fall through the slotted floor are flushed regularly out of the barn. Flushing typically occurs twice daily. Most veal operations have a lagoon to receive and treat their wastewater from flushing, although some operations have a holding pit system in which the manure drops directly into the pit. The pit provides storage until the material can be land applied or transported off site. Wastewater in the lagoon is held in storage for later use as fertilizer off site.

EPA developed the veal model farm used in the cost model from these general characteristics. The animals are totally confined; therefore, the only source of wastewater is from flushing the manure and waste from the barns. Direct precipitation is also collected on the lagoon surface, if the lagoon is uncovered. Figure 1.2.3-1 presents a diagram of the veal model farm waste management system.

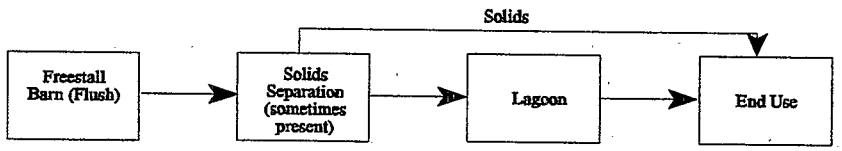

Figure 1.2.3-1. Veal Model Farm Waste Management System

Region

The American Veal Association indicates that veal producers are located predominantly in the Midwest and Central regions (Crouch, A., 1999); therefore, only these two regions are modeled as part of the veal model farm.

1.2.4 Swine Operations

EPA developed the parameters describing the model swine farms using information from the USDA NASS, site visits to swine farms across the country, discussions with the National Pork Producers Council, and the USDA Natural Resources Conservation Service (NRCS). A description of the various components that make up the model farm is presented in the following discussion, and the sources of the information used to develop each piece of the model farm are noted.

Housing

Swine are typically housed in total confinement barns, and less commonly in other housing configurations such as open buildings with or without outside access and pastures (USDA APHIS, 1995b). On many farms, small numbers of pigs (fewer than the number covered by this regulation) are raised outdoors; however, the trend in the industry is toward larger confinement farms at which pigs are raised indoors (NCSU, 1998). For these reasons, the model swine farm is assumed to house its animals in total confinement barns.

Waste Management Systems

The characteristics of waste produced at an operation depends on the type of animals that are present. In farrow-to-finish operations, the pigs are born and raised at the same facility. Therefore, the manure at a farrow-to-finish farm has the characteristics of mixed excreta from varying ages. In grow-finish facilities, young pigs are first born and cared for at a nursery, and then brought onto the finishing farm. Therefore, the manure at a grow/finish farm has characteristics of pigs older than 7 weeks. These are the two predominant types of swine operations in the United States for the size classes that would be covered under the final rule. The Technical Development Document contains additional information on herd and waste characteristics.

Swine houses with greater than 750 head typically store their wastes in pits under the house or flush the wastes to outside lagoons. Slatted floors or flush alleys are used to separate manure and wastes from the animal. It is common to allow manure to collect in a pit and wash the pit one to six times per day with water to move the waste to a lagoon. The waste is stored in the lagoon until it is applied to land or transported off site. Storing the waste in an anaerobic lagoon provides some treatment during storage, conditioning the wastewater for later land application, and reducing odors (NCSU, 1998). EPA developed model farms for farrow-to-finish and grow/finish operations in the Mid-Atlantic and Midwest regions that are assumed to use pits or flush alleys and anaerobic lagoon storage.

In the Midwest, a deep pit storage system is more common. Deep pit systems start with several inches of water in the pit, and the manure is collected and stored under the house until it is pumped out for field application, typically twice a year. This system uses less water, creating a manure slurry that has higher nutrient concentrations than the flush system described earlier. A survey of swine operations in 2000 shows that both lagoons and deep pits are commonly used for waste storage in the Midwest region (USDA APHIS, 2002). For purposes of developing the cost models, EPA estimated, from the USDA APHIS (2002) data, the percentage of farrow-to-finish and grow/finish operations in the Mid-Atlantic and Midwest regions that use pit storage. EPA developed model farms for farrow-to-finish and grow/finish operations in the Mid-Atlantic and Midwest regions that are assumed to use pit storage pumped twice per year.

Although not present in the statistics that were available to the EPA at the time of this analysis, EPA recognizes the increasing number of large swine operations in the Central region. Many of these larger operations in the Central region use evaporative lagoons instead of traditional anaerobic lagoons found in the Mid-Atlantic and Midwest. Thus, EPA developed model farms for large facilities in the Central region and assumed evaporative lagoons are used for waste storage.

EPA's swine model farm's under Option 5 assume that all lagoons are covered with a synthetic cover. Facilities that use deep pit storage are not assumed to need any additional practices to comply with Option 5.

Figure 1.2.4-1 presents these waste management systems used for the model swine farms in this cost model.

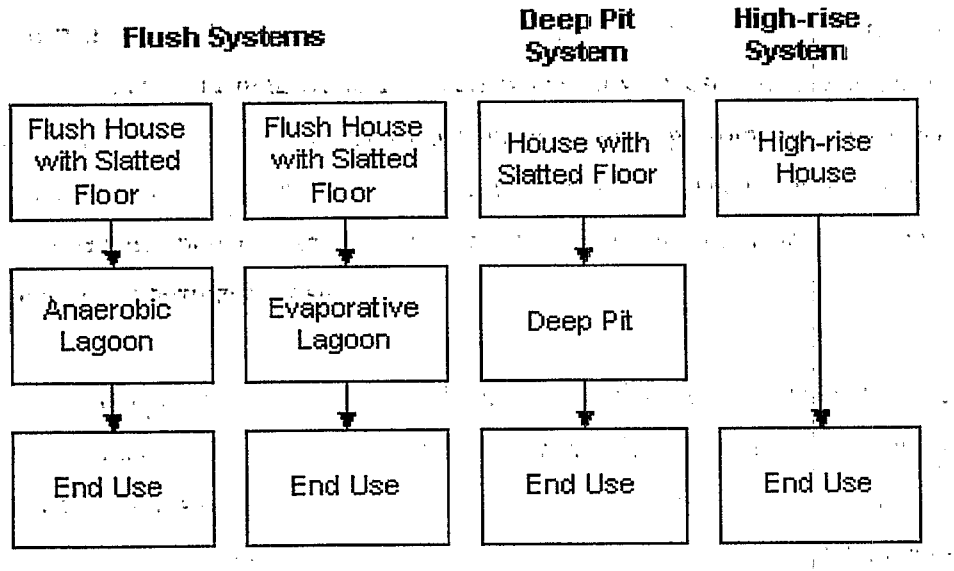

Figure 1.2.4-1. Swine Model Farm Waste Management System

Region

Data from site visits and North Carolina State University's draft *Swine and Poultry Industry Characterization* indicate that the predominant type of waste management system at swine operations varies from region to region (NCSU, 1998). EPA decided to develop model farms for the Mid-Atlantic and Midwest regions because over 93 percent of the facilities with more than 750 head were located in these two regions in 1997 (USDA NASS, 1999). EPA added additional model farms in the Central region based on comments received on the proposed rule that many large facilities had recently located in states in the Central region.

As previously mentioned, flush-to-lagoon waste storage systems are more common in the Mid-Atlantic region while deep-pit storage systems are common in the Midwest. Given the regional variances in waste management systems, other variations in farming practices (e.g., crop rotations), and differences in climate, swine operations with both type of waste storage systems

were modeled in both regions. Large swine operations that use evaporative lagoons for waste storage were modeled in the Central region. Operations located in other regions were split among the modeled regions to fully account for operations in a given size class. Allocating operations from one region to another was necessary since the census data could not be obtained for all desired regions and size groups (USDA NASS, 1999). Table 1.2.4-1 presents a summary of the swine model farms developed by EPA.

Table 1.2.4-1

Model Swine Farms by Farm Type, Size, Region, and Waste Storage System

Farm Type	Size Group	Region				
		Central	Mid-Atlantic	Midwest	Pacific	South
Farrow-to-Finish	Medium 1	NM	L & P	L & P	NM	NM
	Medium 2	NM	L & P	L & P	NM	NM
	Medium 3	NM	L & P	L & P	NM	NM
	Large 1	Evap Lagoon	L & P	L & P	NM	NM
	Large 2	Evap Lagoon	L & P	L & P	NM	NM
Grow/Finish	Medium 1	NM	L & P	L & P	NM	NM
	Medium 2	NM	L & P	L & P	NM	NM
	Medium 3	NM	L & P	L & P	NM	NM
	Large 1	Evap Lagoon	L & P	L & P	NM	NM
	Large 2	Evap Lagoon	L & P	L & P	NM	NM

L = anaerobic lagoon storage
P = under house pit storage
Evap Lagoon = evaporative lagoon storage
NM = Not modeled in this region.

1.2.5 Poultry Operations

EPA developed four model farms to represent poultry operations in the United States. The model farms are broiler, turkey, dry layer, and wet layer operations. EPA developed the parameters describing the model poultry farms using information from NASS, site visits to poultry farms across the country, and the USDA NRCS. A description of the various components

of each model farm is presented in the following discussion, and the sources of the information used to develop each piece of the model farm are noted.

Housing

Broilers and turkeys are typically housed in long barns (approximately 40 feet wide and 400 to 500 feet long; NCSU, 1998) and are grown on the floor of the house. The floor of the barn is covered with a layer of bedding, such as wood shavings, and the broilers or turkeys deposit manure directly onto the bedding. Approximately 4 inches of bedding are initially added to the houses and top dressed with about 1 inch of new bedding between flocks.

Layers are typically confined in cages in high-rise housing or shallow pit flush housing. In a high-rise house, the layer cages are suspended over a bottom story, where the manure is deposited and stored. EPA used this configuration to model housing for dry layer model farms. In shallow pit flush housing, a single layer of cages is suspended over a shallow pit. Manure drops directly into the pit, where it is flushed out periodically using recycled lagoon water. EPA used this configuration to model housing for wet layer model farms.

These poultry housing systems are considered typical systems in the poultry industry (NCSU, 1998). Therefore, the cost model uses these farm housing systems in the model farms.

Waste Management Systems

Manure from broiler and turkey operations accumulate on the floor where it is mixed with bedding, forming litter. Litter close to drinking water forms a cake that is removed between flocks. The rest of the litter in a house is removed periodically (6 months to 2 years) from the barns, and then transported off site or applied to land. Typically, broiler and turkey operations are completely dry waste management systems (NCSU, 1998). Therefore, EPA used this waste management configuration in modeling both broiler and turkey model farms.

reflects the South and Mid-Atlantic regions, and the model layer farm reflects the Midwest and South regions. State-level data from the 1997 Census of Agriculture indicate that states in the Midwest and Mid-Atlantic regions of the United States account for over 70 percent of all turkey turkeys produced. For this reason, model turkey farms are located in the Mid-Atlantic and Midwest regions (USDA NASS, 1999). Table 1.2.5-1 presents the number of facilities modeled for the poultry model farms.

Table 1.2.5-1

Model Poultry Farms by Farm Type, Size, and Region

Farm Type	Size Group	Region				
		Central	Mid-Atlantic	Midwest	Pacific	South
Broilers	Medium 1	NM	Y	NM	NM	Y
	Medium 2	NM	Y	NM	NM	Y
	Medium 3	NM	Y	NM	NM	Y
	Large 1	NM	Y	NM	NM	Y
	Large 2	NM	Y	NM	NM	Y
Dry Layers	Medium 1	NM	Y	Y	NM	NM
	Medium 2	NM	Y	Y	NM	NM
	Medium 3	NM	Y	Y	NM	NM
	Large 1	NM	Y	Y	NM	NM
	Large 2	NM	Y	Y	NM	NM
Wet Layers	Medium 3	NM	NM	NM	NM	Y
	Large 1	NM	NM	NM	NM	Y
Turkeys	Medium 1	NM	Y	Y	NM	NM
	Medium 2	NM	Y	Y	NM	NM
	Medium 3	NM	Y	Y	NM	NM
	Large 1	NM	Y	Y	NM	NM

Y = model farm was developed for this region.

NM = model farm was not developed for this region.

Layer operations may operate as a wet or a dry system. Approximately 12 percent of layer houses use a liquid flush system, in which waste is removed from the house and stored in a lagoon (USDA APHIS, 2000). Operations that use this type of waste management system are referred to as wet layers. The remaining layer operations typically operate as dry systems, with manure stored in the house for up to a year. A scraper is used to remove waste from the collection pit or cage area (NCSU, 1998). Operations that use this type of waste management system are referred to as dry layers. The lagoon wastewater and dry manure are stored until they are applied to land or transported off site. Figure 1.2.5-1 presents the waste management systems for poultry.

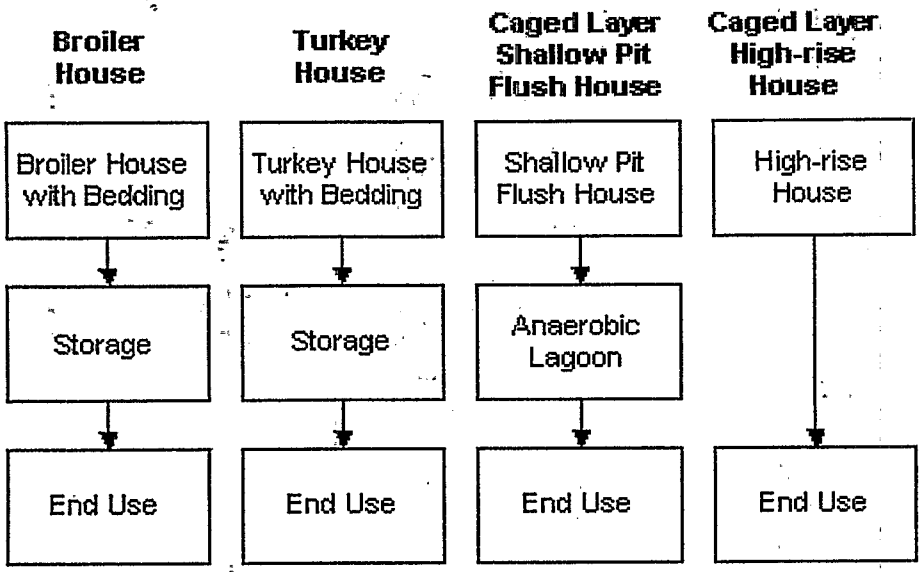

Figure 1.2.5-1 Poultry Model Farm Waste Management System

Region

Data from site visits and North Carolina State University's draft *Swine and Poultry Industry Characterization* indicate that the predominant type of waste management system at poultry operations varies from region to region (NCSU, 1998). Most of the broiler operations in the United States are located in the South and Mid-Atlantic regions, while most of the egg-laying operations are located in the Midwest and South regions. Therefore, the model broiler farm

1.3 Key Terms

This subsection discusses the key terms used in the cost model report, including size groups, frequency factors (technology factors that vary by performance level, technology factors that do not vary by performance level, land availability factors, nutrient management factors), and manure and wastes.

1.3.1 Size Groups

EPA developed and analyzed up to five size groups for each animal type. The size groups include one to two size groups for "Large" farms and up to three size groups for "Medium" farms. Table 1.3-1 presents the size groups for each animal type.

Table 1.3-1

Size Classes for Model Farms

Animal Type	Medium 1	Medium 2	Medium 3	Large 1	Large 2
Beef	300-499	500-749	750-999	1,000-7,999	≥8,000
Heifer	300-499	500-749	750-999	≥1,000	N/A
Dairy (Mature Dairy Cows)	200-349	350-524	525-699	≥700	N/A
Veal	300-499	500-749	>750	N/A	N/A
Swine	750-1,249	1,250-1,874	1,875-2,499	2,500-4,999	≥5,000
Dry Layers	25,000-49,999	50,000-74,999	75,000-81,999	82,000-599,999	>600,000
Wet Layers	N/A	N/A	9,000-29,999	>30,000	N/A
Broilers	37,750-49,999	50,000-74,999	75,000-124,999	125,000-179,999	≥180,000
Turkeys	16,500-27,499	27,500-41,249	41,250-54,999	≥55,000	N/A

N/A - Not applicable.

In this report, references to the model farm size classes will be capitalized. For example, Large would refer to all operations that fall into the Large 1 or Large 2 model farm size classes. When the terms are not capitalized (i.e., "large"), they are used in a general way.

1.3.2 Frequency Factors

EPA developed frequency factors to reflect the baseline industry conditions (industry conditions prior to implementation of the regulation). In the cost model, four types of frequency factors are employed: technology frequency factors that do not vary by performance level, technology frequency factors that do vary by performance level, land availability frequency factors, and nutrient management frequency factors.

The model-farm approach used in the cost model provides the average cost a farm is projected to incur under the proposed regulatory options. EPA recognizes that this approach might underestimate or overestimate the projected costs for farms that are on the extreme ends of applicability. For example, some farms might already meet the proposed regulatory requirements; therefore, those farm costs would be zero. Alternatively, some farms might meet very few of the proposed regulatory requirements; therefore, those operations would incur costs much higher than the "average" model farm costs. Therefore, EPA used frequency factors that vary according to the requirements of the model farm. EPA assumed 25% of farms will have high requirements, 25% will have low requirements, and 50% will have moderate requirements. Frequency factors were estimated according to these assumptions.

Technology Factors That Vary by Performance Level

Technology frequency factors reflect the percentage of operations that have a particular operation, technique, or practice in place at baseline. In most cases, the frequency factors have a performance level (i.e., high, medium, or low performance) as estimated by USDA. Frequency factors that vary by performance level were developed for the following practices or technologies:

- Feeding strategies;
- Solids separation using earthen and concrete settling basins;
- Runoff controls (e.g., berms);

- Liquid land application (e.g,. center pivot irrigation); and
- Nutrient management planning (i.e., setbacks, lagoon markers, soil sampling, manure sampling, recordkeeping, document preparation).

Technology Factors That Do Not Vary by Performance Level

Two of the technology components of the cost model are not based on USDA's performance-based data. The frequency factors for naturally-lined ponds and lagoons and transportation are based on several different data sources as discussed in Section 6.1.3.

Land Availability Factors

Operations fall into three categories with respect to the amount of on-site cropland available for manure application. Using USDA data, EPA calculated the percentage of facilities in each of these categories:

- Category 1 operations have sufficient land to land-apply all of their generated manure and wastewater at appropriate agronomic rates. No manure is transported off site.
- Category 2 operations do not have sufficient land to land-apply all of their generated manure and wastewater at appropriate agronomic rates. The excess manure after agronomic application is transported off site.
- Category 3 operations do not have any available land for manure application. All generated manure and wastewater is transported off site.

Nutrient Management Factors

In the proposed regulation, the land application of manure is governed by the rate determined by the Director and for the purposes of this analysis is assumed to be agronomically limited by either nitrogen or phosphorus. This assumption ensures that EPA has calculated the highest costs of this regulation. Several cost modules compute component costs separately for

both nitrogen- and phosphorus-based application and are adjusted based on frequency factors that indicate the use of the component in the industry. For Options 1 and 1A, all operations are costed for nitrogen-based application, and for Option 2A, all operations are costed for phosphorus-based application. However, under the remaining options, EPA used soil tests and USDA data to determine the percent of facilities in each state that would require nitrogen-based versus phosphorus-based application rates. This ranges from 12% to 66% across animal type and region, but roughly 50% of all facilities would need to apply at a phosphorus rate.

1.3.3 Manure and Waste

In the cost model report, manure refers to excreted manure with no added process water or rain water. Waste and wastewater may refer to the combination of manure and contaminated runoff, process water, and cleaning water. This does not necessarily reflect the official language of the preamble of this regulation.

1.4 Organization of Report

The following information is discussed in detail in this report:

- Section 2.0 presents the structure of the cost model;
- Section 3.0 discusses the data sources used to generate compliance costs;
- Section 4.0 discusses the cost model inputs;
- Section 5.0 discusses the methodology used to calculate costs;
- Section 6.0 discusses the frequency factors used in the report;
- Section 7.0 provides examples of total model farm costs calculated for beef and dairy and swine and poultry operations as well as weighted model farm costs for each animal sector under the selected BAT and NSPS options;
- Section 8.0 discusses sensitivity and side analyses conducted on EPA's model farms; and

- Appendices A through D present cost results.

1.5 References

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2.0 COST MODEL STRUCTURE

EPA created two separate models to estimate compliance costs associated with regulatory options for CAFOs: one model to generate beef, dairy, heifer, and veal costs, and another model to generate swine, broiler, turkey, and layer costs. The following subsections describe the structure of each of these models.

2.1 Beef and Dairy Cost Model

To generate industry compliance cost estimates for beef feedlots, dairies, and heifer and veal operations, EPA developed a computer-based cost model made up of several individual cost modules. The cost model is executed on a personal computer and consists of a collection of programs written in Visual Basic® and data tables created in Microsoft® Access 97. Figure 2.1-1 presents a flow chart of the general cost model methodology. The cost model consists of several components, which can be grouped into five major categories:

- Input data;
- Technology cost modules;
- Frequency factors (including farm-weighting factors);
- Cost test; and
- Model farm costs.

The beef and dairy cost model calculates costs for the following groups of model farms, shown in Table 2.1-1.

Model outputs are presented in Appendices A through D of this report. Each technology cost module calculates a specific piece of operational data (e.g., runoff) or develops a component cost for a specific waste management system component (e.g., an anaerobic lagoon) based on model farm characteristics. Frequency factors are then applied to the component costs to weight the costs by the estimated percentage of operations that already have the component in place. Some component-level frequency factors are performance based, and different factors are used to estimate costs for a low-performing, medium-performing, and high-performing farm.

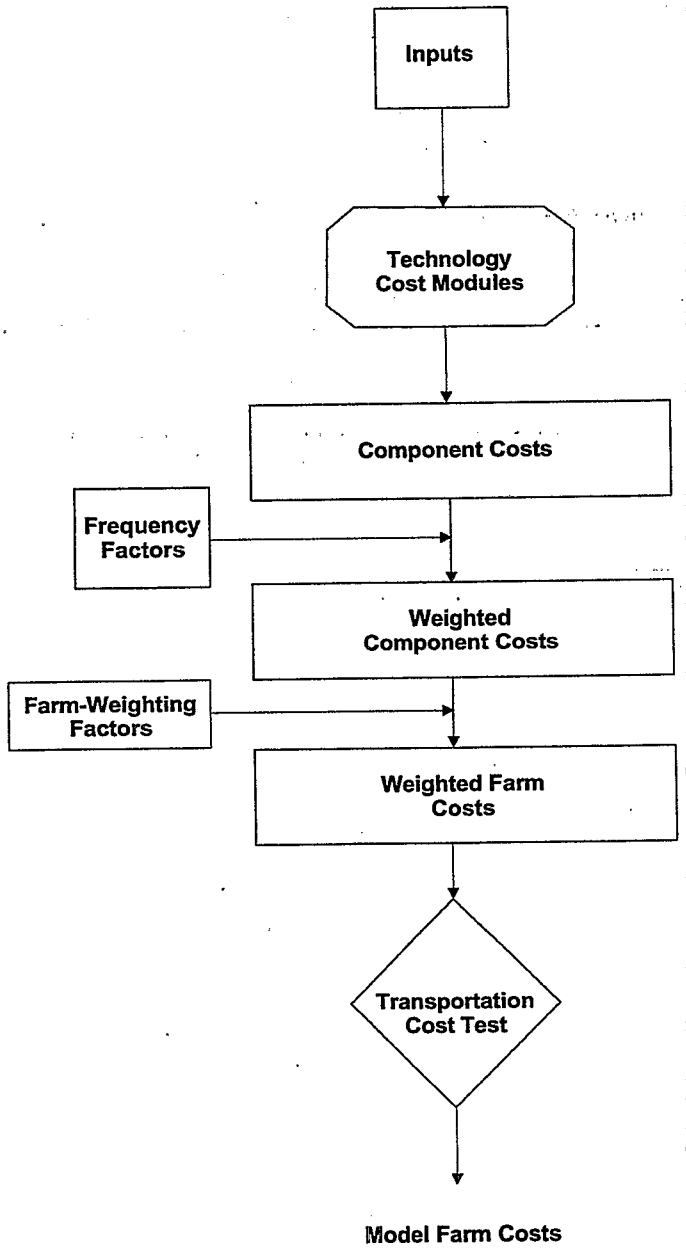

Figure 2.1-1. Flow Chart of General Cost Methodology

Table 2.1-1

Beef and Dairy Model Farm Records

Farm Type	Region	Options/ Sub Options	Land Availability Categories	Size Classes	Nutrient Management Bases	Manure Types	Performance Needs Level	Total Models
Beef	Central	13	3	5	2	1	3	1,035
	Mid-Atlantic	13	3	5	2	1	3	1,035
	Midwest	13	3	5	2	1	3	1,035
	Pacific	13	3	5	2	1	3	1,035
	South	13	3	5	2	1	3	1,035
Dairy	Central	14	3	4	2	2	3	2,205
	Mid-Atlantic	14	3	4	2	2	3	2,205
	Midwest	14	3	4	2	2	3	2,205
	Pacific	14	3	4	2	2	3	2,205
	South	14	3	4	2	2	3	2,205
Heifer	Central	13	3	4	2	1	3	1,035
	Mid-Atlantic	13	3	4	2	1	3	1,035
	Midwest	13	3	4	2	1	3	1,035
	Pacific	13	3	4	2	1	3	1,035
	South	13	3	4	2	1	3	1,035
Veal	Central	13	3	3	2	1	3	1,035
	Midwest	13	3	3	2	1	3	1,035
Total:								23,445

[a]Option 6 is for dairies only. Options 1 and 1A are N-based only, whereas option 2A is P-based only.

Using these factors, cost estimates for a low-performing farm will include the majority of possible costs, and estimates for a high-performing farm will include less of the possible costs.

Farm-weighting factors are then applied to certain weighted component costs to further weight these costs by the percentage of operations that operate in different ways (e.g., flush versus hose dairies, or nutrient basis for land application). These weighted farm costs are then summed for each regulatory option and model farm. Finally, a transportation cost test evaluates several methods of transporting waste off site, identifies the least expensive scenario, and outputs final costs for each model farm and option. All costs are in 1997 dollars. The remainder of this section describes each of these components.

2.1.1 Input Data to Cost Model

Input data to the cost model include information on the model farms, runoff, wastewater generation, and manure generation, as described below:

- Model farm definitions - Animal type, EPA regulatory option, farm type, size class, average number of head, region, performance level, and number of operations that are represented by the model farm;
- Wastewater generation - Volume of milking parlor wastewater and barn wastewater generated;
- Manure generation - Amount and composition of manure generated at the operation; and
- Runoff generation - Precipitation data (including average rainfall, evaporation, and 25-year, 24-hour rainfall amounts) by model farm type and region.

All of these data are used as inputs for cost calculations. Section 4.0 discusses inputs to the cost model in greater detail.

2.1.2 Technology Calculations

Each technology cost module calculates direct capital and annual costs for installing and implementing a particular technology or practice. In some cases, the modules calculate initial fixed costs that are not able to be amortized and operating and maintenance (O&M) costs that only occur every 3 or 5 years. The cost model refers to these periodic O&M costs as a "3-year recurring cost" or a "5-year recurring cost."

For each regulatory option, the cost model combines a series of modules. Table 2.1.2-1 presents the waste management technology components for dairies, beef feedlots, and heifer and veal operations that make up the basis for each regulatory option. Each module uses the input data tables to generate costs to implement the technologies under each regulatory option. Figure 2.1.2-1 presents the components of the technology cost modules, and Section 5.0 discusses each cost module in detail. The cost model uses Microsoft® Access 97 queries to create a module-specific input page that selects only the input required to run the specific waste management component of interest. No costs are calculated for components that are not included in the option.

Table 2.1.2-1

Waste Management Technologies for Beef Feedlots, Dairies, and Heifer and Veal Operations

Technology or Practice	Technology Cost Module	Animal Type		
		Dairy	Beef & Heifer	Veal
Solids Separation	Concrete Basin	✓		✓
	Earthen Basin		✓	
Anaerobic Treatment	Naturally Lined Lagoon	✓		✓
Liquids Storage	Naturally Lined Pond		✓	
Runoff Controls	Berms	✓	✓	
On-Site Land Application	Nutrient Management Planning	✓	✓	✓
	Nutrient-Based Application	✓	✓	✓
	On-Site Irrigation	✓	✓	✓
Off-Site Transportation		✓	✓	✓

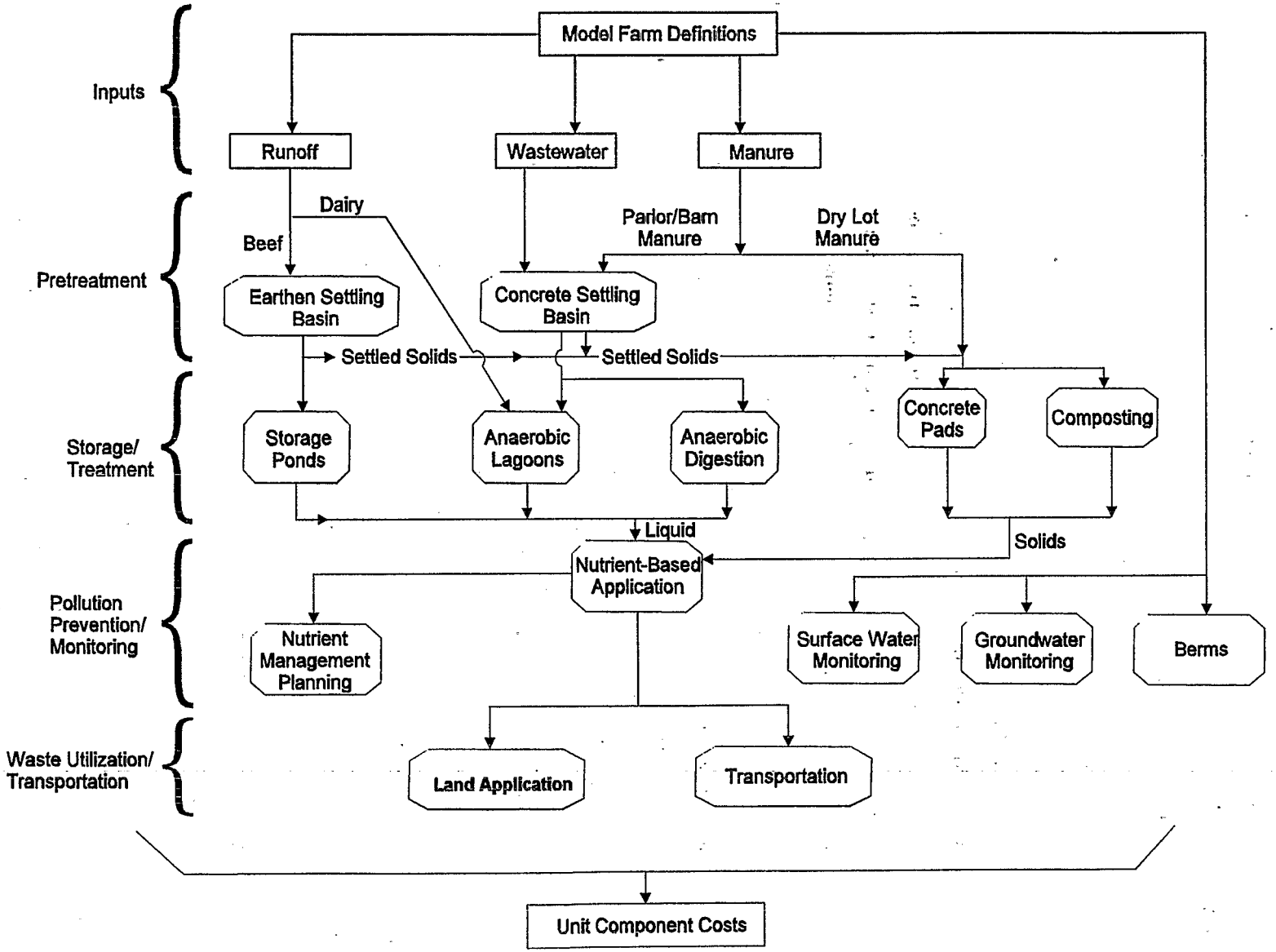

Figure 2.1.2-1 Components of Technology Cost Modules

system to meet the requirements of the rule, which may vary in cost from these estimated costs. Section 6.0 discusses the frequency factors used in the cost model.

Weighted Farm Costs

Some weighted component costs vary depending on the type of manure application basis (nitrogen or phosphorus). To account for these differences, the cost model further weights the weighted component costs, as necessary.

The farm-weighting factor adjusts the weighted component costs for the type of nutrient-based application used. Note, this only applies to land application component costs that are affected by the number of available acres. As discussed in Section 6.2, the cost model estimates the number of operations that require nitrogen-based application and the number of operations that require phosphorus-based application. In fact, most operations will have some fields limited to nitrogen and some limited to phosphorus. The exact distribution will vary for each individual operation. This approach assumes each farm will incur costs based on both nitrogen and phosphorus, and calculates a weighted cost. To calculate costs weighted by application method, the component costs must be proportioned between the number of nitrogen-based operations and phosphorus-based operations. The following equation calculates the weighted farm cost for each type operation that conducts on-site land application.

$$\text{Weighted Cost} = \frac{[(\text{NFacs} \times \text{NCost}) + (\text{PFacs} \times \text{PCost})]}{[\text{NFacs} + \text{PFacs}]}$$

where:

NFacs	=	Number of operations that apply on nitrogen basis
NCost	=	Weighted unit component cost, nitrogen-based application
PFacs	=	Number of operations that apply on phosphorus basis
PCost	=	Weighted unit component cost, phosphorus-based application.

The weighted farm costs are then used in a "cost test," described in Section 5.0, to select the least costly option to transport excess manure off site. There are four transportation

options considered: hiring a contractor to haul manure; purchasing trucks to haul manure; composting to reduce the volume of waste before hiring a contract hauler; and composting before using purchased trucks. The cost model sums and annualizes the weighted farm costs for each of the transportation scenarios, and selects the least costly scenario.

The cost estimates generated contain the following types of costs:

- Capital costs - Costs for facility upgrades (e.g., construction projects).
- Fixed costs - One-time costs for items that cannot be amortized (e.g., training).
- Annual operating and maintenance (O&M) costs - Annually recurring costs, which may be positive or negative. A positive O&M cost indicates an annual cost to operate, and a negative O&M cost indicates a benefit to operate, due to cost offsets.
- Three-year recurring O&M costs - Operating and maintenance costs that only occur once every three years.
- Five-year recurring permit costs - Application fees and reporting costs occur once every five years.
- Annual fertilizer costs - Costs for additional commercial nitrogen fertilizer needed to supplement the nutrients available from manure application.

These costs provide the basis for evaluating the total annualized costs of each regulatory option. Section 7.0 presents these model farm cost outputs.

2.2 Swine and Poultry Cost Model

EPA developed a computer-based cost model to generate industry compliance cost estimates for swine and poultry operations. The cost model is executed on a personal computer and consists of a main program and subroutines written in Digital Fortran 90, Version 6, and data tables created in Microsoft® Excel and text format.

Each module generates an intermediate output page, containing the capital, fixed, annual, and recurring costs associated with that waste management system component. The output page also includes data that may be used as input to subsequent modules.

2.1.3 Frequency Factors

EPA determined the current frequency of existing waste management practices at beef feedlots, dairies, and heifer and veal operations to estimate the portion of the operations that would incur costs to comply with the final regulation. The frequency information is used to estimate compliance costs for specific model farms. These specific technologies are not required to meet the requirements of the regulation. Rather, they are simply for the basis of estimating costs for compliance with the regulation. The resulting weighted farm costs can be multiplied by the number of facilities represented by each model to estimate industry-wide costs.

Currently, no publicly available information is available that can be used with a high degree of confidence to determine what each frequency factor should be for each size class within a given region. EPA, therefore, estimated frequency factors based on the sources below. Each source was considered along with its limitations. Section 6.0 discusses in detail the frequency factors used to develop compliance costs for each regulatory option.

- USDA/Natural Resources Conservation Service (NRCS) - EPA used the data currently available from NRCS to determine the distribution of beef feedlots and dairies across the regions by size class, production category, and performance level.

- EPA site visit information - EPA used this information to assess general practices of beef feedlots, dairies, and heifer and veal operations and how they vary between regions and size classes.

- Observations from industry experts - EPA contacted experts on beef and dairy animal feeding operations to provide insight into operations and practices, especially where data are limited or not publicly available.

- USDA/Animal Plant and Health Inspection Service (APHIS)/National Animal Health Monitoring System (NAHMS) - This source provides information on dairy practices, facility size, and waste system components

sorted by size class and region. These data have limited use due to the small number of respondents in the size classes of interest.

- *State Compendium: Programs and Regulatory Activities Related to AFOs* - EPA used this summary of state regulatory programs to estimate frequency factors based on current waste-handling requirements that already apply to beef feedlots and dairies in various states and in specific size classes as related to off-site transportation and nitrogen-based land application.

2.1.4 Calculation of Weighted Costs

The cost model generates weighted technology costs and weighted farm costs from the waste management system component costs calculated within each module. Methodologies used to develop both of these costs are described below.

Weighted Technology Costs

To ensure that only operations that do not have the technology are costed, the cost model weights the technology component costs to reflect the percentage of operations that already have some components in place. For some technologies (e.g., settling basins), there are three different frequency factors that represent facilities that have low, medium, and high requirements reflecting the performance level of the farm. The cost model uses the following equation to weight the component costs:

$$Cost_{weighted} = Cost_{component} \times (1 - \text{Frequency Factor})$$

where:

$Cost_{weighted}$	=	Weighted component cost
$Cost_{component}$	=	Component cost
Frequency Factor	=	Percentage of operations that have the component in place.

This weighted component cost reflects the conservative assumptions made in this cost model for compliance with the regulation. In practice, a facility may choose a different waste management

The components of the cost model can be grouped into six major categories as illustrated in Figure 2.2-1:

- Model farm input data;
- Preprocessor subroutines (get farm counts, manure characteristics, etc.);
- Basic calculations (manure production, nutrient needs, etc.);
- Other input data (technology performance and costs, frequency factors, etc.);
- Cost subroutines for practices; and
- Model farm costs (outputs).

The core of the cost model is the "Main" program. Data files with model feedlot information, constants associated with manure characteristics and cropping systems, frequency factors, number of farms represented by each model, technology costs, and various other variables essential to the cost modeling effort are input into the main program and its subroutines. The program then calculates practice-specific and total costs for each model farm. The total national cost of the proposed regulation is estimated by multiplying model farm costs by the number of farms represented by each particular model. The cost model creates both formatted and unformatted outputs.

The model's subroutines read into the Main program the basic information regarding model farms (e.g., animal type, operation type) and the various constants used in a wide range of Main program calculations (e.g., nutrient management training costs, regional nitrogen and phosphorus uptake values, frequency factors), and they perform the more complex calculations (e.g., berm size, lagoon size, lagoon cover size) and analyses (e.g., selecting the least-cost alternative for each option). Unlike the beef and dairy cost model, total confinement was assumed for all swine and poultry operations; thus, runoff generation was not calculated.

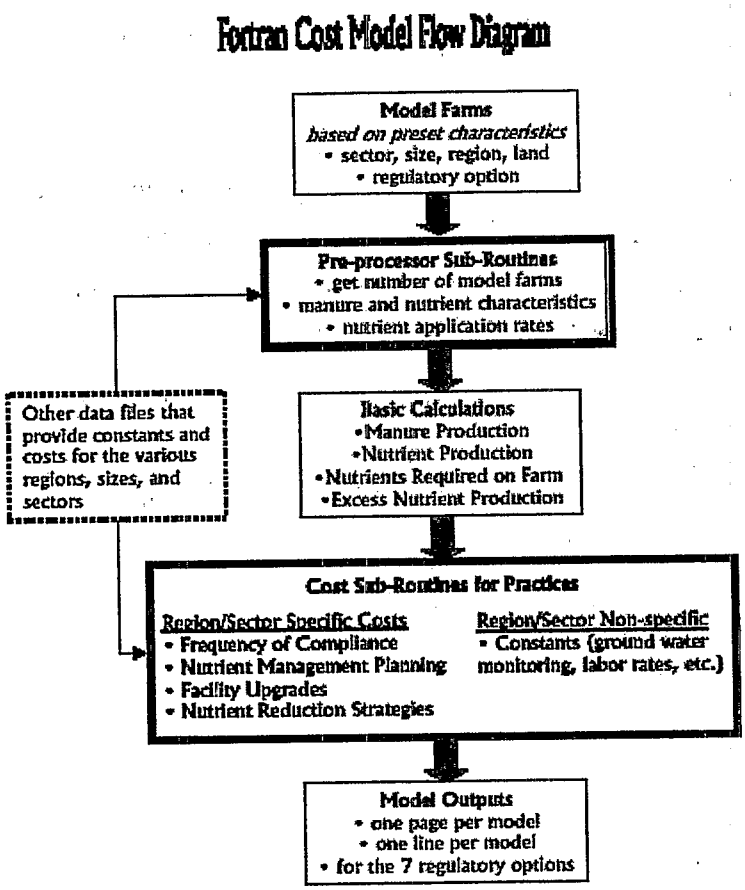

Figure 2.2-1. Flow Chart of Swine and Poultry Cost Model

The cost model developed costs for multiple model farms based on their size, region, operation type (e.g., type of animal raised), and nutrient (nitrogen or phosphorus) used in nutrient planning. Costs are calculated for nutrient management planning (e.g., training, soil testing), facility upgrades (e.g., mortality composting facility, lagoon liner, buffers), land application, and a range of scenarios for reducing excess nutrients (e.g., separation and hauling, feeding strategies). Frequency factors are applied to the component costs to weight the costs by the estimated percentage of operations that already have the component in place. Costs include capital costs; fixed, one-time costs; nonannual but recurring costs; and annual costs, all in 1997 dollars.

Model components and operations are described in greater detail in the following subsections. In addition, Section 8.0 describes side analyses conducted to test the sensitivity of the model to various inputs, to determine the factors that drive the costs, and to evaluate the overall robustness of the model.

2.2.1 Input Data to Cost Model

Input data to the cost model include information on the model farms, manure and wastewater generation and characteristics, regional information, technology costs, technical characteristics and performance, and frequency factors, as described below. Two types of data file structures — fixed-format files (*.dat) and variable-format files (*.csv) — are used, and data elements are separated by commas.

- Model farm definitions - Animal type, EPA regulatory option number, operation type (e.g., broiler, farrow to finish, wet layer), size class (e.g., Large 1), average number of head, region, performance level (high, medium, low), nutrient management basis (N or P), land availability category (1, 2, or 3), acreage, manure management system (e.g., liquid, solid), and number of operations that are represented by the model.

- Manure and waste generation and characteristics - Animal turnover rate, average weight of animal, manure characteristics, weight of manure produced, volume of manure produced, moisture content of fresh manure, nitrogen in fresh manure, efficiency of nitrogen application to field,

phosphorus in fresh manure, efficiency of phosphorus application to field, potassium in manure, efficiency of potassium application to field, dilution factor, percentage of birds that die in one turnover of animals, animal life span, average weight of animals at death, etc.

- Regional information - Recoverable manure correction factors, nitrogen uptake, phosphorus uptake, transportation distance, chronic rainfall, etc.

- Technology costs (including labor) - Installing ground-water monitoring well; time to sample ground-water monitoring well; water sample analysis; assessment of crop field/ground water link to surface water; recordkeeping and reporting; training and certification to land apply manure; manure sampler; manure nutrient analysis; setup and time required to take first manure sample; time required for additional samples; soil sampling frequency—low end; soil sampling frequency—site-specific approach; soil auger; time required to take sample—low end; time required to take sample—site-specific approach; cost of soil analysis; rate for obtaining a certified CNMP; scale to calibrate manure spreader; time required to calibrate manure spreader; tarp to calibrate manure spreader; hourly tractor operation costs; general labor rate; professional labor rate; amortization rate; property tax; standard maintenance; time allowance for litter transfer to storage; time allowance for litter storage cleaning; bulk price for wood shavings; lagoon depth marker; time required for weekly visual inspection; liner material; insulated lagoon cover; unit area cost of litter storage facility; phosphorus feeding strategy cost per pig; phosphorus feeding strategy cost per chicken; nitrogen feeding strategy cost per pig; nitrogen feeding strategy cost per chicken; hauling and applying liquid manure; hauling and applying solid manure; solid/liquid separator; pipe; installing a steel storage tank; time required to install pipe and set up separator; retrofit initial investment; retrofit 1/4-HP motor per 1,250 swine; retrofit motor usage per day; electricity; retrofit labor required; retrofit blades required per year; unit cost of high-rise construction; high-rise fuel, repairs, and utilities; hoop structure construction; hoop feed and manure equipment; hoop bedding; hoop fuel, repairs, and utilities; hoop labor, etc.

- Technology characteristics and performance - Shaving material application depth, rate of litter storage cleaning, length of litter storage, lagoon depth, lagoon side slopes, diversion berm top width, diversion berm height, diversion berm side slope, cost to move earth, area of house, nitrogen reduction in manure from feeding strategies, phosphorus reduction in manure from feeding strategies, separation safety factor, separator efficiency, solids content of separated manure, pipe length to connect lagoon to separator, amount of phosphorus transferred after separation, amount of nitrogen transferred after separation, etc.

- Frequency factors - Frequencies at which practices are currently implemented on model farms.

The central data file for model farms contains 14,346 records covering the range of values for animal type, operation type, region, nutrient management basis, baseline management level, land availability category, regulatory option, manure type, and operation size class. Separate costs were developed for each of these records (summarized in Table 2.2.1-1). Section 4.0 discusses inputs to the cost model in greater detail.

2.2.2 Technology Calculations

Execution of the cost model begins with a series of routines to load the input data described in Section 2.2.1. The Main program uses the regulatory option value to set rules regarding which practices the cost model will use. For example, only Option 3 includes costs for additional ground water protection practices. Next, the program executes a number of basic calculations, including total manure generation, nutrient (nitrogen and phosphorus) generation, and alternative technologies to reduce total nutrient generation, such as feeding strategies.

Another series of calculations follows to determine the land required to spread manure. These calculations are keyed to one of the following land availability categories:

- ***Category 1:*** Farm has the acreage needed to agronomically apply the nutrients in manure generated at the farm using regional estimates of crop uptake and yield. This acreage does not include the area of the buffer strip.
- ***Category 2:*** Farm has some land, but not enough to agronomically apply all nutrients in manure generated at the farm.
- ***Category 3:*** Farm has no land available for application of manure.

Table 2.2.1-1

Swine and Poultry Model Farm Input Records

Operation Type and Region	Options/ Suboptions[a]	Land Availability Categories	Size Classes	Nutrient Management Bases[b]	Manure Types	BMP Imp. Levels	Total
Broilers							**1,890**
Mid-Atlantic	12	3	5	2	1	3	945
South	12	3	5	2	1	3	945
Layers - Wet							**378**
South	12	3	2	2	1	3	378
Layers - Dry							**1,890**
Midwest	12	3	5	2	1	3	945
South	12	3	5	2	1	3	945
Turkeys							**1,512**
Mid-Atlantic	12	3	4	2	1	3	756
Midwest	12	3	4	2	1	3	756
Swine - Grow-to-Finish							**4,338**
Central	13	3	2	2	1	3	414
Mid-Atlantic	13	3	5	2	2	3	1,962
Midwest	13	3	5	2	2	3	1,962
Swine - Farrow-to-Finish							**4,338**
Central	13	3	2	2	1	3	414
Mid-Atlantic	13	3	5	2	2	3	1,962
Midwest	13	3	5	2	2	3	1,962
Total							**14,346**

[a]Option 6 is for swine only; N and P basis, liquid and pit for two regions, evaporative pond for one region, two sizes and Options 1 and 1A are N-based only, whereas option 2A is P-based only.

Next, the cost model determines nutrient management planning costs, which include fixed one-time costs (e.g., engineering costs, soil augers), nonannual recurring costs (e.g., CNMP development), and annual costs (e.g., recordkeeping). Some of these costs (e.g., soil testing) are incurred by all Category 1 and 2 farms, but not by Category 3 farms because they have no land.

After calculating nutrient management planning, the cost model calculates facility upgrade costs. Fixed, one-time costs include both amortizable and nonamortizable costs. Recurring costs for facility upgrades include visual inspection and operation and maintenance of the various upgrades. Fixed costs include mortality composting facilities, storage for solid waste, lagoon depth markers, stormwater diversions (berms), lagoon liners, buffers, recycling pumps, larger lagoons, and digesters (swine only, Option 6). The cost of storage for liquid waste is included only in the cases where increased storage is needed to contain chronic rainfall events (regulatory Option 1A) or where secondary lagoons are included to address hauling costs (Category 2 farms). In all other cases, the storage facility design is used only to derive costs for liners, covers, and storm water diversions. Storage costs in these cases are set to zero because it is assumed that the storage already exists.

The cost model then evaluates a series of 18 scenarios are then evaluated to determine the least cost alternative for addressing excess manure nutrients at Category 2 farms. These scenarios include the initial and annual costs for: feeding strategies; hauling with and without feeding strategies; separation and hauling with and without feeding strategies; retrofit flush to scrape (swine operations and wet layer operations); 5-year recurring sludge hauling with and without feeding strategies (swine operations); high-rise houses (swine operations), including hauling with and without feeding strategies; hoop houses (swine operations), including hauling with and without feeding strategies; and lagoon covers, with and without biogas generation and capture (swine operations).

Costs calculated for the various technologies are included under each option for which the technology applies. The cost model then conducts a cost test to determine the set of technologies that produces the lowest cost for each option, using the following equation:

$$\text{Annualized Model Farm Cost} = 0.14 \times \text{Capital Cost} + \text{O\&M} + \text{Fixed} + \text{Recurring Cost}_{(3\text{-yr})} + \text{Recurring Cost}_{(5\text{-yr})}$$

Outputs include fixed, fixed amortized, and annual nonamortized costs for facility upgrades, land application, and nutrient management for each of the model farms for swine and poultry. The cost model determines the total cost of each option by multiplying the costs of each model farm by the number of farms the model represents. Totals can be generated for each animal type, operation type, and other distinguishing characteristics by summing the costs across the selected characteristic.

Figure 2.2.2-2 illustrates the set of practices included in the costing under Option 2A, phosphorus-based nutrient management. All costs for nutrient management planning and facility upgrades are included in the cost for all options, but the components of these two cost categories can differ across categories and options. For example, manure sampling devices are included for all farms under Option 2A, but soil testing is not included for Category 3 farms because they have no land. The cost model calculates costs for all of the technology options listed in Figure 2.2.2-1, including options to haul manure with and without feeding strategies, and then selects the cheapest option as described above.

2.2.3 Frequency Factors

EPA developed frequency factors that describe the percentage of the swine and poultry industries that already implements particular operations, techniques, or practices that my be used to comply with the option. These particular operations, techniques, or practices are not required by the regulation. Rather, they serve as the cost basis for estimating compliance costs for specific model farms. The resulting weighted farm costs can be multiplied by the number of facilities represented by each model to estimate industry-wide costs.

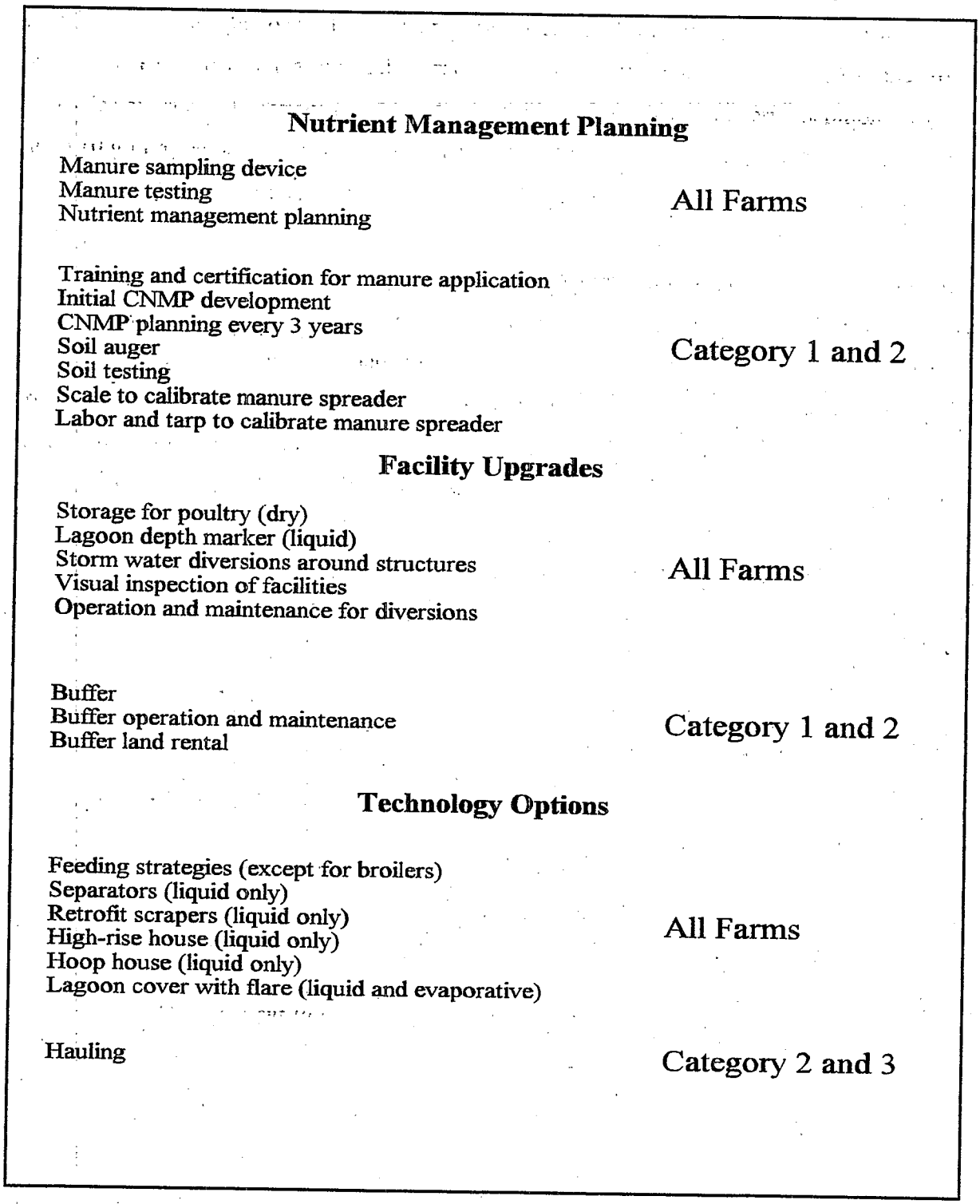

Figure 2.2.2-1 Practices Included Under Option 2A, Phosphorus-Based Management

USDA provided data from which some frequency factors were developed. Where data from USDA were not available, EPA used frequency factors obtained from other sources, which vary by sector, component, or practice. Industry and USDA data were used as the basis for most of the frequency factors for layers and swine; analysis of state and federal regulations was used primarily for broilers and turkeys. EPA's report on state regulatory programs (USEPA, 1999) was also used for all animal sectors. Costs were not attributed to CAFO model farms when state regulations specify standards or require practices equal to or more stringent than the proposed technology options.

Because the literature and industry-provided data for the broiler and turkey sectors were generally not detailed enough to generate frequency factors, EPA reviewed the specific regulatory language and summaries of regulations for 12 major poultry-producing states regarding requirements for nutrient management plans (NMPs) at broiler and turkey farms (Tetra Tech, 2000). Requirements were considered for farms in two size groups: 300 to 1,000 animal units (AU) and greater than 1,000 AU. All broiler and turkey farms were assumed to use dry waste management systems. Detail on the frequency factor calculations is provided in Section 6.

2.2.4 Calculation of Weighted Costs

EPA applied the frequency factors to develop a weighted-average cost for each model farm. For example, if a practice costs $100 and 60 percent (the frequency factor) of the operations in the model category already implement the practice, the average cost to farms represented by that model farm is $40. Each of these weighted-average costs was then multiplied by the number of farms represented by the particular model farm to estimate industry-level costs. Varying farm performance was addressed by assigning 25 percent of represented farms to the high performance level, 50 percent to the medium level, and 25 percent to the low level. As described above, these levels have different frequency factors values.

The following equation was used to weight the component costs:

$$Cost_{weighted} = Cost_{component} \times (1 - \text{Frequency Factor})$$

where:

$Cost_{weighted}$	=	Weighted component cost
$Cost_{component}$	=	Component cost
Frequency Factor	=	Percentage of operations that have component in place.

2.3 References

Tetra Tech. 2000. *Frequency Factors for Broiler and Turkey Facilities*, Memorandum from Tetra Tech, Inc., to Paul Shriner, Work Assignment Manager, U.S. Environmental Protection Agency, March 3, 2000. EPA Contract 68-C-99-263, Work Assignment B-04.

USEPA. 1999. *State Compendium: Programs and Regulatory Activities Related to Animal Feeding Operations - Interim Final Report.* U.S. Environmental Protection Agency, Office of Water, Washington, DC.

3.0 DATA SOURCES

EPA collected and evaluated data from a variety of sources during the course of developing the costs for the revised effluent limitations guidelines and standards for the concentrated animal feeding operations (CAFO) industry. These data sources include EPA site visits, industry trade associations, the U.S. Department of Agriculture (USDA), published literature, and data collected and analyzed conducted by the National Climate Data Center (NCDC), as well as previous EPA Office of Water studies of the Feedlots Point Source Category and other EPA studies of animal feeding operations. These data sources are discussed below. The list of references for each section of the cost model report is provided at the end of each section.

3.1 Summary of EPA's Site Visit Program

The Agency conducted approximately 116 site visits to collect information about animal feeding operations (AFOs) and waste management practices. Specifically, EPA visited beef feedlots, dairies, and swine, poultry, and veal operations throughout the United States. In general, the Agency visited a wide range of operations, including those demonstrating centralized treatment or new and innovative technologies. EPA chose the majority of facilities with the assistance of the following industry trade associations:

- National Pork Producers Council;
- United Egg Producers and United Egg Association;
- National Turkey Federation;
- National Cattlemen's Beef Association;
- National Milk Producers Federation; and
- Western United Dairymen.

EPA also received assistance from environmental groups, such as the Natural Resources Defense Council and the Clean Water Network. The Agency contacted university experts, state cooperatives and extension services, and state and EPA regional representatives

when identifying facilities for site visits. EPA also attended USDA-sponsored farm tours, as well as industry, academic, and government conferences.

Table 3-1 summarizes the number of site visits EPA conducted by animal industry sector, site locations, and size of animal operations.

Table 3-1

Number of Site Visits Conducted by EPA for the Various Animal Industry Sectors

Animal Type	Number of Site Visits	Location(s)	Size of Operations
Swine	30	NC, PA, OH, IA, MN, TX, OK, UT	900 - 1 million head
Poultry	6 (broiler)	GA, AR, NC, VA, WV, MD, DE, PA, OH, IN, WI	20,000 - 1 million birds
	12 (layer)		
	6 (turkey)		
Dairy	29	PA, FL, CA, WI, CO, VA	40 - 4,000 cows
Beef	30	TX, OK, KS, CO, CA, IN, NE, IA	500 - 120,000 head
Veal	3	IN	500 - 540 calves

The Agency considered the following factors when identifying representative facilities for site visits:

- Type of animal feeding operation;
- Location;
- Feedlot size; and
- Current waste management practices.

Facility-specific selection criteria are contained in site visit reports (SVRs) prepared for each facility visited by EPA. The SVRs are located in the administrative record for this rulemaking.

During the site visits, EPA typically collected the following types of information:

- General facility information, including size and age of facility, number of employees, crops grown, precipitation information, and proximity to nearby waterways;
- Animal operation data, including flock or herd size, culling rate, and method for disposing of dead animals;
- Description of animal holding areas, such as barns or pens, and any central areas, such as milking centers;
- Manure collection and management information, including the amount generated, removal methods and storage location, disposal information, and nutrient content;
- Wastewater collection and management information, including the amount generated, runoff information, and nutrient content;
- Nutrient management plans and best management practices (BMPs); and
- Available wastewater discharge permit information.

This information, along with other site-specific information, is documented in the SVRs for each facility visited. Some of the information collected from the site visits was used in the cost model, such as the percentage of beef feedlots and heifer operations that require the installation of a pond and the percentage of dairies that would require the installation of a lagoon.

3.2 Industry Trade Associations

EPA contacted the following industry trade associations and representatives during the development of the proposed and promulgated rules and used the information provided for the cost model.

US Poultry and Egg Association (USPOULTRY). USPOULTRY represents all segments of the poultry and egg industry, from producers of eggs, turkeys, and broilers to the processors of these products and allied companies that serve the industry. USPOULTRY

sponsors the world's largest poultry industry show, scientific research, and a comprehensive, year-round educational program for members of the industry.

Capitol Link. Capitol Link represents the interests of many livestock organizations and acts as a liaison with federal agencies such as EPA. They frequently provide comments and data on proposed federal regulatory actions.

National Pork Producers Council (NPPC). NPPC is a marketing organization and trade association made up of 44 affiliated state pork producer associations. NPPC's purpose is to increase the quality, production, distribution, and sales of pork and pork products.

United Egg Producers and United Egg Association (UEP/UEA). UEP/UEA promotes the egg industry in the following areas: price discovery, production and marketing information, unified industry leadership, USDA relationships, and promotional efforts.

National Turkey Federation (NTF). NTF is the national advocate for all segments of the turkey industry, providing services and conducting activities that increase demand for its members' products.

National Chicken Council (NCC). NCC represents the vertically integrated companies that produce and process about 95 percent of the chickens sold in the United States. The association provides consumer education, public relations, and public affairs support, and is working to seek a positive regulatory, legislative, and economic environment for the broiler industry.

National Cattlemen's Beef Association (NCBA). NCBA is a marketing organization and trade association for cattle farmers and ranchers, representing the beef industry.

National Milk Producers Federation (NMPF). NMPF is involved with milk quality and standards, animal health and food safety issues, dairy product labeling and standards, and legislation affecting the dairy industry.

American Veal Association (AVA). AVA represents the veal industry, and advances the industry's concerns in the legislative arena, coordinates production-related issues affecting the industry, and handles other issues relating to the industry.

Western United Dairymen (WUD). WUD, a dairy organization in California, promotes legislative and administrative policies and programs for the industry and consumers.

Professional Dairy Heifer Growers Association (PDHGA). PDHGA is an association of heifer growers who are dedicated to growing high-quality dairy cow replacements. The association offers educational programs and professional development opportunities, provides a communication network, and establishes business and ethical standards for the dairy heifer grower industry.

All of the above organizations, along with several of their state affiliates, assisted EPA's efforts to understand the industry by helping with site visit selection, submitting supplemental data, and reviewing descriptions of the industry and waste management practices. These organizations also participated in and hosted meetings with EPA for the purpose of exchanging information with the Agency. EPA also obtained copies of membership directories and conference proceedings, which were used to identify contacts and obtain additional information on the industry. For the cost model, EPA used information provided by the trade associations regarding the operations at AFOs and locations of these operations throughout the U.S. The membership directories for the trade associations were also used.

3.3 U.S. Department of Agriculture (USDA)

EPA obtained data from several agencies within the USDA, including the National Agricultural Statistics Service (NASS), the Animal and Plant Health Inspection Service (APHIS), Natural Resources Conservation Service (NRCS), and the Economic Research Service (ERS) in order to better characterize the AFO industry. The collected data used in the cost model include statistical survey information and published reports. Data collected from each agency are described below.

3.3.1 National Agricultural Statistics Service (NASS)

NASS is responsible for objectively providing accurate statistical information and data support services of structure and activities of agricultural production in the United States. Each year NASS conducts hundreds of surveys and prepares reports covering virtually every facet of U.S. agricultural publications. The primary source of data is the animal production facility. NASS collects voluntary information using mail surveys, telephone and in-person interviews, and field observations. NASS is also responsible for conducting a Census of Agriculture, which is currently performed once every 5 years; the last census occurred in 1997. EPA gathered information from the following published NASS reports:

- *Hogs and Pigs: Final Estimates 1993 - 1997*;
- *Chickens and Eggs: Final Estimates 1994 - 1997*;
- *Poultry Production and Value: Final Estimates 1994 - 1997*;
- *Cattle: Final Estimates 1994 - 1998*;
- *Milking Cows and Production: Final Estimates 1993 - 1997;*
- *1997 Census of Agriculture*; and
- *Estimation of Private and Public Costs Associated with Comprehensive Nutrient Management Plan Implementation: A Documentation, 2002.*

The information EPA collected from these sources is summarized below.

Hogs and Pigs: Final Estimates 1993 - 1997

EPA used data from this report to augment the swine industry profile. The report presents information on inventory, market hogs, breeding herd, and pig crops. Specifically, the report provides the number of farrowings, sows, and pigs per litter. This report presents the number of operations with hogs; however, EPA did not use this report to estimate farm counts

because the report provided limited data. Instead, EPA used the 1997 Census of Agriculture data to estimate farm counts, as discussed later in this section.

Chickens and Eggs: Final Estimates 1994 - 1997

EPA used data from this report to augment the poultry industry profile. The report presents national and state-level data for the top-producing states on chickens and eggs, including the number laid and production for 1994 through 1997.

Poultry Production and Value: Final Estimates 1994 - 1997

EPA used data from this report to augment the poultry industry profile. The report presents national and state-level data for the top-producing states on production (number and pounds produced/raised), price per pound or egg, and value of production of broilers, chickens, eggs, and turkeys for 1994 through 1997.

Cattle: Final Estimates 1994 - 1998

EPA used data from this report to augment the beef industry profile. The report provides the number of and population estimates for beef feedlots that have a capacity of over 1,000 head of cattle, grouped by size and geographic distribution. This report provides national and state-level data, which include the number of feedlots, cattle inventory, and number of cattle sold per year by size class for the 13 top-producing beef states. The report also provides the total number of feedlots that have a capacity of fewer than 1,000 head of cattle, total cattle inventory, and number of cattle sold per year for these operations. However, EPA did not use this report to estimate farm counts because the report provided limited data. Instead, as discussed earlier in this section, EPA used the 1997 Census of Agriculture data to estimate farm counts, as discussed later in this section.

Milking Cows and Production: Final Estimates 1993 - 1997

EPA used data from this report to augment the dairy industry profile. The report presents national and state-level estimates of dairy cattle inventory and the number of dairy operations by size group. This particular report presents data for all dairy operations with over 200 mature dairy cows in one size class. However, EPA did not use this report to estimate farm counts because the report provided limited data. Instead, EPA used the 1997 Census of Agriculture data to estimate farm counts, as discussed below.

1997 Census of Agriculture

The Census of Agriculture is a complete accounting of U.S. agricultural production and is the only source of uniform, comprehensive agricultural data for every county in the nation. The census is conducted every 5 years. Prior to 1997, the Bureau of the Census conducted this activity. Starting with the 1997 Census of Agriculture, the responsibility passed to USDA NASS. The census includes all farm operations from which $1,000 or more of agricultural products are produced and sold. The most recent census occurred in late 1997 and is based on calendar year 1997 data.

The census collects information relating to land use and ownership, crops, livestock, and poultry. This database is maintained by USDA; data used for this analysis were compiled with the assistance of staff at USDA NASS. (USDA periodically publishes aggregated data from these databases and also compiles customized analyses of the data for members of the public and other government agencies. In providing such analyses, USDA maintains a sufficient level of aggregation to ensure the confidentiality of any individual operation's activities or holdings.)

Several size groups were developed to allow tabulation of farm counts by farm size using different criteria than those used in the published 1997 Census of Agriculture. EPA developed algorithms to define farm size in terms of capacity, or number of animals likely to be found on the farm at any given time. To convert sales of hogs and pigs and feeder pigs into an

inventory, EPA divided total sales by the number of groups of pigs likely to be produced and sold in a given year. EPA estimates that the larger grow-finish farms produce 2.8 groups of pigs per year. Farrow-finish operations produce 2.0 groups of pigs per year. Nursery operations produce up to 10 groups per year. Data used to determine the groups of pigs produced per year were obtained from a survey performed by USDA (USDA APHIS,1999).

For beef operations, EPA estimates the larger feedlots produce up to 3.5 groups of cattle per year, while the smaller operations produce only 1 to 1.5 groups per year (ERG, 2002). The newly aggregated data better depict the size and geographic distribution of operations needed for EPA's analysis, particularly smaller beef feedlots (fewer than 1,000 head capacity) and larger dairies (more than 200 mature dairy cows). EPA used the census data to gather more details on the larger dairies, such as the number of operations and number of head for additional size classes (200 to 499, 500 to 999, and more than 1,000 head).

USDA NRCS also compiled and performed analyses on census data that EPA used for its analyses. These data identify the number of feedlots, their geographical distributions, and the amount of cropland available to land apply animal manure generated from their confined feeding operations (based on nitrogen and phosphorus availability relative to crop need). EPA used these estimates to identify feedlots that may not own sufficient land to apply all of the animal manure to the land. EPA used the results of this analysis to estimate the number of operations that may incur additional manure transportation costs under the various regulatory options considered under the proposed rule.

Estimation of Private and Public Costs Associated with Comprehensive Nutrient Management Plan Implementation: A Documentation, 2002

EPA received data from USDA as part of a document entitled *Estimation of Private and Public Costs Associated with Comprehensive Nutrient Management Plan Implementation: A Documentation.* This document presents costs and frequency factors for three performance-based categories of facilities (low requirement, medium requirement, and high requirement) for a series of "representative" farms defined by USDA in nine USDA-defined

regions. This approach is similar to EPA's modeling approach, and allowed EPA to directly use some of USDA's data to calculate corresponding frequency factors in the cost models.

3.3.2 Animal and Plant Health Inspection Service (APHIS)/National Animal Health Monitoring System (NAHMS)

APHIS provides leadership in ensuring the health and care of animals and plants, improving agricultural productivity and competitiveness, and contributing to the national economy and public health. One of its main responsibilities is to enhance the care of animals. In 1983, APHIS initiated the National Animal Health Monitoring System (NAHMS) as an information-gathering program to collect, analyze, and disseminate data on animal health, management, and productivity across the United States. NAHMS conducts national studies to gather data and generate descriptive statistics and information from data collected by other industry sources. NAHMS has published national study reports for various food animal populations (e.g., swine, dairy cattle).

EPA gathered information for the cost model report from the following NAHMS reports:

- *Swine '95 Part I: Reference of 1995 Swine Management Practices*;
- *Swine '95 Part II: Reference of Grower/Finisher Health & Management Practices*;
- *Swine 2000 Part I: Reference of Swine Health and Management in the United States;*
- *Layers '99 Parts I and II: Reference of 1999 Table Egg Layer Management in the U.S.*;
- *Dairy '96 Part I: Reference of 1996 Dairy Management Practices*;
- *Dairy '96 Part III: Reference of 1996 Dairy Health and Health Management*;

- *Beef Feedlot '95 Part I: Feedlot Management Practices;* and
- *Feedlot '99 Part I: Baseline Reference of Feedlot Management Practices.*

EPA also collected information from NAHMS fact sheets, specifically the *Swine '95* fact sheets, which describe biosecurity measures, vaccination practices, environmental practices/management, and antibiotics used in the industry.

Swine '95 Part I: Reference of 1995 Swine Management Practices

This report provides references on productivity, preventative and vaccination practices, biosecurity issues, and environmental programs (including carcass disposal). The data were obtained from a sample of 1,477 producers representing nearly 91 percent of the U.S. hog inventory from the top 16 pork-producing states. Population estimates are broken down into farrowing and weaning, nursery, grower/finisher, and sows.

Swine '95 Part II: Reference of Grower/Finisher Health & Management Practices

This report provides additional references on feed and waste management, health and productivity, marketing, and quality control. The data were collected from 418 producers with operations having 300 or more market hogs (at least one hog over 120 pounds) and represent about 90 percent of the target population. NAHMS also performed additional analyses for EPA that present manure management information for the swine industry by two size classes (fewer than 2,500 marketed head and more than 2,500 marketed head) and three regions (Midwest, North, and Southeast) (USDA APHIS, 1999).

Swine 2000 Part I: Reference of Swine Health and Management in the United States

Swine 2000 was designed to statistically sample from operations with 100 or more pigs. The study included 17 of the major pork-producing states that account for 94 percent of the U.S. pig inventory. Data for this report were collected from 2,328 operations. This report

provides information on feed and waste management, health and productivity, animal management, and facility management. In addition to this report, NAHMS also performed additional analyses for EPA that present the percentage of sites where pit holding was the waste management system used most by region and herd size for the farrowing and grow/finish phase (USDA APHIS, 2002).

Layers '99 Parts I and II: Reference of 1999 Table Egg Layer Management in the U.S.

The Layers '99 study is the first NAHMS national study of the layer industry. Data were obtained from 15 states, which account for over 75 percent of the table egg layers in the United States. Part I of this report provides a summary of the study results, including descriptions of farm sites and flocks, feed, and health management. Part II of this report provides a summary of biosecurity, facility management, and manure handling.

Dairy '96 Part I: Reference of 1996 Dairy Management Practices and Dairy '96 Part III: Reference of 1996 Dairy Health and Health Management

These reports present the results of a survey that was distributed to dairies in 20 major states to collect information on cattle inventories; dairy herd management practices; health management; births, illness, and deaths; housing; and biosecurity. The results represent 83 percent of U.S. milk cows, or 2,542 producers. The reports also provide national data on cattle housing, manure and runoff collection practices, and irrigation/land application practices for dairies with more than 200 or fewer than 200 mature dairy cows. NAHMS provided the same information to EPA with the results reaggregated into three size classes (fewer than 500, 500 to 699, and more than 700 mature dairy cows) and into three regions (East, West, and Midwest).

Beef Feedlot '95 Part I: Feedlot Management Practices

This report contains information on population estimates, environmental programs (e.g., ground-water monitoring and methods of waste disposal), and carcass disposal at small and

large beef feedlots (fewer than and more than 1,000 head capacity). The data were collected from 3,214 feedlots in 13 states, representing almost 86 percent of the U.S. cattle-on-feed inventory.

Feedlot '99 Part I: Baseline Reference of Feedlot Management Practices

This report also contains information on population estimates, environmental programs, and carcass disposal at beef feedlots. The data were collected from 1,250 feedlots in 12 states, representing 77 percent of all cattle on feed in the United States.

3.3.3 Natural Resources Conservation Services (NRCS)

NRCS provides leadership in a partnership effort to help people conserve, improve, and sustain our natural resources and the environment. NRCS relies on many partners to help set conservation goals, work with people on the land, and provide assistance. Its partners include conservation districts, state and federal agencies, NRCS Earth Team volunteers, agricultural and environmental groups, and professional societies.

NRCS publishes the *Agricultural Waste Management Field Handbook*, which is an agricultural/engineering guidance manual that explains general waste management principles, and provides detailed design information for particular waste management systems. The handbook reports specific design information on a variety of farm production and waste management practices at different types of feedlots. The handbook also reports runoff calculations under normal and peak precipitation as well as information on manure and bedding characteristics. EPA used this information to develop its cost and environmental analyses. NRCS personnel also contributed technical expertise in the development of EPA's estimates of compliance costs and environmental assessment framework by providing EPA with estimates of manure generation in excess of expected crop uptake.

NRCS also analyzed the census data that EPA used for its analysis. In the draft February 23, 2002 *Profile of Farms with Livestock in the United States: A Statistical Summary* USDA NRCS presents estimates of the number of CAFOs by animal sector and size group, as

well as the number of head at these farms. EPA used these estimates to calculate the average number of head and the number of CAFOs by animal sector and size group. In the case of beef feedlots, NRCS used a turnover rate of 2.5 to estimate capacity for all size operations. EPA recalculated the number of head at these operations using the turnover rates discussed above.

Another NRCS report, *Manure Nutrients Relative to the Capacity of Cropland and Pastureland to Assimilate Nutrients: Spatial and Temporal Trends for the United States* published in December 2000, provides background information on trends in animal agriculture and manure production based on information collected in the 1997 Census of Agriculture. EPA used data on the percentage of farms with sufficient cropland, insufficient cropland, and no cropland to determine the number of CAFOs that require off-site transport of excess manure. EPA also used data from this report to determine the amount of excess manure at operations with an insufficient amount of cropland to agronomically land apply all of the manure and wastewater generated on site.

Beginning in early 2002, NRCS shared drafts of its report *Overview of Cost Analysis for Implementation of CNMPs On Animal Feeding Operations* with EPA. This report presents a cost analysis for planning, designing, implementing and following up on CNMPs on AFOs. The report also estimated the percentage of operations that have high, medium, and low requirements for the development and implementation of CNMPs. The scheduled release of the final document was October 2002. EPA used information from this report to refine baseline conditions of the CAFOs industry.

3.3.4 Agricultural Research Service (ARS)

ARS is the primary research agency working internally for the USDA. One of its many objectives is to heighten awareness of natural resources and the environment. EPA used information provided from ARS's *Agricultural Phosphorus and Eutrophication* report (USDA ARS, 1999) to estimate the number of CAFOs that could be subject to a phosphorus-based regulation.

3.3.5 Economic Research Service (ERS)

ERS provides economic analyses on efficiency, efficacy, and equity issues related to agriculture, food, the environment, and rural development to improve public and private decision making. ERS uses data from the Farm Costs and Returns Survey (FCRS) to examine farm financial performance (USDA ERS, 1997). This report developed 10 regions that were intended to group agricultural production into broad geographic regions of the United States: Pacific, Mountain, Northern Plains, Southern Plains, Lake States, Corn Belt, Delta, Northeast, Appalachian, and Southern. EPA further consolidated the 10 sectors into 5 regions in order to analyze aggregated Census of Agriculture data.

ERS is also responsible for the Agricultural Resource Management Study (ARMS), USDA's primary vehicle for collection of information on a broad range of issues about agricultural resource use and costs and farm sector financial conditions. The ARMS is a flexible data collection tool with several versions and uses. Information is collected via surveys, and it provides a measure of the annual changes in the financial conditions of production agriculture.

3.4 Literature Sources

EPA performed several Internet and literature searches to identify papers, presentations, and other applicable materials to use in the cost model report. Literature sources were identified from library literature searches as well as through EPA contacts and industry experts. Literature collected by EPA covers such topics as housing equipment, fertilizer and manure application, general agricultural waste management, air emissions, pathogens, and construction cost data. EPA used literature sources to estimate the costs of design and expansion of waste management system components at AFOs. EPA also used publicly available information from several universities specializing in agricultural research for industry profile information, waste management and modeling information, and construction cost data, as well as existing computer models, such as the FarmWare Model that was developed by EPA's AgStar program.

3.5 National Climate Data Center (NCDC)

EPA used data from another government agency, the National Climate and Data Center (NCDC). The National Oceanic and Atmospheric Administration (NOAA) conducts research and gathers data, which is provided on the NCDC web site. For the cost model, EPA used the *Normal Monthly Precipitation* report from the NCDC web site to obtain the normal monthly precipitation values from 1971 to 2000 for cities in each state. These values were used to calculate the annual precipitation for each region.

3.6 References

ERG, 2002. *Beef Production Cycles and Capacity*. Memorandum from D. Bartram to Feedlots Rulemaking Record. December 9, 2002.

ERG, 2000. *Facility Counts for Beef, Dairy, Veal, and Heifer Operations.* Memorandum by Deborah Bartram, Eastern Research Group, Inc. to the Feedlots Rulemaking Record. December 13, 2002.

USDA ERS, 1997. *Farm Costs and Returns Survey (FCRS).*

USDA ARS, 1999. *Agricultural Phosphorus & Eutrophication (ARS-149).* July 1, 1999.

USDA APHIS, 1999. Data summaries of NAHMS Swine '95, prepared at request of EPA. *National Animal Health Monitoring System.* Washington, DC.

USDA, 2002. Queries run by Centers for Epidemiology and Animal Health prepared by Eric Bush; March 22, 2002; 2 pages.

4.0 INPUT DATA

This section describes in detail the input data to the cost model that EPA used to estimate the compliance costs for CAFOs. Section 4.1 defines the geographic regions that were modeled, Section 4.2 describes the size groups for each animal group, Section 4.3 discusses farm counts, Section 4.4 discusses average head at animal feeding operations, Section 4.5 discusses wastewater/dilution water, Section 4.6 discusses manure generation, Section 4.7 discusses precipitation data and runoff, Section 4.8 discusses crops and agronomic application rates, Section 4.9 discusses excess manure, and Section 4.10 discusses acres available for land application of manure.

4.1 Definition of Regions

For the purposes of this analysis, EPA classified animal feeding operations into various geographic regions. The Agency used these classifications to differentiate the types of waste management system components that are expected to be in place at baseline (due either to existing regulations or to geographic location), as well as the amount of wastes generated, the crops grown, and the ability of the operations to use manure, litter, and other process wastewater on site. This subsection describes the geographic regions developed and used to estimate compliance costs for CAFOs.

The cost model addresses variations between operations in different regions of the country. For example, the crop nutrient removal rates, which are used to set manure application rates, vary among regions of the country based on average crop yields in each region. Many of the costs in the model rely on the manure and associated nutrient production of the animals at an operation, and are affected by regional differences such as climate and rainfall. Some frequency factors also vary by region when data were available.

EPA generally obtained information on animal production from USDA's 1997 Census of Agriculture, USDA's National Agricultural Statistics Service (NASS), and information gathered from site visits and trade associations. For information obtained from the 1997 Census

of Agriculture, EPA divided the United States into five production regions and designated them the South, Mid-Atlantic, Midwest, West, and Central regions. Originally, the USDA Economic Research Service (ERS) established ten regions so that it could group economic information. EPA condensed these regions into the five regions because of similarities in animal production and manure-handling techniques, and to allow for the aggregation of critical data on the number of facilities, production quantities, and financial conditions, which may otherwise not be possible due to concerns about disclosure.[1] Table 4.1-1 presents the production regions.

Table 4.1-1

Animal Feeding Operation (AFO) Production Regions

Region	States Included
Central	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Oklahoma, Texas, Utah, Wyoming
Mid-Atlantic	Connecticut, Delaware, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, Tennessee, Vermont, Virginia, West Virginia
Midwest	Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin
Pacific	Alaska, California, Hawaii, Oregon, Washington
South	Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, South Carolina

For swine and poultry operations, EPA developed key geographic regions on which to focus cost modeling efforts because the swine and poultry animal sectors tend to be concentrated in these regions. Also, data are lacking for those regions where a particular sector has a lesser presence. The climate of each key region defines the amount of precipitation that will need to be managed and the typical evaporation rate. The region also defines typical crop yields, soil types, housing types, and manure management practices that vary across the nation. In practice, a given state may have many soil types and climatic variations; EPA adopted the key

[1]For example, USDA Census of Agriculture data are typically not released unless there are enough observations to ensure confidentially. Consequently, if data were aggregated on a state basis (instead of a regional basis), many key data points needed to describe the industry segments would be unavailable.

region approach to account for typical geographical variations without using an impractical number of model farms.

Table 4.1-2 presents the key regions for each animal sector. The Swine 95 survey found that 78 percent of U.S. hog operations were located in the Mid-Atlantic and Midwest Regions. However, more recent reports indicate an increasing trend toward large facilities in the Central Region. Thus, the key regions selected for the swine sector are the Mid-Atlantic, Midwest, and Central. As described in Chapter 2, swine operations do not generally collect runoff, and direct rainfall variations in the other regions does not significantly change costs. To account for all potentially regulated operations, the cost model distributed operations in regions other than the key regions evenly among the regions that were modeled. For example, the Midwest region combines operations from the Midwest with a portion of the operations from the "non-key" regions that are assumed to have similar production and manure management practices. Large swine operations that use evaporative lagoons for waste storage were modeled in the Central region. Operations located in other regions were split among the modeled regions to fully account for operations in a given size class. Allocating operations from one region to another was necessary since the census data could not be obtained for all desired regions and size groups (USDA NASS, 1999).

Beef feedlots, dairies, heifer, and veal operations were modeled in all regions in which operations were identified within EPA's size classes. No Large beef feedlots were identified in the South region. Additionally, no heifer operations were identified in the Mid-Atlantic and South regions, no Large heifer operations were identified in the Midwest region, and no veal operations were identified in the Pacific and South regions. The regions used for each animal sector are presented in Table 4.1-2.

Table 4.1-2

Key Regions Modeled by Animal Sector

Animal Sector	Regions Modeled
Swine: Farrow to Finish	Mid-Atlantic, Midwest, Central
Swine: Grow Finish	Mid-Atlantic, Midwest, Central
Layer: Wet	South
Layer: Dry	Midwest, South
Broiler	Mid-Atlantic, South
Turkey	Mid-Atlantic, Midwest
Beef Feedlots	Central, Mid-Atlantic, Midwest, Pacific, South
Dairies	Central, Mid-Atlantic, Midwest, Pacific, South
Heifer Operations	Central, Midwest, Pacific
Veal Operations	Central, Mid-Atlantic, Midwest

The key regions for broilers are the Mid-Atlantic and South (containing 86 percent of larger farms), while the Mid-Atlantic and Midwest are the key regions for turkeys (containing 67 percent of larger farms). Layer farms with wet manure systems are located primarily in the South and Texas, where approximately half of all layer farms use wet-manure-handling systems. EPA used industry reports and NAHMS data to estimate the number of layer farms with wet manure systems in the rest of the United States (USDA APHIS, 1999). The South and Midwest are the key regions for all other layer farms, capturing 53 percent of larger layer farms in addition to the 12 percent of farms with layers with wet manure systems. For large broiler, turkey, and layer farms (other than wet manure systems), precipitation was not a key factor affecting costs. These operation use confining housing almost exclusively. Therefore, operations from "non-key" regions were folded into the key regions for these animal types in the same manner as described above for swine operations.

4.2 Definition of Size Groups

EPA developed and analyzed up to five size groups for each animal type. These size groups included one to two "Large" groups, representing operations that are already subject to the 1974 effluent limitations guidelines and standards for the Feedlots Point Source Category, as well as three "Medium" groups to evaluate the costs, benefits, and impacts of the regulatory options on operations that may be defined as CAFOs. Table 4.2-1 presents the size groups for each animal type.

Table 4.2-1

Size Classes for Model Farms[a]

Animal Type	Medium 1	Medium 2	Medium 3	Large 1	Large 2
Beef	300-499	500-749	750-999	1,000-7,999	≥8,000
Heifer	300-499	500-749	750-999	≥1,000	NA
Dairy (Mature Dairy Cows)	200-349	350-524	525-699	≥700	NA
Veal	300-499	500-749	≥750	NA	NA
Swine	750-1,249	1,250-1,874	1,875-2,499	2,500-4,999	≥5,000
Dry Layers	25,000-49,999	50,000-74,999	75,000-81,999	82,000-599,999	>600,000
Wet Layers	NA	NA	9,000-29,999	>30,000	NA
Broilers	37,750-49,999	50,000-74,999	75,000-124,999	125,000-179,999	≥180,000
Turkeys	16,500-27,499	27,500-41,249	41,250-54,999	≥55,000	NA

NA - Not applicable.

[a]These size classes represent capacity at a given point in the year, which does not necessarily correspond to annual production.

4.3 Farm Counts

This subsection describes how EPA developed farm counts for each animal sector.

4.3.1 Farm Counts - Beef Feedlots

Table 4.3.1-1 presents the total number of potential beef CAFOs by size class, as estimated by USDA's NRCS, using the 1997 Census of Agriculture data (USDA, 2002). The USDA estimates grouped all large operations (≥1,000 head) into one group. EPA supplemented these data with USDA's NASS data to estimate that there are 421 beef feedlots with ≥8,000 head (USDA NASS, 1999b).

Table 4.3.1-1

Number of Potential Beef CAFOs by EPA Size Class from the 1997 Census of Agriculture Database

Size Class (Number of Milk Cows)				
Medium 1 (300-499 head)	Medium 2 (500-749 head)	Medium 3 (750-999 head)	Large 1 and 2 (≥1,000 head)	Total
1,466	801	415	1,766	7,230

Source: USDA, 2002 (Table 16).

To estimate the number of operations by geographic region, EPA used the number of operations that sold fattened cattle by state provided in the 1997 Census of Agriculture data to develop a distribution of beef feedlots by region. Because the Census data are sales numbers, EPA estimated the number of production cycles per year and converted the sales data into cattle capacity (i.e., the number of beef cattle estimated on site at any one time) (ERG, 2002). Table 4.3.1-2 presents the distribution of beef feedlots by region for each size category provided in the Census. Table 4.3.1-2 also presents the estimated cattle capacity for each size category in the Census.

Table 4.3.1-2

Percentage of Beef Feedlots by Region and Census of Agriculture Size Category

Region	Percentage of Beef Feedlots				
Census Size Categories	500-999 Head Sold	1,000-2,499 Head Sold	2,500-4,999 Head Sold	≥5,000 Head Sold	≥1,000 head capacity[b]
Estimated Capacity[a]	380-750 Head Capacity	750-1,785 Head Capacity	1,785-3,424 Head Capacity	≥3,425 Head Capacity	
Central	11.6	15.2	21.4	36.6	31.5
Mid-Atlantic	3.9	2.7	1.6	0.2	0.6
Midwest	82.5	78.7	74.5	58.3	63.7
Pacific	1.4	2.7	2.5	5.0	4.2
South	0.5	0.7	0	0	0

Source: Census of Agriculture (USDA, 1997).
[a]ERG memorandum (2002.).
[b]Estimated as the geographic distribution of both the 2,500 to 4,999 and the ≥5,000 head sold categories.

EPA assumed that the regional distribution of operations for the Medium 1 and Medium 2 size classes is represented by the 500 to 999 head sold category in the Census and the regional distribution of operations for the Medium 3 size class is represented by the 1,000 to 2,499 head sold category in the Census. EPA also estimated that the regional distribution for both the Large 1 and Large 2 size classes is represented by the combination of the 2,500 to 4,999 and the ≥5,000 head sold category (the regional distribution of operations for this size class is presented in Table 4.3.1-2 under the heading "≥1,000 head").

For example, EPA estimated the potential number of beef CAFOs in the Central region by size class using the following equations and the data presented in Tables 4.3.1-1 and 4.3.1-2:

Medium 1:	1,466 operations × 11.6%	= 170;
Medium 2:	801 operations × 11.6%	= 93;
Medium 3:	415 operations × 15.2%	= 63;
Large 1:	1,345 operations × 31.5%	= 424; and
Large 2:	421 operations × 31.5%	= 133.

Table 4.3.1-3 presents the final number of beef feedlot CAFOs by size class and region.

Table 4.3.1-3

Number of Beef Feedlots by Region and Size Class

Region	Size Class				
	Medium 1	Medium 2	Medium 3	Large 1	Large 2
Central	170	93	63	424	133
Mid-Atlantic	58	32	11	8	3
Midwest	1,210	661	327	856	268
Pacific	21	11	11	57	17
South	7	4	3	0	0

Not all medium operations are expected to be CAFOs under the rule. The percentage of medium facilities EPA estimates will be CAFOs is presented in Table 4.3.1-4 (See Preamble Section 4 and 40 CFR part 122.23).

Table 4.3.1-4

Percentage of Beef Facilities That Are Expected to Be CAFOs

Region	Size Class	
	All Medium	All Large
Central	10	100
Mid-Atlantic	4	100
Midwest	6	100
Pacific	10	100
South	4	10

4.3.2 Farm Counts - Dairies

Table 4.3.2-1 presents the total number of potential dairy CAFOs by size class, as estimated by USDA's NRCS, using the 1997 Census of Agriculture data (USDA NRCS, 2002). To estimate the number of operations by geographic region, EPA used the number of milk cow operations by state provided in the 1997 Census of Agriculture data to develop a distribution of dairies by region. However, the Census provides farm counts for different size groups than those evaluated by EPA, as shown in Table 4.3.2-2.

Table 4.3.2-1

Number of Potential Dairy CAFOs by EPA Size Class from the 1997 Census of Agriculture Database

Size Class (Number of Milk Cows)				
Medium 1 (200-349 head)	Medium 2 (350-524 head)	Medium 3 (525-699 head)	Large 1 (≥700 head)	Total
3,805	1,372	603	1,450	7,230

Source: USDA NRCS, 2002 (Table 16).

Table 4.3.2-2

Percentage of Dairies by Region and Census of Agriculture Size Category

Region	Percentage of Dairies			
	200-499 head	500-999 head	≥1,000 head	≥700 head[a]
Central	17.5	20.9	31.9	27.6
Mid-Atlantic	25.7	12.5	3.8	7.1
Midwest	27.9	9.6	4.7	6.6
Pacific	21.3	49.8	54.0	52.4
South	7.5	7.2	5.7	6.3

Source: Census of Agriculture (USDA, 1997).
[a]Estimated as 40 percent of operations with 500-999 head and all of operations with ≥1,000 head.

For the purposes of this rule, EPA assumed that the regional distribution of operations in the Medium 1 and Medium 2 size classes were represented by the 200 to 499 head category in the Census. EPA also assumed that the regional distribution of operations in the Medium 3 size class were represented by the 500 to 999 head category in the Census. EPA estimated that 40 percent of operations in the Census' 500 to 999 head category and all of the operations in the Census' ≥1,000 head category make up the Large 1 size class. The regional distribution of operations for this size class is presented in Table 4.3.2-2 under the heading "≥700 head."

For example, EPA estimated the number of dairy CAFOs in the Central region by size class using the following equations and the data presented in Tables 4.3.2-1 and 4.3.2-2:

Medium 1:	3,805 operations × 17.5%	= 667;
Medium 2:	1,372 operations × 17.5%	= 241;
Medium 3:	603 operations × 20.9%	= 126; and
Large 1:	1,450 operations × 27.6%	= 401.

Table 4.3.2-3 presents the final number of dairies by size class and region.

Table 4.3.2-3

Number of Dairies by Region and Size Class

Region	Size Class			
	Medium 1	Medium 2	Medium 3	Large 1
Central	667	241	126	401
Mid-Atlantic	979	353	75	104
Midwest	1,062	383	58	95
Pacific	812	293	301	759
South	285	102	43	91

Not all medium operations are expected to be CAFOs under the rule. The percentage of medium operations EPA estimates will be CAFOs is presented in Table 4.3.2-4 (See Preamble Section 4 and 40 CFR part 122.23).

Table 4.3.2-4

Percentage of Dairies That Are Expected to Be CAFOs

Region	Size Class	
	All Medium	All Large
Central	20	100
Mid-Atlantic	55	100
Midwest	45	100
Pacific	10	100
South	35	100

4.3.3 Farm Counts - Heifer Operations

Table 4.3.3-1 presents the total number of potential heifer CAFOs by size, as estimated by USDA's NRCS, using the 1997 Census of Agriculture data (USDA NRCS, 2002). To estimate the number of operations by geographic region, EPA reviewed membership data from the Professional Heifer Growers Association, as well as available data from the Census of Agriculture. However, none of these sources provided an estimate of operations by both size class and geographic location. Because heifer operations directly support the dairy industry, EPA assumed that they are concentrated in areas where the dairy industry is moving toward specialization (Bocher L.W., 1999). Using best professional judgement, EPA estimated that the majority of large heifer operations are located in the west and south (represented by the Pacific and Central regions), while the majority of the smallest operations are located in the Midwest. Table 4.3.3-2 presents EPA's estimated distribution of heifer operations by size class and region.

Table 4.3.3-1

Number of Potential Heifer CAFOs by EPA Size Class from the 1997 Census of Agriculture Database

Size Class				Total
Medium 1 (300-499 head)	Medium 2 (500-749 head)	Medium 3 (750-999 head)	Large 1 (≥1,000 head)	
417	218	89	242	966

Source: USDA NRCS, 2002 (Table 16).

Table 4.3.3-2

Percentage of Heifer Operations by Region and Size Class

Region	Percentage of Dairy Operations			
	Medium 1	Medium 2	Medium 3	Large 1
Central	10	50	50	60
Mid-Atlantic	0	0	0	0
Midwest	80	20	20	0
Pacific	10	30	30	40
South	0	0	0	0

For example, EPA estimated the number of heifer CAFOs in the Central region by size class using the following equations and the data presented in Tables 4.3.3-1 and 4.3.3-2:

Medium 1: 417 operations × 10% = 42;
Medium 2: 218 operations × 50% = 109;
Medium 3: 89 operations × 50% = 44; and
Large 1: 242 operations × 60% = 145.

Table 4.3.3-3 presents the final number of heifer operations by size class and region.

Table 4.3.3-3

Number of Heifer Operations by Region and Size Class

Region	Size Class			
	Medium 1	Medium 2	Medium 3	Large 1
Central	42	109	44	145
Mid-Atlantic	0	0	0	0
Midwest	333	44	18	0
Pacific	42	65	27	97
South	0	0	0	0

Not all medium operations are expected to be CAFOs under the rule. The percentage of medium operations EPA estimates will be CAFOs is presented in Table 4.3.3-4 (See Preamble Section 4 and 40 CFR part 122.23).

Table 4.3.3-4

Percentage of Heifer Operations That Are Expected to Be CAFOs

Region	Size Class	
	All Medium	All Large
Central	20	100
Mid-Atlantic	55	100
Midwest	45	100
Pacific	10	100
South	35	100

4.3.4 Farm Counts - Veal Operations

Table 4.3.4-1 presents the total number of potential veal CAFOs by size, as estimated by USDA's NRCS, using the 1997 Census of Agriculture data (USDA NRCS, 2002). EPA conducted site visits to veal operations and requested distribution data from industry to estimate the number of veal operations by size class and region in the United States. These data indicate that veal producers are located predominantly in the Midwest and Central regions

(Crouch A., 1999). Using best professional judgement, EPA estimated that the vast majority (95 percent) of operators are located in the Midwest, with the remaining operations located in the Mid-Atlantic and Central regions. Table 4.3.4-2 presents EPA's estimated distribution of veal operations by size class and region.

Table 4.3.4-1

Number of Potential Veal CAFOs by EPA Size Class from the 1997 Census of Agriculture Database

Size Class			Total
Medium 1 (300-499 head)	Medium 2 (500-749 head)	Medium 3 (≥750 head)[a]	
35	17	17	69

Source: USDA NRCS, 2002 (Table 16).
[a]USDA estimates that 12 veal operations are ≥1,000 head.

Table 4.3.4-2

Percentage of Veal Operations by Region and Size Class

Region	Percentage of Veal Operations		
	Medium 1	Medium 2	Medium 3
Central	2.5	5	5
Mid-Atlantic	2.5	0	0
Midwest	95	95	95
Pacific	0	0	0
South	0	0	0

For example, EPA estimated the number of veal CAFOs in the Central region by size class using the following equations and the data presented in Tables 4.3.4-1 and 4.3.4-2:

Medium 1: 35 operations × 2.5% = 1;
Medium 2: 17 operations × 5% = 1; and
Medium 3: 17 operations × 5% = 1.

Table 4.3.4-3 presents the final number of veal operations by size class and region.

Table 4.3.4-3

Number of Veal Operations by Region and Size Class

Region	Size Class		
	Medium 1	Medium 2	Medium 3
Central	1	1	1
Mid-Atlantic	1	0	0
Midwest	33	16	16
Pacific	0	0	0
South	0	0	0

Not all medium operations are expected to be CAFOs under the rule. The percentage of medium operations EPA estimates will be CAFOs is presented in Table 4.3.4-4 (See Preamble Section 4 and 40 CFR part 122.23).

Table 4.3.4-4

Percentage of Veal Operations That Are Expected to Be CAFOs

Region	Size Class		
	Medium 1	Medium 2	Medium 3
Central	10	10	100
Mid-Atlantic	4	4	100
Midwest	6	6	100
Pacific	10	10	100
South	4	4	100

4.3.5 Farm Counts - Poultry Operations

Layers

Table 4.3.5-1 presents the total number of layer, layer/pullet, and pullet operations using the 1997 Census of Agriculture database (USDA NRCS, 2002). Lacking more recent state- or region-specific data, EPA also relied on queries from the 1997 Census of Agriculture database

(Table 4.3.5-2) that were used for the draft rulemaking that included region- and subsector-level information (USDA NASS, 1999b).

Table 4.3.5-1

Number of Layer Operations by EPA Size Class from the 1997 Census of Agriculture Database

Sector	Size Class (EPA AU)				Total Operations
	Medium 1 (300-499 AU/ 30,000-49,999 head	Medium 2 500-749 AU/ 50,000-74,999 head	Medium 3 750-999 AU/ 75,000-99,999 head	Large 1 and 2 AU/ >100,000 head	
Layers	776	446	238	671	2,131

Source: USDA NRCS, 2002.

EPA made the following assumptions to reorganize the data presented in Table 4.3.5-2 to match selected facility size classes (Table 4.3.5-3 presents the results of these assumptions):

- Pullet operations are located near and provide birds to laying operations. Pullet operations >180,000 can be split into 180,000-600,000 and >600,000 size classes using the proportion of layer operations (i.e., 237/(237+89));
- National pullet operations can be split into regions using the proportion of layer operations in that region for each size class; and
- Other pullet size classes can be resized to the selected size classes by assuming a uniform distribution of operations within each size class.

The number of wet layer operations is computed from the layer operations in Table 4.3.5-3 assuming 60 percent of the South and Central regions and 5 percent each of the other three regions use wet layer systems (USDA APHIS, 2000). Applying these percentages to Table 4.3.5-3 results in 349.4 wet layer operations with more than 30,000 head (see Table 4.3.5-4).

Table 4.3.5-2

Number of Layer Operations by Size Class and Region from 1997 Census of Agriculture Database

Region	Size Class (head)				Total Operations
	30,000-62,500	62,500-180,000	180,000-600,000	>600,000	
Layer and Layer/Pullet Operations					
Central	76	41	28	9	154
Mid-Atlantic	150	133	48	15	346
Midwest	123	182	78	39	422
Pacific	38	66	39	17	160
South	208	90	44	9	351
Total	595	512	237	89	1,433
Pullet Operations					
	30,000-100,000	**100,000-180,000**	**>180,000**		**Total Operations**
National	516	61	44	NA	621

Source: USDA NASS, 1999c.
NA = Not available.

Table 4.3.5-3

Reorganized Layer and Pullet Operation Counts

Region	Size Class (head)					Total Operations
	30,000-49,999	50,000-74,999	75,000-99,999	100,000-599,999	>600,000	
Layer Operations						
Central	47	34	9	56	9	154
Mid-Atlantic	92	72	28	139	15	346
Midwest	76	67	39	202	39	422
Pacific	23	22	14	84	17	160
South	128	90	19	105	9	351
Total	366	283	109	586	89	1,433
Pullet Operations						
Central	19	15	6	22	1	63
Mid-Atlantic	37	33	19	66	2	157
Midwest	31	32	26	92	5	185
Pacific	9	11	9	35	2	66
South	52	39	13	46	1	150
Total	148	128	72	261	12	621

Table 4.3.5-4

Reorganized Distribution of Dry Layer, Wet Layer, and Pullet Operations by Region

Region	Size Class (head)					Total Operations
	30,000-49,999	50,000-74,999	75,000-99,999	100,000-599,999	>600,000	
Dry Layer Operations						
Central	18.7	13.4	3.5	22.4	3.6	61.6
Mid-Atlantic	87.7	68.2	26.9	131.6	14.3	328.7
Midwest	71.9	63.3	36.8	191.8	37.1	400.9
Pacific	22.2	20.6	13.3	79.7	16.2	152.0
South	51.2	35.8	7.7	42.1	3.6	140.4
Total	251.7	201.4	88.2	467.7	74.7	1,083.6
Wet Layer Operations						
Central	28.1	20.2	5.2	33.5	5.4	92.4
Mid-Atlantic	4.6	3.6	1.4	6.9	0.8	17.3
Midwest	3.8	3.3	1.9	10.1	2.0	21.1
Pacific	1.2	1.1	0.7	4.2	0.9	8.0
South	76.8	53.7	11.5	63.2	5.4	210.6
Total	114.4	81.9	20.8	117.9	14.4	349.4
Pullet Operations						
Central	18.9	14.7	5.7	22.2	1.2	62.6
Mid-Atlantic	37.2	32.6	18.6	66.1	2.0	156.5
Midwest	30.5	31.8	25.5	92.1	5.3	185.2
Pacific	9.4	10.5	9.2	34.8	2.3	66.3
South	51.6	38.6	12.6	46.3	1.2	150.3
Total	147.7	128.2	71.7	261.4	12.0	621.0
All Operations	513.8	411.5	180.6	847.0	101.0	2,054.0

The USDA NRCS (2002) analysis (Table 4.3.5-1) did not divide the >1,000 AU size class into the two size classes EPA uses in the modeling exercise. EPA maintained the facility count from the original queries (USDA NASS, 1999b) for the largest operations with >600,000 head (i.e., 101 total operations with >600,000 head). For the remaining size classes, EPA used the proportion of each operation type (e.g., dry layer, wet layer, pullets) using the facility count from Table 4.3.5-4 (and repeated in the top half of Table 4.3.5-5) to disaggregate the data provided in Table 4.3.5-1. For example, the number of dry layers for the smallest size class is equal to (251.7/513.8) × 776.0, or 380.1.

Table 4.3.5-5

Reorganized Distribution of Dry Layer, Wet Layer, and Pullet Operations

Sector	Size Class (head)					Total Operations
	30,000-49,999	50,000-74,999	75,000-99,999	100,000-599,999	>600,000	
Facility Count using USDA NASS (1999c)						
Dry Layers	252	201	88	468	75	1,084
Wet Layers	114	82	21	118	14	349
Pullets	148	128	72	261	12	621
Total	514	412	181	847	101	2,054
Facility Count using USDA NRCS (2002)						
Dry Layers	380	218	116	315	75	1,104
Wet Layers	173	89	27	79	14	383
Pullets	223	139	95	176	12	644
Total	776	446	238	570	101	2,131

The facility counts using USDA NRCS (2002) data from Table 4.3.5-5 were further disaggregated by region using the data in Table 4.3.5-4. Wet layer operations greater than 30,000 head were aggregated into one size class while dry layer and pullet operations were combined by region and size class. Wet layer operations greater than 30,000 head were combined since there are relatively few operations and potential issues related to disclosure precluded further resolution. Pullets are housed in cages similar to layers, or on bedded floors such as

broilers and turkeys. Therefore no separate model was developed for pullets. Though there are many pullet farms located apart from the laying farms or broiler breeder farms, the production and manure management at these operations is very similar to broiler and caged layer operations. Therefore no separate model was developed for pullet farms. The results of these steps are presented in Table 4.3.5-6. For example, the number of dry layers in the smallest Midwest size class is (71.9/251.7) × 380.1 (for dry layers) plus (30.5/147.7) × 223.0 (for pullets) for a total of 154.7 operations. In addition, another 800 wet layer operations with 9,000-29,999 head were included in the evaluation since their manure is handled in a wet form and the threshold for being a CAFO is lower than for dry manure management systems. The number of wet layer operations with 9,000-29,999 head was estimated as approximately equal to 7,300 operations × 0.73 × 0.15, where 7,300 is the approximate number of operations in the South region with fewer than 30,000 head (USDA NASS, 1999b), 0.73 is the fraction of operations in the size class of 9,000-29,999 relative to <30,000, and 0.15 is the fraction of these operations that use wet-manure-handling systems.

In order to evaluate the impact of including smaller operations, the smallest dry layer size class was expanded to include operations from 25,000-49,999. To account for the size interval increasing by 25 percent, 25 percent more operations were added to the smallest size class. Also, the division between the third and fourth dry layer size class was changed from 100,000 to 82,000. To account for this size class change, 72 percent of the operations from the third size class were moved to the fourth size class. Seventy-two percent was selected because that represents the size class interval change (e.g., 75,000-99,999 versus 75,000-81,999). Table 4.3.5-7 presents the estimated number of facilities by sector, size class, and region. Table 4.3.5-8 presents the final number of facilities by sector, size class, and modeled region, which distributes the remaining dry layer operations from the Central, Mid-Atlantic, and Pacific regions evenly to the Midwest and South regions. These operations use total confinement housing, and do not need storage for feedlot runoff. Therefore, they are not subject to climate variations that result in variable process waste water. All wet layer operations are modeled as the Southern region, which accounts 65 percent of all wet layer operations.

Table 4.3.5-6

Intermediate Layer Operation Counts by Sector, Size Class, and Region

Region	Size Class (head)					Total Operations
	NA	NA	9,000-29,999	>30,000	NA	
Wet Layers						
Central	NA	NA	196	99	NA	295
Mid-Atlantic	NA	NA	32	18	NA	50
Midwest	NA	NA	27	21	NA	47
Pacific	NA	NA	8	8	NA	16
South	NA	NA	537	237	NA	774
Total	NA	NA	800	383	NA	1,183
Region	**Size Class (head)**					**Total Operations**
	30,000-49,999	**50,000-74,999**	**75,000-81,999**	**82,000-599,999**	**>600,000**	
Dry Layers						
Central	57	31	12	30	5	134
Mid-Atlantic	189	109	60	133	16	507
Midwest	155	103	82	191	42	573
Pacific	48	34	30	77	18	207
South	155	81	27	60	5	327
Total	603	357	211	491	87	1,748

NA - Not applicable.

Table 4.3.5-7

Final Layer Operation Counts by Sector, Size Class, and Region

Region	Size Class (head)					Total Operations
	NA	NA	9,000-29,999	>30,000	NA	
Wet Layers						
Central	NA	NA	196	99	NA	295
Mid-Atlantic	NA	NA	32	18	NA	50
Midwest	NA	NA	27	21	NA	47
Pacific	NA	NA	8	8	NA	16
South	NA	NA	537	237	NA	774
Total	NA	NA	800	383	NA	1,183
Region	**Size Class (head)**					**Total Operations**
	25,000-49,999	**50,000-74,999**	**75,000-81,999**	**82,000-599,999**	**>600,000**	
Dry Layers						
Central	71	31	3	39	5	148
Mid-Atlantic	236	109	17	176	16	554
Midwest	193	103	23	250	42	612
Pacific	60	34	8	99	18	219
South	194	81	8	79	5	366
Total	754	357	59	642	87	1,899

NA - Not applicable.

Table 4.3.5-8

Final Layer Operation Counts by Sector, Size Class, and Modeled Region

Region	Size Class (head)					Total Operations
	NA	NA	9,000-29,999	>30,000	NA	
Wet Layers						
South	NA	NA	800	383	NA	1,183
Region	**Size Class (head)**					**Total Operations**
	25,000-49,999	**50,000-74,999**	**75,000-81,999**	**82,000-599,999**	**>600,000**	
Dry Layers						
Midwest	377	190	37	407	62	1,073
South	377	167	22	235	25	827
Total	754	357	59	642	87	1,899

NA - Not applicable.

Not all medium operations are expected to be CAFOs under the rule. The percentage of medium operations EPA estimates will be CAFOs is presented in Tables 4.3.5-9 and 4.3.5-10 (See Preamble Section 4 and 40 CFR part 122.23).

Table 4.3.5-9

Percentage of Layer Operations That Are Expected to Be CAFOs

Region	Size Class			
	Medium 1	Medium 2	Medium 3	Large 1
Central	3	3	3	100
Mid-Atlantic	3	3	3	100
Midwest	3	3	3	100
Pacific	3	3	3	100
South	3	3	3	100

Table 4.3.5-10

Percentage of Dry Layer Operations That Are Expected to Be CAFOs

Region	Size Class	
	All Medium	All Large
Central	2	100
Mid-Atlantic	2	100
Midwest	2	100
Pacific	5	100
South	2	100

Turkeys

Table 4.3.5-11 presents the total number of turkey operations using the 1997 Census of Agriculture database (USDA NRCS, 2002). Lacking state- or region-specific data, EPA also relied on queries from the 1997 Census of Agriculture database (Table 4.3.5-12) that were used for the draft rulemaking that included region-level information (USDA NASS, 1999b).

Table 4.3.5-11

Number of Turkey Operations by Size Class from 1997 Census of Agriculture Database

Animal Type	Size Class (EPA AU)				Total Operations
	Medium 1 300-500 AU/ 16,500-27,499 head	Medium 2 500-750 AU/ 27,500-41,249 head	Medium 3 750-1000 AU/ 41,250-54,999 head	Large 1 >1,000 AU/ >55,000 head	
Turkeys	875	478	262	388	2,003

Source: USDA NRCS, 2002.

Table 4.3.5-12

Number of Turkey Operations by Size Class and Region from 1997 Census of Agriculture Database

Region	Size Class (head)			Total Operations
	16,500-38,500	38,500-55,000	>55,000	
Central	54	19	34	107
Mid-Atlantic	597	143	83	823
Midwest	493	121	142	756
Pacific and South	222	83	110	415
Total	1,366	366	369	2,101

Source: USDA NASS, 1999b.

EPA made the following assumptions to reorganize the data presented in Table 4.3.5-13 to match the selected facility size classes (Table 4.3.5-14 presents the results of these assumptions):

- Large turkey operations use total confinement housing and generally do not store litter uncovered. Therefore climate does not play a role in manure and process wastewater generation.
- More than 75 percent of turkey operations are located in the Mid-Atlantic and Midwest regions, i.e., the key regions. Separate model farms were developed for the two key regions to account for differences in facility operation (e.g., crop rotations and BMP implementation).
- Operations in the combined Pacific and South region were split based on the total number of turkey operations reported in the 1997 Census of Agriculture state summaries. (Approximately 39 percent of the combined Pacific and South region were assigned to the Pacific Region.)
- Turkey size classes can be resized to the current size classes by assuming a uniform distribution of operations within each size class.

The facility counts in Table 4.3.5-11 can be disaggregated using the data provided in Table 4.3.5-13 (see Table 4.3.5-14). For example, EPA calculated the number of Central region operations in the smallest size class as (27.0/683.0) × 875, or 34.6 operations. Table 4.3.5-15 presents the final number of facilities by size class and modeled region, which were

distributed from the Central, Pacific and South regions evenly to the Mid-Atlantic and Midwest regions.

Table 4.3.5-13

Reorganized Turkey Operation Counts

Region	Size Class (head)				Total Operations
	16,500-27,499	27,500-41,249	41,250-54,999	≥55,000	
Central	27	30	16	34	107
Mid-Atlantic	299	322	119	83	823
Midwest	247	267	101	142	756
Pacific	43	49	27	43	162
South	68	76	42	67	253
Total	683	744	305	369	2,101

Table 4.3.5-14

Final Turkey Operation Counts by Size Class and Region

Region	Size Class (head)				Total Operations
	16,500-27,499	27,500-41,249	41,250-54,999	≥55,000	
Central	35	19	14	36	103
Mid-Atlantic	382	207	102	87	779
Midwest	316	171	87	149	723
Pacific	56	31	23	45	155
South	87	49	36	70	242
Total	875	478	262	388	2,003

Table 4.3.5-15

Final Turkey Operation Counts by Size Class and Modeled Region

Region	Size Class (head)				Total Operations
	16,500-27,499	27,500-41,249	41,250-54,999	≥55,000	
Mid-Atlantic	471	257	139	163	1,030
Midwest	404	221	123	225	973
Total	875	478	262	388	2,003

Not all medium operations are expected to be CAFOs under the rule. The percentage of medium operations EPA estimates will be CAFOs is presented in Table 4.3.5-16 (See Preamble Section 4 and 40 CFR part 122.23).

Table 4.3.5-16

Percentage of Turkey Operations That Are Expected to Be CAFOs

Region	Size Class	
	All Medium	All Large
Central	2	100
Mid-Atlantic	2	100
Midwest	2	100
Pacific	2	100
South	5	100

Broilers

USDA NRCS (2002) provided information to EPA on the number of broiler operations based on the following classifications as shown in Table 4.3.5-17:

- Operation size: ≥100,000 head, 50,000-99,999 head, and 30,000-49,999 head.

Table 4.3.5-17

Number of Broiler Operations as Provided by USDA NRCS (2002) Based on Analyses of 1997 Census of Agriculture Database

Location	Land Availability Category	Operation Size and Nutrient Basis					
		≥100,000		50,000-99,999		30,000-49,999	
		N	P	N	P	N	P
AL	No excess	d	d	34	15	39	32
	Excess, no acres	98	98	227	227	217	217
	Excess, with acres	268	274	666	685	412	419
AR	No excess	d	d	58	49	104	93
	Excess, no acres	69	69	155	155	226	226
	Excess, with acres	260	263	797	806	672	683
GA	No excess	d	d	17	6	14	10
	Excess, no acres	169	169	319	319	194	194
	Excess, with acres	382	387	494	505	250	254
KT, TN, VA, WV	No excess	d	d	34	17	23	15
	Excess, no acres	58	58	169	169	129	129
	Excess, with acres	187	201	304	321	149	157
MD, DE	No excess	d	d	106	31	103	38
	Excess, no acres	62	62	275	275	294	294
	Excess, with acres	38	73	146	221	107	172
MS	No excess	d	d	10	8	14	14
	Excess, no acres	72	72	172	172	70	70
	Excess, with acres	230	230	437	439	143	143
NC, SC	No excess	d	d	61	12	59	19
	Excess, no acres	105	105	287	287	290	290
	Excess, with acres	177	198	394	443	292	332
OK, MO, KS	No excess	d	d	19	12	30	29
	Excess, no acres	26	26	49	49	32	32
	Excess, with acres	124	126	248	255	171	172
TX, LA	No excess	d	d	23	21	9	8
	Excess, no acres	53	53	117	117	41	41
	Excess, with acres	231	231	312	314	86	87
Other	No excess	d	d	41	11	45	17
	Excess, no acres	113	113	162	162	112	112
	Excess, with acres	100	104	190	220	99	127

d - Data not disclosed.

- Land availability: No excess (Category 1 farms with sufficient crop or pasture land).

  Excess, with acres (Category 2 farms with some land, but not enough land to assimilate all manure nutrients).

  Excess, no acres (Category 3 farms with none of the 24 major crop types identified by NRCS).

- Location: Ten states or groups of states.

- Nutrient basis: Applications are based on nitrogen (N) or phosphorus (P) application rates.

For an example of the data contained in Table 4.3.5-17, in Alabama there are 98 facilities with more than 100,000 birds with none of the 24 major crop types identified by NRCS for application of animal wastes. There are 268 operations and 274 operations with 100,000 or more birds with some land in Alabama, but not enough land to assimilate all manure nutrients using nitrogen-based and phosphorus-based application rates, respectively. An undisclosed number of facilities have enough land (i.e., no excess manure). Based on additional USDA NRCS (2002) information, there are a total of 2,945 operations with 100,000 or more head, 6,323 operations with 50,000-99,999 head, and 4,426 operations with 30,000-49,999 head within the United States. Thus, by comparison to Table 4.3.5-17, EPA concluded that 123 operations with 100,000 or more head do not have excess manure using nitrogen-based application rates and 33 operations do not have excess manure using phosphorus-based application rates. USDA NRCS (2002) also computed from the 1997 Census of Agriculture that there are a total of 598 broiler operations with 180,000 or more birds and 1,034 broiler operations with 125,000-179,999 birds.

Based on these data, EPA adjusted the size classes to the following: 37,500-49,999, 50,000-74,999, 75,000-124,999, 125,000-179,999, and ≥180,000. Thus, using a uniform distribution, EPA eliminated 37.5 percent of the 4,426 operations with 30,000-49,999 head from

consideration, leaving 2,766 operations in the smallest size class and 12,034 total broiler operations. Based on the above information, the data in Table 4.3.5-17 were modified to account for the undisclosed operations and the modified size classes, and were further disaggregated to match the five size classes selected by EPA for modeling. Tables 4.3.5-18 and 4.3.5-19 present the results of these calculations for nitrogen- and phosphorus-based application rates, respectively.

Because the location groupings in Tables 4.3.5-18 and 4.3.5-19 do not match the regions chosen by EPA for modeling, it was necessary to disaggregate the data in Tables 4.3.5-18 and 4.3.5-19 to the state level. The data in Tables 4.3.5-18 and 4.3.5-19 were disaggregated by using the number of operations with 200,000-499,999 broilers sold or 500,000 or more broilers sold as reported in the 1997 Census of Agriculture state summaries. The number of operations with 500,000 or more broilers sold was used for the larger three class sizes. State-disaggregated data were then recombined into regions chosen by EPA for modeling. The results of these calculations are presented in Tables 4.3.5-20 and 4.3.5-21. Approximately 87 percent of all broiler operations with more than 30,000 bird spot capacity were located in the South and Mid-Atlantic regions in 1997 (USDA NASS, 1999b). These two regions were selected as the key regions. Since climate is not a major factor in estimating costs at broiler operations (which have total confinement buildings and generally have covered manure storage), total birds from the Midwest, Central and Pacific regions were divided equally among the South and Mid-Atlantic regions for modeling purposes (see Tables 4.3.5-22 and 4.3.5-23).

Table 4.3.5-18

Intermediate Number of Broiler Operations Based on Location, Land Availability Category, Operation Size for Nitrogen-Based Application of Manure

Location	Land Availability Category	180,000+	125,000-179,999	75,000-124,999	50,000-74,999	37,750-49,999
AL	No excess	4	7	20	21	24
	Excess, no acres	20	34	133	142	136
	Excess, with acres	54	94	389	415	258
AR	No excess	1	1	34	36	65
	Excess, no acres	14	24	91	97	141
	Excess, with acres	53	91	466	497	420
GA	No excess	1	2	10	11	9
	Excess, no acres	34	59	186	199	121
	Excess, with acres	78	134	289	308	156
KT, TN, VA, WV	No excess	4	7	20	21	14
	Excess, no acres	12	20	99	105	81
	Excess, with acres	38	66	178	190	93
MD, DE	No excess	8	14	62	66	64
	Excess, no acres	13	22	161	172	184
	Excess, with acres	8	13	85	91	67
MS	No excess	1	2	6	6	9
	Excess, no acres	15	25	101	107	44
	Excess, with acres	47	81	255	273	89
NC, SC	No excess	5	8	36	38	37
	Excess, no acres	21	37	168	179	181
	Excess, with acres	36	62	230	246	183
OK, MO, KS	No excess	1	2	11	12	19
	Excess, no acres	5	9	29	31	20
	Excess, with acres	25	44	145	155	107
TX, LA	No excess	0	0	13	14	6
	Excess, no acres	11	19	68	73	26
	Excess, with acres	47	81	182	195	54
Other	No excess	1	1	24	26	28
	Excess, no acres	23	40	95	101	70
	Excess, with acres	20	35	111	119	62
Total		598	1,034	3,693	3,943	2,766

Table 4.3.5-19

Intermediate Number of Broiler Operations Based on Location, Land Availability Category, Operation Size for Phosphorus-Based Application of Manure

Location	Land Availability Category	180,000+	125,000-179,999	75,000-124,999	50,000-74,999	37,750-49,999
AL	No excess	3	5	9	9	20
	Excess, no acres	20	34	133	142	136
	Excess, with acres	56	96	400	427	262
AR	No excess	0	0	29	31	58
	Excess, no acres	14	24	91	97	141
	Excess, with acres	53	92	471	503	427
GA	No excess	0	0	4	4	6
	Excess, no acres	34	59	186	199	121
	Excess, with acres	79	136	295	315	159
KT, TN, VA, WV	No excess	1	2	10	11	9
	Excess, no acres	12	20	99	105	81
	Excess, with acres	41	71	188	200	98
MD, DE	No excess	1	2	18	19	24
	Excess, no acres	13	22	161	172	184
	Excess, with acres	15	26	129	138	108
MS	No excess	1	2	5	5	9
	Excess, no acres	15	25	101	107	44
	Excess, with acres	47	81	256	274	89
NC, SC	No excess	0	0	7	8	12
	Excess, no acres	21	37	168	179	181
	Excess, with acres	40	70	259	276	208
OK, MO, KS	No excess	1	1	7	8	18
	Excess, no acres	5	9	29	31	20
	Excess, with acres	26	44	149	159	108
TX, LA	No excess	0	0	12	13	5
	Excess, no acres	11	19	68	73	26
	Excess, with acres	47	81	183	196	54
Other	No excess	0	0	6	7	11
	Excess, no acres	23	40	95	101	70
	Excess, with acres	21	37	129	137	79
Total		598	1,034	3,693	3,943	2,766

Table 4.3.5-20

Final Number of Broiler Operations Based on Region, Land Availability Category, Operation Size for Nitrogen-Based Application of Manure

Region	Land Availability Category	180,000+	125,000-179,999	75,000-124,999	50,000-74,999	37,750-49,999
Central	Excess, no acres	11	19	65	66	26
	Excess, with acres	48	84	222	199	75
	No excess	1	2	17	15	10
Mid-Atlantic	Excess, no acres	51	88	438	422	405
	Excess, with acres	84	145	502	475	300
	No excess	16	28	121	119	110
Midwest	Excess, no acres	8	13	34	36	24
	Excess, with acres	13	22	70	125	83
	No excess	1	1	10	12	17
Pacific	Excess, no acres	3	5	12	39	27
	Excess, with acres	3	4	14	45	24
	No excess	0	0	3	10	11
South	Excess, no acres	95	164	580	642	521
	Excess, with acres	258	446	1,521	1,643	1,007
	No excess	7	13	85	96	127
Total		598	1,034	3,693	3,943	2,766

Table 4.3.5-21

Final Number of Broiler Operations Based on Region, Land Availability Category, Operation Size for Phosphorus-Based Application of Manure

Region	Land Availability Category	180,000+	125,000-179,999	75,000-124,999	50,000-74,999	37,750-49,999
Central	Excess, no acres	11	19	65	66	26
	Excess, with acres	49	84	226	201	76
	No excess	1	1	13	13	10
Mid-Atlantic	Excess, no acres	51	88	438	422	405
	Excess, with acres	98	170	587	558	366
	No excess	2	4	36	37	43
Midwest	Excess, no acres	8	13	34	36	24
	Excess, with acres	13	22	76	130	86
	No excess	0	0	4	6	14
Pacific	Excess, no acres	3	5	12	39	27
	Excess, with acres	3	5	16	53	30
	No excess	0	0	1	3	4
South	Excess, no acres	95	164	580	642	521
	Excess, with acres	262	452	1,554	1,683	1,033
	No excess	4	6	52	56	101
Total		598	1,034	3,693	3,943	2,766

Table 4.3.5-22

Final Number of Broiler Operations Based on Modeled Region, Land Availability Category, Operation Size for Nitrogen-Based Application of Manure

Region	Land Availability Category	180,000+	125,000-179,999	75,000-124,999	50,000-74,999	37,750-49,999
Mid-Atlantic	Excess, no acres	62	107	494	492	444
	Excess, with acres	116	200	655	660	391
	No excess	17	29	136	137	129
South	Excess, no acres	106	183	635	713	560
	Excess, with acres	290	501	1,674	1,827	1,097
	No excess	8	14	100	114	146
Total		598	1,034	3,693	3,943	2,766

Table 4.3.5-23

Final Number of Broiler Operations Based on Modeled Region, Land Availability Category, Operation Size for Phosphorus-Based Application of Manure

Region	Land Availability Category	180,000+	125,000-179,999	75,000-124,999	50,000-74,999	37,750-49,999
Mid-Atlantic	Excess, no acres	62	107	494	492	444
	Excess, with acres	130	225	746	750	462
	No excess	3	5	45	47	57
South	Excess, no acres	106	183	635	713	560
	Excess, with acres	294	508	1,713	1,875	1,129
	No excess	4	7	61	66	115
Total		598	1,034	3,693	3,943	2,766

Not all medium operations are expected to be CAFOs under the rule. The percentage of medium operations EPA estimates will be CAFOs is presented in Table 4.3.5-24 (See Preamble Section 4 and 40 CFR part 122.23).

Table 4.3.5-24

Percentage of Broiler Operations That Are Expected to Be CAFOs

Region	Size Class	
	All Medium	All Large
Central	5	100
Mid-Atlantic	5	100
Midwest	5	100
Pacific	5	100
South	5	100

4.3.6 Farm Counts - Swine Operations

USDA NRCS (2002) provided information to EPA on the number of swine operations based on the following classifications as shown in Table 4.3.6-1:

- Operation size: ≥2,500 head, 1,250-2,499 head, and 750-1,249 head.
- Land availability: No excess (Category 1 farms with sufficient crop or pasture land).

  Excess, with acres (Category 2 farms with some land, but not enough land to assimilate all manure nutrients).

  Excess, no acres (Category 3 farms with none of the 24 major crop types identified by NRCS).
- Location: Eleven states or groups of states.
- Nutrient basis: Applications are based on nitrogen (N) or phosphorus (P) application rates.

As an example of the data contained in Table 4.3.6-1, in Illinois there are 72 facilities with more than 2,500 head with none of the 24 major crop types identified by NRCS for application of animal wastes. There are 34 operations with 2,500 or more head that have some land in Illinois. However, these operations do not have enough land to assimilate all of the manure nutrients using nitrogen-based application rates. There are 184 Illinois operations with 2,500 or more head that have enough land to assimilate all manure nutrients using nitrogen based application rates. Based on USDA NRCS (2002) analysis of the 1997 Census of Agriculture data, there are a total of 3,924 operations with 2,500 or more head, 1,507 operations with 1,875-2,499 head, 2,840 operations with 1,250-1,874 head, and 5,554 operations with 750-1,249 head within the United States.

Based on these data, EPA adjusted these size classes to the following: 750-1,249, 1,250-1,874, 1,875-2,499, 2,500-4,999, and ≥5,000. Using data provided by USDA NRCS (2002), EPA placed 65.33 percent of the operations in the 1,250-2,499 size class into the 1,250-1,874 size class. Based on data from USDA NASS (1999b), EPA placed 41.8 percent of the operations in the ≥2,500 size class into the ≥5,000 size class. Thus, the information in Table 4.3.6-1 was reaggregated to match the five size classes selected by EPA for modeling. Tables 4.3.6-2 and 4.3.6-3 present the results of these calculations for nitrogen- and phosphorus-based application rates, respectively.

EPA then imputed the data in Table 4.3.6-2 and Table 4.3.6-3 to the state level by using the number of operations with 1,000 or more hogs and pigs sold as reported in the 1997 Census of Agriculture state summaries. State-disaggregated data were then recombined into regions (see Tables 4.3.6-4 and 4.3.6-5). Facilities from the South, Pacific, and Central regions were divided equally among the Mid-Atlantic and Midwest regions for modeling the three smaller size classes and combined into the Central region for the larger two size classes for modeling purposes (see Tables 4.3.6-6 and 4.3.6-7).

Table 4.3.6-1

Number of Swine Operations as Provided by USDA NRCS (2002) Based on Analyses of 1997 Census of Agriculture Database

Location	Land Availability Category	Operation Size and Nutrient Basis					
		≥2,500		1,250-2,499		750-1,249	
		N	P	N	P	N	P
AR, KS, OK	No excess	52	21	76	50	101	80
	Excess, no acres	66	66	36	36	22	22
	Excess, with acres	113	144	78	104	40	61
IL	No excess	184	95	357	283	528	472
	Excess, no acres	72	72	45	45	39	39
	Excess, with acres	34	123	31	105	21	77
IN	No excess	179	107	254	205	387	346
	Excess, no acres	68	68	53	53	50	50
	Excess, with acres	35	107	29	78	36	77
IA	No excess	411	164	1,155	796	1,587	1,346
	Excess, no acres	211	211	183	183	235	235
	Excess, with acres	120	367	89	448	51	292
MI, WI	No excess	57	25	97	65	169	136
	Excess, no acres	31	31	30	30	29	29
	Excess, with acres	19	51	19	51	8	41
MN	No excess	225	97	386	272	523	430
	Excess, no acres	152	152	83	83	69	69
	Excess, with acres	50	178	28	142	28	121
MO	No excess	54	32	104	87	203	183
	Excess, no acres	17	17	18	18	25	25
	Excess, with acres	59	81	48	65	33	53
NC	No excess	194	15	83	23	56	21
	Excess, no acres	185	185	71	71	33	33
	Excess, with acres	630	809	157	217	45	80
NE	No excess	40	15	164	141	279	245
	Excess, no acres	81	81	49	49	82	82
	Excess, with acres	32	57	29	52	29	63
OH	No excess	45	23	98	61	202	154
	Excess, no acres	23	23	33	33	31	31
	Excess, with acres	12	34	17	54	29	77
Other	No excess	184	87	244	145	404	289
	Excess, no acres	132	132	99	99	102	102
	Excess, with acres	157	254	104	203	78	193

Table 4.3.6-2

Intermediate Number of Swine Operations Based on Location, Land Availability Category, Operation Size for Nitrogen-Based Application of Manure

Location	Land Availability Category	Size Class				
		5,000+	2,500-4,999	1,875-2,499	1,250-1,874	750-1,249
AR, KS, OK	No excess	22	30	26	50	101
	Excess, no acres	28	38	13	24	22
	Excess, with acres	47	66	27	51	40
IL	No excess	77	107	124	233	528
	Excess, no acres	30	42	16	29	39
	Excess, with acres	14	20	11	20	21
IN	No excess	75	104	88	166	387
	Excess, no acres	28	40	18	35	50
	Excess, with acres	15	20	10	19	36
IO	No excess	172	239	400	755	1,587
	Excess, no acres	88	123	63	120	235
	Excess, with acres	50	70	31	58	51
MI, WI	No excess	24	33	34	63	169
	Excess, no acres	13	18	10	20	29
	Excess, with acres	8	11	7	12	8
MN	No excess	94	131	134	252	523
	Excess, no acres	64	89	29	54	69
	Excess, with acres	21	29	10	18	28
MO	No excess	23	31	36	68	203
	Excess, no acres	7	10	6	12	25
	Excess, with acres	25	34	17	31	33
NC	No excess	81	113	29	54	56
	Excess, no acres	77	108	25	46	33
	Excess, with acres	263	367	54	103	45
NE	No excess	17	23	57	107	279
	Excess, no acres	34	47	17	32	82
	Excess, with acres	13	19	10	19	29
OH	No excess	19	26	34	64	202
	Excess, no acres	10	13	11	22	31
	Excess, with acres	5	7	6	11	29
Other	No excess	77	107	85	159	404
	Excess, no acres	55	77	34	65	102
	Excess, with acres	66	91	36	68	78
Total		1,639	2,285	1,507	2,840	5,554

Table 4.3.6-3

Intermediate Number of Swine Operations Based on Location, Land Availability Category, Operation Size for Phosphorus-Based Application of Manure

Location	Land Availability Category	5,000+	2,500-4,999	1,875-2,499	1,250-1,874	750-1,249
AR, KS, OK	No excess	9	12	17	33	80
	Excess, no acres	28	38	13	24	22
	Excess, with acres	60	84	36	68	61
IL	No excess	40	55	98	185	472
	Excess, no acres	30	42	16	29	39
	Excess, with acres	51	72	36	69	77
IN	No excess	45	62	71	134	346
	Excess, no acres	28	40	18	35	50
	Excess, with acres	45	62	27	51	77
IO	No excess	69	96	276	520	1,346
	Excess, no acres	88	123	63	120	235
	Excess, with acres	153	214	155	293	292
MI, WI	No excess	10	15	23	43	136
	Excess, no acres	13	18	10	20	29
	Excess, with acres	21	30	18	33	41
MN	No excess	41	57	94	178	430
	Excess, no acres	64	89	29	54	69
	Excess, with acres	74	104	49	93	121
MO	No excess	13	19	30	57	183
	Excess, no acres	7	10	6	12	25
	Excess, with acres	34	47	23	43	53
NC	No excess	6	9	8	15	21
	Excess, no acres	77	108	25	46	33
	Excess, with acres	338	471	75	142	80
NE	No excess	6	9	49	92	245
	Excess, no acres	34	47	17	32	82
	Excess, with acres	24	33	18	34	63
OH	No excess	10	13	21	40	154
	Excess, no acres	10	13	11	22	31
	Excess, with acres	14	20	19	35	77
Other	No excess	36	51	50	95	289
	Excess, no acres	55	77	34	65	102
	Excess, with acres	106	148	70	133	193
Total		1,639	2,285	1,507	2,840	5,554

Table 4.3.6-4

Final Number of Swine Operations Based on Region, Land Availability Category, Operation Size for Nitrogen-Based Application of Manure

Region	Land Availability Category	5,000+	2,500-4,999	1,875-2,499	1,250-1,874	750-1,249
Central	Excess, no acres	10	13	5	10	13
	Excess, with acres	14	19	8	15	14
	No excess	11	15	12	23	54
Mid-Atlantic	Excess, no acres	102	142	40	75	79
	Excess, with acres	292	408	71	133	80
	No excess	115	161	67	125	236
Midwest	Excess, no acres	300	418	185	349	595
	Excess, with acres	188	263	122	229	272
	No excess	528	736	939	1,770	4,022
Pacific	Excess, no acres	2	2	1	2	3
	Excess, with acres	2	3	1	2	2
	No excess	2	3	3	5	12
South	Excess, no acres	21	29	11	21	28
	Excess, with acres	30	42	17	32	30
	No excess	23	32	26	49	115
Total		1,639	2,285	1,507	2,840	5,554

Table 4.3.6-5

Final Number of Swine Operations Based on Region, Land Availability Category, Operation Size for Phosphorus-Based Application of Manure

Region	Land Availability Category	5,000+	2,500-4,999	1,875-2,499	1,250-1,874	750-1,249
Central	Excess, no acres	10	13	5	10	13
	Excess, with acres	20	27	12	23	28
	No excess	5	7	8	14	40
Mid-Atlantic	Excess, no acres	102	142	40	75	79
	Excess, with acres	385	537	107	201	166
	No excess	23	31	30	57	150
Midwest	Excess, no acres	300	418	185	349	595
	Excess, with acres	470	655	379	713	876
	No excess	246	343	682	1,286	3,419
Pacific	Excess, no acres	2	2	1	2	3
	Excess, with acres	3	5	2	4	6
	No excess	1	2	2	3	9
South	Excess, no acres	21	29	11	21	28
	Excess, with acres	43	60	27	51	60
	No excess	10	14	16	30	85
Total		1,639	2,285	1,507	2,840	5,554

Table 4.3.6-6

Final Number of Swine Operations Based on Modeled Region, Land Availability Category, Operation Size for Nitrogen-Based Application of Manure

Region	Land Availability Category	5,000+	2,500-4,999	1,875-2,499	1,250-1,874	750-1,249
Central	Excess, no acres	32	45	0	0	0
	Excess, with acres	46	64	0	0	0
	No excess	36	50	0	0	0
Mid-Atlantic	Excess, no acres	102	142	49	92	100
	Excess, with acres	292	408	84	157	103
	No excess	115	161	87	164	327
Midwest	Excess, no acres	300	418	194	366	617
	Excess, with acres	188	263	135	254	295
	No excess	528	736	959	1,808	4,113
Total		1,639	2,285	1,507	2,840	5,554

Table 4.3.6-7

Final Number of Swine Operations Based on Modeled Region, Land Availability Category, Operation Size for Phosphorus-Based Application of Manure

Region	Land Availability Category	5,000+	2,500-4,999	1,875-2,499	1,250-1,874	750-1,249
Central	Excess, no acres	32	45	0	0	0
	Excess, with acres	66	92	0	0	0
	No excess	16	22	0	0	0
Mid-Atlantic	Excess, no acres	102	142	49	92	100
	Excess, with acres	385	537	127	240	213
	No excess	23	31	43	81	217
Midwest	Excess, no acres	300	418	194	366	617
	Excess, with acres	470	655	399	752	922
	No excess	246	343	695	1,309	3,485
Total		1,639	2,285	1,507	2,840	5,554

While USDA NRCS (2002) provided information to estimate the number of operations by region, size class, and land availability category, it did not provide data to estimate the number of operations by operation type (i.e., farrow-to-finish, grow-finish) or the number of operations by manure storage (i.e., pit storage, lagoon, evaporative lagoon). Using data provided by USDA NASS (1999b), EPA estimated that 50.6, 45.6, 40.7, and 35.0 percent of operations with 2,500+, 1,875-2,499, 1,250-1,874, and 750-1,249 head, respectively, were grow-finish operations. Using data from USDA APHIS (2002), EPA estimated the following percentages of swine operations that use pit storage: 14.4 and 23.9 percent of medium and large farrow-to-finish operations, respectively, and 26.3 and 37.5 percent of medium and large grow-finish operations, respectively, in the Mid-Atlantic region; and 54.9 and 56.4 percent of medium and large farrow-to-finish operations, respectively, and 67.7 and 70.7 of medium and large grow-finish operations, respectively, in the Midwest region. All operations modeled in the Central region were assumed to use evaporative lagoons.

Not all medium operations are expected to be CAFOs under the rule. The percentage of medium operations EPA estimates will be CAFOs is presented in Table 4.3.6-8 (See Preamble Section 4 and 40 CFR part 122.23).

Table 4.3.6-8

Percentage of Swine Operations That Are Expected to Be CAFOs

Region	Size Class			
	Medium 1	Medium 2	Medium3	Large1
Central	15	15	15	100
Mid-Atlantic	15	15	15	100
Midwest	15	15	15	100
Pacific	15	15	15	100
South	15	15	15	100

4.4 Average Head

This section describes the methodology used to calculate average head in each size group for each animal type.

4.4.1 Average Head - Beef Feedlots

Table 4.4.1-1 presents the total number of fattened cattle at potential beef feedlot CAFOs by size class, as estimated by USDA NRCS, using the 1997 Census of Agriculture data (USDA NRCS, 2002).

Table 4.4.1-1

Number of Fattened Cattle at Potential CAFOs by EPA Size Class from the 1997 Census of Agriculture Database

Size Class	Number of Beef Feedlots	Number Fattened Cattle		Average Number of Fattened Cattle
		Based on 2.5 turnovers/year and 1,000 pounds	Based on variable turnovers and 877 pounds	
Medium 1	1,466	251,015	541,742	370
Medium 2	801	204,850	442,109	552
Medium 3	415	147,322	317,951	766
Size Class	**Number of Beef Feedlots**	**Number of Fattened Cattle Sold**	**Number On Site (based on variable turnovers)**	**Average Number of Fattened Cattle**
Large 1	1,654[a]	4,347,000	10,902,500	1,839
Large 2	421	18,442,000	3,041,250	25,897

[a]Number of Large 1 beef feedlots estimated by USDA/NASS. This estimate is used only to calculate the average head for the Large 1 size class.

To estimate average head at Medium beef feedlots, EPA first converted these animal unit estimates back to sales estimated using the turnover of 2.5 beef cycles per year (ERG, 2002). Information collected by EPA from the National Cattlemen's Beef Association and the USDA National Agricultural Statistics Service indicate that beef feedlots generally operate at less than 100 percent capacity, and smaller feedlots tend to have less production cycles per year.

Based on these data, EPA used production cycle estimates based on the size of operation to recalculate head estimates from the sales data (ERG, 2002). EPA also recalculated the number of beef cows based on a weight of 877 pounds, as shown in the equation below:

$$\#\ \text{Fattened Cattle}_{\text{Total Head}} = \#\ \text{Fattened Cattle}_{AU} \times \frac{2.5}{\text{Turnover}_{\text{Size Class}}} \times \frac{\text{Weight}_{AU}}{\text{Weight}_{\text{Beef Cow}}}$$

where:

$\#\ \text{Fattened Cattle}_{AU}$	=	USDA's NRCS data for number of AU for a size class
$\text{Turnover}_{\text{Size Class}}$	=	Estimated number of production cycles for a size class
Weight_{AU}	=	Weight of one animal unit (1,000 lbs)
$\text{Weight}_{\text{Beef Cow}}$	=	Average weight of beef cow (877 lbs).

Next, EPA calculated the average head per operation by dividing the number of fattened cattle by the number of operations. These average head are also presented in Table 4.3.1-1.

For example, USDA estimates that there are 204,850 animal units at Medium 2 operations. Multiplying this number by 2.5 turnovers and converting the weight basis to 877 pounds yields 583,951 cows. It is estimated that there are 1.32 production cycles at these operations, which yields 442,109 cattle at 801 operations in the Medium 2 size class, which results in an average head size of 552 fattened cattle at Medium 2 operations.

For large operations, the USDA/NRCS data does not provide the number of head for both the Large 1 and Large 2 size classes. Instead, EPA used data from USDA/NASS to estimate the average head at large operations.

4.4.2 Average Head - Dairies

Table 4.4.2-1 presents the total number of milk cows at potential dairy CAFOs by size class, as estimated by USDA's NRCS, using the 1997 Census of Agriculture data (USDA NRCS, 2002). The estimates prepared by NRCS are presented as the number of animal units

assuming a weight of 1,000 pounds per animal unit. EPA first converted these animal unit estimates to the number of dairy cows based on a weight of 1,350 pounds, as shown in the equation below:

$$\#\ \text{Mature Dairy Cows}_{\text{Total Head}} = \#\ \text{Mature Dairy Cows}_{\text{AU}} \times \frac{\text{Weight}_{\text{AU}}}{\text{Weight}_{\text{Dairy Cattle}}}$$

where:

$\#\text{Mature Dairy Cows}_{\text{AU}}$	=	USDA's NRCS data for number of farms with milk cows for a size category
$\text{Weight}_{\text{AU}}$	=	Weight of one animal unit (1,000 lbs)
$\text{Weight}_{\text{Dairy Cattle}}$	=	Average weight of dairy cow (1,350 lbs).

Table 4.4.2-1

Number of Dairy Cows at Potential CAFOs by EPA Size Class from the 1997 Census of Agriculture Database

Size Class	Number of Dairies	Number of AU	Number of Dairy Cows	Average Number of Mature Dairy Cows
Medium 1	3,805	1,285,821	952,460	250
Medium 2	1,372	787,492	583,327	425
Medium 3	603	488,283	361,691	600
Large 1	1,450	2,798,343	2,072,847	1,430

Next, EPA calculated the average head per operation by dividing the number of dairy cows by the number of operations. These average head are also presented in Table 4.4.2-1.

For example, USDA estimates that there are 787,492 animal units at Medium 2 operations. Converting this number to dairy cows yields 583,327 cows. It is estimated that there are 1,372 operations in the Medium 2 size class, which results in an average head size of 425 dairy cows at Medium 2 operations.

$$\#\ \text{Mature Dairy Cows}_{\text{Total head}} = 787{,}492 \times \frac{1{,}000}{1{,}350}$$

$$\#\ \text{Mature Dairy Cows}_{\text{Total head}} = 583{,}327$$

$$\#\ \text{Mature Dairy Cows}_{\text{Head per farm}} = \frac{583{,}327}{1{,}372}$$

$$\#\ \text{Mature Dairy Cows}_{\text{Head per farm}} = 425$$

4.4.3 Average Head - Heifer Operations

The average size of heifer operations ranges from 50 head to 25,000 head and varies geographically. The average size of a heifer operation located west of the Mississippi River is 1,000 to 5,000 head, while the average size in the upper Midwest, Northeast, and South is 50 to 200 head. Nationally, the median size of a heifer operation is approximately 200 head (Cady R., 2000). The average head for each Medium size class is calculated as the median of the size class range, as shown in Table 4.4.3-1. Using best professional judgement, EPA set the Large size class equal to 1,500 head.

Table 4.4.3-1

Average Head for Heifer Model Farm

Size Class	Average Head
Medium 1	400
Medium 2	625
Medium 3	875
Large 1	1,500

4.4.4 Average Head - Veal Operations

The average head of veal calves in each size class is based on discussions with the American Veal Association and site visits (Crouch A., 1999). A veal confinement barn may hold between 200 and 300 calves, and on average houses 270 calves. Most commonly, veal operations have two barns. Therefore, the Medium 1 facilities were estimated to have two confinement

barns with 200 calves per barn, Medium 2 facilities were estimated to have two barns with 270 calves in each barn, and Medium 3 facilities were estimated to have four barns with 270 calves in each barn, as presented in Table 4.4.4-1.

Table 4.4.4-1

Average Head for Veal Model Farm

Size Class	Average Head
Medium 1	400
Medium 2	540
Medium 3	1,080

Source: ERG, 2000b.

4.4.5 Average Head - Poultry Operations

The calculation of average head for poultry operations includes separate calculations for layers, turkeys, broilers. Each of these is described in detail in the following discussion.

Layers

Table 4.4.5-1 presents the number of layer facilities and total USDA-based animal units (USDA AUs) using the 1997 Census of Agriculture (USDA NRCS, 2002). According to USDA NRCS (2000), the number of birds per USDA AU ranges from 250 for layers to 455 for pullets less than three months old. To convert the total USDA AUs (in Table 4.4.5-1) to birds count, EPA estimated a conversion factor that represented both pullets and layers. Using the three smaller size classes in Table 4.4.5-1, EPA developed a conversion factor of 310 head per USDA AU. The Agency developed this conversion factor so that the average head count per operation (last column in Table 4.4.5-1) for these three size classes was near the middle of the size class interval. Lacking specific data to directly compute the average head count for either of the larger two size classes, EPA selected a mid-value (i.e., 350,000 head) for the 100,000-

599,999 size class. With this information and the assumption that 101 of the 671 facilities with more than 1,000 EPA AUs had more than 600,000 head, EPA was able to estimate the average head count for the largest size class.

Table 4.4.5-1

Layer Facility Demographics from the 1997 Census of Agriculture Database

Size Class	Number of Facilities	Total USDA AUs	Size Class Interval (Number of Head)		Average Head Count per Operation
			Lower	Upper	
Medium 1	776	95,648	30,000	49,999	38,210
Medium 2	446	88,817	50,000	74,999	61,734
Medium 3	238	69,379	75,000	99,999	90,368
Large 1 and Large 2	671[a]	922,558	100,000	599,999	350,000
			≥600,000		856,368
Total	2,131	1,176,402			

Source: USDA NRCS, 2002.
[a]Section 4.3.5 documents the methodology used to estimate that 101 of the 671 facilities with more than 1,000 EPA AUs had more than 600,000 head.

To analyze the alternative layer thresholds ultimately adopted by EPA, the smallest dry layer size class was expanded to include operations from the 25,000-49,999 size class. Also, the division between the third and fourth dry layer size class was changed from 100,000 to 82,000. Section 4.3.5 describes the approach used to adjust the number of operations per size class. Correspondingly, EPA recomputed the average head based on the number of operations that were removed or added to each size class. The resulting average head count per operation for dry layers is presented in Table 4.4.5-2. The average head count for wet layer operations with 9,000-29,999 head was estimated as the midpoint, or 19,500 head. The average head count for wet layer operations with 30,000 or more head was estimated as 146,426 head.

Table 4.4.5-2

Average Head Count for Layer Operations

Size Class	Size Class Interval (Number of Head)		Average Head Count per Operation
	Lower	Upper	
Dry Layer Operations			
Medium 1	25,000	49,999	36,068
Medium 2	50,000	74,999	61,734
Medium 3	75,000	81,999	78,546
Large 1	82,000	599,999	291,153
Large 2	≥600,000		856,368
Wet Layer Operations			
Medium 1	9,000	29,999	19,500
Large 1	≥30,000		146,426

Turkeys

Table 4.4.5-3 presents the number of turkey facilities and total USDA AUs using the 1997 Census of Agriculture (USDA NRCS, 2002). According to USDA's NRCS (2000), the number of head per USDA AU ranges from 50 for breeding turkeys to 67 for slaughter turkeys. To convert the total USDA AUs (in Table 4.4.5-3) to head count, EPA estimated a conversion factor that represented both breeding and slaughter turkeys. Using the three smaller size classes in Table 4.4.5-3, EPA developed a conversion factor of 54 head per USDA AU. The Agency developed this conversion factor so that the average head count per operation (last column in Table 4.4.5-3) for these three size classes was near the middle of the size class interval. The average head count for the largest size class was directly calculated using the conversion factor.

Table 4.4.5-3

Turkey Facility Demographics from the 1997 Census of Agriculture Database

Size Class	Number of Operations	Total USDA AUs	Size Class Interval (Number of Head)		Average Head Count per Operation
			Lower	Upper	
Medium 1	875	360,475	16,500	27,499	22,246
Medium 2	478	306,632	27,500	41,249	34,640
Medium 3	262	230,628	41,250	54,999	47,534
Large 1	388	915,367	≥55,000		127,396
Total	2,003	1,813,102			

Source: USDA NRCS, 2002.

Broilers

USDA NRCS (2002) provided information to EPA on the number of broiler facilities and total USDA AUs using the 1997 Census of Agriculture based on the following classifications:

- Operation size: ≥100,000 head, 50,000-99,999 head, and 30,000-49,999 head.
- Land availability: No excess manure nutrients (Category 1 farms with sufficient crop or pasture land).

  Excess manure nutrients, with acres (Category 2 farms with some land, but not enough land to assimilate all manure nutrients).

  Excess manure nutrients, no acres (Category 3 farms with none of the 24 major crop types identified by NRCS).
- Location: Ten states or groups of states.
- Nutrient basis: Applications are based on nitrogen (N) or phosphorus (P) application rates.

Table 4.3.5-17 in Section 4.3.5 presents the number of facilities for each classification combination. According to USDA's NRCS (2000), the number of head per USDA AU is 455 for broilers. EPA used this conversion factor to convert the USDA NRCS data to number of birds. Total number of birds was disaggregated using a procedure that corresponds to the procedure described in Section 4.3.5 (to disaggregate broiler facilities) for each modeled size class and individual state. These results were aggregated into regions, and then ultimately into modeled regions as summarized in Tables 4.4.5-4 and 4.4.5-5 for nitrogen- and phosphorus-based application rates. Approximately 87 percent of all broiler operations with more than 30,000 bird spot capacity were located in the South and Mid-Atlantic regions in 1997 (USDA NASS, 1999b). These two regions were selected as the key regions. Since climate is not a major factor in estimating costs at broiler operations (which have total confinement buildings and generally have covered manure storage), total number of operations from the Midwest, Central and Pacific regions was divided equally among the South and Mid-Atlantic regions for modeling purposes.

Table 4.4.5-4

Final Number of Broilers per Operation Based on Modeled Region, Land Availability Category, Operation Size for Nitrogen-Based Application of Manure

Region	Land Availability Category	Medium 1	Medium 2	Medium 3	Large 1	Large 2
Mid-Atlantic	No excess	39,786	55,963	85,865	125,000	273,909
	Excess, with acres	39,842	58,359	89,574	133,430	329,505
	Excess, no acres	39,609	56,176	86,342	151,184	381,884
South	No excess	39,075	54,921	84,423	125,000	251,127
	Excess, with acres	39,414	57,684	88,640	134,913	314,098
	Excess, no acres	39,419	57,557	88,516	132,017	325,838

Table 4.4.5-5

Final Number of Broilers per Operation Based on Modeled Region, Land Availability Category, Operation Size for Phosphorus-Based Application of Manure

Region	Land Availability Category	Medium 1	Medium 2	Medium 3	Large 1	Large 2
Mid-Atlantic	No excess	39,642	55,618	85,355	125,000	219,247
	Excess, with acres	39,851	58,110	89,171	132,696	326,246
	Excess, no acres	39,609	56,176	86,342	149,292	385,154
South	No excess	38,845	53,886	82,820	125,000	219,247
	Excess, with acres	39,427	57,644	88,596	135,091	312,224
	Excess, no acres	39,419	57,557	88,516	132,017	325,838

4.4.6 Average Head - Swine Operations

USDA NRCS (2002) provided information to EPA on the number of swine facilities and total USDA AUs using the 1997 Census of Agriculture based on the following classifications:

- Operation size: ≥2,500 head, 1,250-2,499 head, and 750-1,249 head.
- Land availability: No excess (Category 1 farms with sufficient crop or pasture land).

  Excess, with acres (Category 2 farms with some land, but not enough land to assimilate all manure nutrients).

  Excess, no acres (Category 3 farms with none of the 24 major crop types identified by NRCS).
- Location: Eleven states or groups of states.
- Nutrient basis: Applications are based on nitrogen (N) or phosphorus (P) application rates.

Table 4.3.6-1 in Section 4.3.6 presents the number of facilities for each classification combination. While USDA NRCS (2002) provided information by region, size class, and land availability category, it did not provide data to estimate average head count by operation type (i.e., farrow-to-finish, grow-finish) or the number of operations by manure storage (i.e., pit storage, lagoon, evaporative lagoon). Thus, it was necessary to estimate a conversion factor that represented both breeding hogs and hogs for slaughter to convert the total USDA AUs to head count. According to USDA NRCS (2000), the number of head per USDA AU ranges from 2.67 for breeding hogs to 9.09 for hogs for slaughter. Using summary data provided by the USDA NRCS (2002), EPA developed a conversion factor of 6 head per USDA AU, in order to convert the USDA NRCS data to number of head. Total head were disaggregated using the same procedure as described in Section 4.3.6 (to disaggregate swine facilities) for each modeled size class and individual state. These results were aggregated into regions, and then ultimately into modeled regions, as summarized in Tables 4.4.6-1 and 4.4.6-2 for nitrogen-and phosphorus-based application rates, respectively.

Table 4.4.6-1

Final Number of Swine per Operation Based on Modeled Region, Land Availability Category, Operation Size for Nitrogen-Based Application of Manure

Region	Land Availability Category	Medium 1	Medium 2	Medium 3	Large 1	Large 2
Central	No excess	NA	NA	NA	2,500	6,553
	Excess, with acres	NA	NA	NA	3,696	11,065
	Excess, no acres	NA	NA	NA	4,999	34,944
Mid-Atlantic	No excess	889	1,368	1,900	2,664	7,838
	Excess, with acres	1,031	1,554	2,158	4,581	13,713
	Excess, no acres	976	1,477	2,051	4,424	14,929
Midwest	No excess	871	1,332	1,898	2,505	5,927
	Excess, with acres	950	1,465	2,035	3,457	12,132
	Excess, no acres	976	1,522	2,114	4,561	16,982

NA - Not applicable.

Table 4.4.6-2

Final Number of Swine per Operation Based on Modeled Region, Land Availability Category, Operation Size for Phosphorus-Based Application of Manure

Region	Land Availability Category	Medium 1	Medium 2	Medium 3	Large 1	Large 2
Central	No excess	NA	NA	NA	2,500	6,037
	Excess, with acres	NA	NA	NA	3,304	9,890
	Excess, no acres	NA	NA	NA	4,999	34,944
Mid-Atlantic	No excess	883	1,346	1,888	2,500	6,390
	Excess, with acres	964	1,496	2,077	4,134	12,375
	Excess, no acres	976	1,477	2,051	4,424	14,929
Midwest	No excess	863	1,311	1,885	2,500	5,094
	Excess, with acres	926	1,415	1,965	2,878	9,172
	Excess, no acres	976	1,522	2,114	4,463	16,636

NA - Not applicable.

EPA decided to develop model farms for the Mid-Atlantic and Midwest regions because over 93 percent of the facilities with more than 750 head were located in these two regions in 1997 (USDA NASS, 1999b). EPA added additional model farms in the Central region based on comments received on the proposed rule that many large facilities had recently located to states in the Central region.

4.5 Wastewater/Dilution Water

The amount of wastewater and dilution water generated at dairies and veal operations is needed for the design of storage and treatment technologies. The cost model calculates the amount of wastewater generated for each model farm. Sections 4.5.1 through 4.5.4 describe the estimates of wastewater generated at dairies and veal, poultry, and swine operations and the assumptions and equations used in the cost model. Beef feedlots and heifer operations do not generate any wastewater under the model farm assumptions. (For the purpose of this report, the term "wastewater" does not include rainwater runoff.)

4.5.1 Wastewater Generation at Dairies

The cost model calculates the total amount of wastewater generated at dairies and uses it as input for the design of storage and treatment technologies. Wastewater, as used in the cost model, includes water from flushing or hosing confinement barns and milk parlors at dairies and veal operations. Section 4.5.1 describes the equations used to calculate the wastewater generated, and the different wastewater sources present at hose and flush dairies.

Hose Dairies

Wastewater generated at hose dairies includes wash water for equipment, milk parlor floors, and holding area floors. The cost model assumes wastewater is generated only in the milk parlor for hose dairies, because confinement barn waste is scraped without using flush water. Table 4.5.1-1 lists the sources of milk parlor wastewater by size class for dairies using hose systems.

Table 4.5.1-1

Milk Parlor Wastewater Generated at Dairies Using Hose Systems

Water Source	Units	Small Operations (< 200 Head)	Medium Operations (200-700 Head)	Large Operations (> 700 Head)
Bulk Tank-Manual[a]	gal/wash	40	35	30
Pipeline In Parlor[a]	gal/wash	75	100	125
Miscellaneous Equipment[a]	gal/day	30	30	30
Cow Preparation-Manual[b]	gal/wash-cow	0.5	0.375	0.25
Milkhouse Floor[b]	gal/day	20	15	10
Parlor and Holding Area Flush[b]	gal/milking	40	30	20

[a]Information taken from Midwest Plan Service - 7, Dairy Freestall Housing and Equipment, p78.
[b]Information taken from Midwest Plan Service - 18, Livestock Waste Facilities Handbook, p2.5

Based on site visits, dairies milk their cows either two or three times per day; therefore, the cost model assumes each cow is milked an average of 2.5 times per day and the equipment is washed after each milking. The general parlor wastewater generation equation is thus:

$$\text{Parlor Wastewater (gal/day)} = \frac{\text{No. Washes}}{\text{Day}} \times \left(\frac{\text{Bulk Tank Rinse}}{\text{Wash}} + \frac{\text{Pipeline Rinse}}{\text{Wash}}\right) + \text{Miscellaneous Equipment} + \frac{\text{No. Washes}}{\text{Day}} \times \text{Cow Preparation} \times \text{Number of Dairy Cattle} + \text{Milkhouse Floor Wash} + \frac{\text{No. Milkings}}{\text{Day}} \times \text{Parlor and Holding Area Flush}$$

After plugging in the values from Table 4.5.1-1, and assuming the number of washes and milkings equals 2.5, the total wastewater generated in the milk parlor for each size class is computed using the following equations:

< 200 Head

Parlor Wastewater (gal/day) = [2.5 washes/day × (40 + 75) gal/wash] + 30 gal/day + [0.5 gal/wash-cow × 2.5 washes/day × Number of Dairy Cattle] + 20 gal/day + [40 gal/milking × 2.5 milkings/day]

Parlor Wastewater (gal/day) = 437.5 gal/day + (1.25 gal/cow-day × Number of Dairy Cattle)

200-700 Head

Parlor Wastewater (gal/day) = [2.5 washes/day × (35 + 100) gal/wash] + 30 gal/day + [0.375 gal/wash-cow × 2.5 washes/day × Number of Dairy Cattle] + 15 gal/day + [30 gal/milking × 2.5 milkings/day]

Parlor Wastewater (gal/day) = 457.5 gal/day + (0.9375 gal/cow-day × Number of Dairy Cattle)

> 700 Head

Parlor Wastewater (gal/day) = [2.5 washes/day × (30 + 125) gal/wash] + 30 gal/day + [0.25 gal/wash-cow × 2.5 washes/day × Number of Dairy Cattle] + 10 gal/day + [20 gal/milking × 2.5 milkings/day]

Parlor Wastewater (gal/day) = 477.5 gal/day + (0.625 gal/cow-day × Number of Dairy Cattle)

Only the mature herd is used to calculate the wastewater use in the parlor because the wastewater use estimates are based on the number of animals passing through the parlor. Although the dairy model farm includes calves and heifers in addition to the milking herd on site, these animals are not counted in the milking herd count because they do not produce milk. To be conservative, all mature dairy cows, both lactating and dry, are used to calculate parlor wastewater.

Flush Dairies

Dairies using flush systems generate larger quantities of water than dairies using hose systems. Table 4.5.1-2 lists the sources of wastewater by size class for dairies using flush systems.

Table 4.5.1-2

Milk Parlor Wastewater Generated at Dairies Using Flush Systems[a]

Water Source	Units	Small Operations (<200 Head)	Medium Operations (200-700 Head)	Large Operations (>700 Head)
Bulk Tank-Automatic	gal/wash	60	55	50
Pipeline In Parlor	gal/wash	75	100	125
Miscellaneous Equipment	gal/day	30	30	30
Cow Preparation-Automatic	gal/wash-cow	2	2	2
Milkhouse Floor	gal/day	20	15	10
Parlor and Holding Area Flush	gal/day-cow	40	32.5	25

[a]Information taken from Midwest Plan Service - 18, Livestock Waste Facilities Handbook, page 2.5

As with hose dairies, the cost model assumes each cow is milked 2.5 times per day and the equipment is washed after each milking. The general parlor wastewater generation equation is thus:

$$\text{Parlor Wastewater (gal/day)} = \frac{\text{No. Washes}}{\text{Day}} \times \left(\frac{\text{Bulk Tank Rinse}}{\text{Wash}} + \frac{\text{Pipeline Rinse}}{\text{Wash}}\right)$$

+ Miscellaneous Equipment

+ $\frac{\text{No. Washes}}{\text{Day}}$ × Cow Preparation × Number of Dairy Cattle

+ Milkhouse Floor Wash

+ $\frac{\text{No. Milkings}}{\text{Day}}$ × Parlor and Holding Area Flush

After plugging in the values from Table 4.5.1-2, the total wastewater generated in the milk parlor for each size class is computed using the following equations:

< 200 Head

Parlor Wastewater (gal/day) = [2.5 washes/day × (60 + 75) gal/wash] + 30 gal/day + [2 gal/wash-cow × 2.5 washes/day × Number of Dairy Cattle] + 20 gal/day + [40 gal/day-cow × Number of Dairy Cattle]

Parlor Wastewater (gal/day) = 387.5 gal/day + (45 gal/cow-day × Number of Dairy Cattle)

200-700 Head

Parlor Wastewater (gal/day) = [2.5 washes/day × (55 + 100) gal/wash] + 30 gal/day + [2 gal/wash-cow × 2.5 washes/day × Number of Dairy Cattle] + 15 gal/day + [32.5 gal/day-cow × Number of Dairy Cattle]

Parlor Wastewater (gal/day) = 432.5 gal/day + (37.5 gal/cow-day × Number of Dairy Cattle)

> 700 Head

Parlor Wastewater (gal/day) = [2.5 washes/day × (50 + 125) gal/wash] + 30 gal/day + [2 gal/wash-cow × 2.5 washes/day × Number of Dairy Cattle] + 10 gal/day + [25 gal/day-cow × Number of Dairy Cattle]

Parlor Wastewater (gal/day) = 477.5 gal/day + (30 gal/cow-day × Number of Dairy Cattle)

Only the milking herd is used to calculate the wastewater use in the parlor because the wastewater use estimates are based on the number of animals passing through the parlor. Although the dairy model farm includes calves and heifers in addition to the milking herd on site, these animals are not counted in the milking herd count because they do not produce milk.

In addition to the milk parlor wastewater, water is used to flush the confinement barns. The amount of water required is estimated at 100 gal/day-cow (MWPS, 1993). The amount of wastewater generated is calculated using the following equation:

Barn Wastewater (gal/day) = 100 gal/day-cow × Number of Dairy Cattle

Because only the milking herd is housed in the confinement barn for the flush dairy model farm, only the milking herd is counted in the number of dairy cattle. Table 4.5.1-3 presents a summary of the wastewater generation by dairy model farm given the average head described in Section 4.4.

Table 4.5.1-3

Wastewater Generation by Dairy Model Farm

Animal Type	Size Class	Average Head	Parlor Wastewater[a] (gal/day)	Barn Wastewater[a] (gal/day)	Total Wastewater (gal/day)
Dairy-Flush	Medium 1	250	9,808	25,000	34,808
	Medium 2	425	16,370	42,500	58,870
	Medium 3	600	22,933	60,000	82,933
	Large 1	1,430	43,378	143,000	186,378
Dairy-Hose	Medium 1	250	692	0	692
	Medium 2	425	856	0	856
	Medium 3	600	1,020	0	1,020
	Large 1	1,430	1,371	0	1,371

[a]For the dairy model farm, only the mature herd is included in the calculation of wastewater generation. To be conservative, all mature dairy cows, both lactating and dry, are used to calculate parlor wastewater.

4.5.2 Wastewater Generation at Veal Operations

Veal operations do not generate as much wastewater as dairies because there is no milk parlor wastewater. Wastewater is generated at veal operations from flushing confinement barns only. It is estimated that the amount of water required is 100 gal/day-cow, the same value as provided for dairy barns (MWPS, 1993); therefore, the wastewater generated from veal operations is calculated using the following equation:

Barn Wastewater (gal/day) = 100 gal/day-calf × Number of Veal Calves

Total Wastewater Generation

The equations listed in Section 4.4 require the average number of animals as input. Table 4.4.4-1 lists the average number of head for each model farm. The total wastewater generated is the sum of the wastewater generated from the confinement barn and milk parlor.

Total Wastewater (gal/day) = Parlor Wastewater (gal/day) + Barn Wastewater (gal/day)

Table 4.5.2-1 shows the wastewater generation by veal model farm.

Table 4.5.2-1

Wastewater Generation by Veal Model Farm

Animal Type	Size Class	Average Head	Parlor Wastewater (gal/day)	Barn Wastewater (gal/day)	Total Wastewater (gal/day)
Veal	Medium 1	400	0	40,000	40,000
	Medium 2	540	0	54,000	54,000
	Medium 3	1,080	0	108,000	108,000

4.5.3 Wastewater and Dilution at Dry Poultry Operations

The dilution of as-excreted manure is calculated to provide the volume of manure and additional liquids stored. Manure is diluted with water by a dilution value of one to three. A dilution value of one means the stored manure has roughly the same volume as the excreted manure (e.g., layer manure that is stored in the bottom of the layer house). Broiler and turkey manure has a 75- to 80-percent moisture content when excreted. After the manure dries, broiler and turkey manure is usually handled as litter. However, the loss of moisture during storage is approximately replaced by the bedding material. Thus, a dilution value of one was used to estimate the volume of broiler and turkey manure/litter.

4.5.4 Wastewater and Dilution at Swine and Wet Layer Operations

Under baseline conditions, EPA assumed a dilution value of three when the manure is flushed to a lagoon for storage and a dilution factor of 1.2 when manure is stored in a pit beneath the house. EPA estimated the dilution value for lagoon storage by adding together typical slatted floor manure flush volumes (MWPS), the annual net precipitation for the lagoon surface, and the volume of a 25-year 24-hour rainfall event. This value is multiplied by the manure production in an approach similar to USDA NRCS (1998). Thus, an operation that produces 1,000 gallons of manure "as excreted" actually produces 3,000 gallons of liquid wastes after flushing. The resulting volume is the estimated total annual pumpdown volume.

As a comparison, the University of Missouri estimates annual pumpdown volumes based on contributions from manure, daily fresh water inputs, net rainfall, and runoff. Though pumpdown will vary by rainfall and climate, the Missouri model predicts the dilution value used by EPA may overestimate the volume of effluent associated with lagoon operations. EPA decided to use a dilution value of three for baseline conditions to ensure that the amount of waste produced and the associated manure handling costs were not underestimated.

A dilution value of two reflects methods of lowering the amount of dilution that occurs (e.g., reducing wastewater volumes due to recycling of flush water and the corresponding reduction in fresh water use; reducing or eliminating precipitation from entering the liquid waste impoundments). A lower dilution value will result in a large reduction in the volume of liquid manure that must be hauled, with a corresponding reduction in hauling costs. A dilution factor of two was assumed when manure is flushed to a lagoon for storage and the facility constructs a secondary lagoon and installs a pump to recycle water for flushing. These practices were used to lower the costs of Category 2 and 3 facilities with lagoons that had to haul excess manure nutrients away from the facility.

4.6 Manure Generation

The amount of manure generated at animal feeding operations is also needed for the design of storage and treatment technologies. In addition to the volume generated, the location of manure generation and collection affects the size and type of different waste management components. For cattle model farms, the cost model calculates the amount of manure generated for each model farm. Section 4.6.1 describes the estimates of manure generated at beef feedlots, dairies, and veal operations and the assumptions and equations used in the cost model. Sections 4.6.2 and 4.6.3 describes the calculation of recoverable manure at poultry and swine operations.

4.6.1 Manure Generation at Beef Feedlots, Heifer Operations, Dairies, and Veal Operations

The cost model calculates the total amount of manure generated using manure characteristics and the total number of animals on the beef feedlots, dairies, heifer and veal operations. Table 4.6.1-1 lists the assumptions used to approximate the manure generated. The moisture content can be used to calculate the total solids content or total water content of the manure. In practice, manure characteristics are variable; the values shown here reflect the best available data for national estimates.

Manure Placement

The amount of manure generated is distributed among the different areas of the operation. For beef feedlots and heifer operations, it is assumed that all manure is generated on the drylot. For veal operations, it is assumed that all manure from mature cattle is generated in the confinement barn. For dairies, it is assumed that 85 percent of the manure from mature cattle is generated in the confinement barn and 15 percent is generated in the milking parlor (USDA, 1996). Also, at dairies, it is assumed that calves and heifers on site deposit manure on the drylot. These estimates are based on the amount of time dairy cattle typically spend in each facility.

Table 4.6.1-1

Cattle Manure Production and Characteristics

Animal Type	Animal Weight (lbs)[a]	Manure Production (lb/day/1,000-lb animal)	Manure Density (lb/ft^3)[a]	Manure Moisture (percent)
Beef Cattle	877	63[b]	62	88[c]
Mature dairy cows	1,350	83.5[b]	62	87[c]
Calves	350	65.8[b]	62	98[d]
Heifers	550	66[b]	62	87[d]
Veal Calves	275	65.8[b]	62	98[e]

a Technical Development Document, 2002.
[b] Lander, C.H., D. Moffit, and K. Alt, 1998.
[c] NCSU, 1994.
[E]Assumes that heifers are equal to dairy cows and calves are equal to veal calves.
[d]ASAE, 1993.

Total Manure Generation

The cost model calculates the amount of manure generated in each area of the farm using the following equations. Information in Table 4.6.1-2 is used for manure generation information, and information in Table 4.4.1-1 is used to obtain the average number of head.

Beef cattle, calves, and heifers

Drylot Manure Generated = Average Head × Animal Weight (lbs) × Manure Production (lb/day/1,000-lb animal)

Mature dairy cows

Milking Parlor Manure Generated = 0.15 × Average Head × Animal Weight (lbs) × Manure Production (lb/day/1,000-lb animal)

Barn Manure Generated = 0.85 × Average Head × Animal Weight (lbs) × Manure Production (lb/day/1,000-lb animal)

Veal calves

Barn Manure Generated = Average Head × Animal Weight (lbs) × Manure Production (lb/day/1,000-lb animal)

Table 4.6.1-2 presents manure generation by model farm. Manure generation does not vary by region.

Table 4.6.1-2

Cattle Manure Generation by Model Farm

Animal Type	Size Class	Drylot Manure[a] (lbs/day)	Milking Parlor Manure (lbs/day)	Barn Manure (lbs/day)	Total Manure (lbs/day)
Beef	Medium 1	20,427	NA	NA	20,427
	Medium 2	30,495	NA	NA	30,495
	Medium 3	42,330	NA	NA	42,330
	Large 1	101,590	NA	NA	101,590
	Large 2	1,430,804	NA	NA	1,430,804
Heifers	Medium 1	17,010	NA	NA	17,010
	Medium 2	26,578	NA	NA	26,578
	Medium 3	37,209	NA	NA	37,209
	Large 1	63,787	NA	NA	63,787
Dairy	Medium 1	4,461	3,345	18,958	26,764
	Medium 2	7,576	5,682	32,200	45,458
	Medium 3	10,689	8,017	45,427	64,132
	Large 1	25,474	19,106	108,266	152,846
Veal	Medium 1	NA	NA	7,238	7,238
	Medium 2	NA	NA	9,771	9,771
	Medium 3	NA	NA	19,543	19,543

[a]For dairy farms, drylot manure includes calf and heifer waste. The number of calves and heifers is estimated as 0.3 × Average Mature Cattle Head.
NA - Not applicable.

4.6.2 Recoverable Manure Generation at Poultry Operations

The poultry cost model did not use estimates of manure generation to calculate costs. Instead, estimates of recoverable manure were made. A procedure for the calculation of on-farm nutrient production was outlined in a report by USDA NRCS (1998) and subsequently updated (USDA NRCS, 2000). Total nutrient availability was estimated for each livestock type by first multiplying the average confined livestock population (in animal units) by the number of tons of manure produced (i.e., manure as-excreted) by each type of livestock, and then

multiplying by the recovery factor. The recovery factor reflects that portion of manure that can be collected from the confinement areas and land applied. The recovery factor recognizes that not all nutrients may be recovered and reflects typical nutrient losses due to volatilization, nutrients taken up by plants in grazing areas, accumulation in confinement area soils, feedlot runoff, or leaching into ground water. This result, tons of recoverable manure, was multiplied by the number of pounds of nitrogen or phosphorus contained in one ton of manure to compute the total pounds of recoverable nutrients. The resulting value was further adjusted for typical nutrient losses that occur during storage and handling to generate an estimate of total available nitrogen and phosphorus from confined livestock manure. Table 4.6.2-1 presents details of manure and animal characteristics for poultry.

Table 4.6.2-1

Poultry Manure Characteristics Used to Calculate Nutrient Production

Animal	Operation	Animal Turnover	Average Animal Weight	Animal Unit Conversion	Manure Production	Nutrient Content	
						N	P
		#	lb	#animals/AU (USDA AU)	tons/AU/yr (USDA AU)	lb/ton of manure	
Chicken	Broiler	5.5	3	400	15	16	7
Chicken	Layer	1.0	4	270	11	18	9
Chicken	Pullet	2.0	2	500	8	14	9
Chicken	Integrated Layer	1.0	4	270	11	16	7
Turkey		2.5	11	89	9	12	11

Source: USDA NRCS, 1998.

Regional Recovery Factors

EPA developed regional recovery factors based on state-level recovery factors provided by USDA (see Table 4.6.2-2). The regional factor was calculated by weighting the state recovery factor with the number of animals of each type in a given state. Table 4.6.2-3 gives an example of the calculation of weighting factors. In Table 4.6.2-3, the number of broilers (NB) is multiplied by the state recovery factor (RF) to produce the weighting factor. The weighting

factor (RF × NB) is summed and divided by the total number of broilers in a region to obtain the regional recovery factor.

Table 4.6.2-2

Poultry Regional Recovery Factors for Manure

Region	Recoverable Manure Correction Factor	
	Chicken	Turkey
Central	0.95	0.75
Mid-Atlantic	0.97	0.97
Midwest	0.94	0.62
Pacific	0.90	0.94
South	0.96	0.72

Table 4.6.2-3

Example of Weighted Averaging Method for Manure Recovery Factor

State	Number of Broilers (NB)[a]	Recovery Factor (RF)[b]	RF × NB
AL	134,027,304	0.98	131,346,758
AR	172,617,806	0.95	163,986,916
FL	19,973,361	0.95	18,974,693
GA	149,740,420	0.95	142,253,399
LA	20,538,744	1.00	20,538,744
MS	26,313,171	0.95	24,997,512
SC	617,762,696	1.00	617,762,696
	Sum of NB	Sum of (Nb × RF)/sum of NB	Sum of (NB × RF)
	523,210,806	Weighted mean = 0.960	502,098,022

[a]USDA NASS, 1999.
[b]USDA NRCS, 1998.

Nutrient Losses

The values for nitrogen and phosphorus content after losses were estimated to provide the amount of nutrients that would be present in land-applied manure and effluent. There is no national or even regional perspective on what these values should be. These estimates are based on a three-part assumption:

- Nitrogen losses will greatly exceed those of phosphorus primarily due to volatilization of nitrogen compounds.

- As the quality (from an automation view) and number of manure management systems improve, the losses of nutrients, particularly nitrogen, may increase. In other words, as the manure management system becomes more automated, nitrogen losses through volatilization also increase.

- Phosphorus amounts are present within the bottom sludge of lagoons and ponds, and even though the sludge is not removed on a regular basis, the phosphorus content must be considered in an application strategy. In other words, effluent composition may not reflect actual nitrogen and phosphorus contents in the lagoon or holding pond.

Numerous individuals from USDA, universities, and industry groups were consulted to arrive at the "national" values for nutrient content after losses. The discussions focused on the types of manure systems typically used by the industry in different parts of the country, the losses typically associated with these systems (see Chapter 11, *Agricultural Waste Management Field Handbook*, USDA, 1992), and the portion of the nation's livestock raised in different parts of the country.

4.6.3 Recoverable Manure Generation at Swine Operations

The same procedure used to compute on-farm nutrient production used for poultry (see Section 4.6.2) is used for swine. Details of manure and animal characteristics are given in Table 4.6.3-1 for swine. EPA developed regional recovery factors based on state-level recovery factors provided by USDA (see Table 4.6.3-2). The regional factor was calculated by weighting the state recovery factor with the number of animals of each type in a given state.

Table 4.6.3-1

Swine Manure Characteristics Used to Calculate Nutrient Production

Animal	Operation	Animal Turnover	Average Animal Weight	Animal Unit Conversion	Manure Production	Nutrient Content	
						N	P
		#	lb	#animals/AU (USDA AU)	tons/AU/yr (USDA AU)	lb/ton of manure	
Swine	Integrated	2.1	110	9	15	3	3
Swine	Slaughter	2.8	135	7	12	3	3

Source: USDA NRCS (1998).

Table 4.6.3-2

Swine Regional Recovery Factors for Manure

Region	Recoverable Manure Correction Factor
Central	0.75
Mid Atlantic	0.87
Midwest	0.76
Pacific	0.76
South	0.54

4.7 Precipitation Data and Runoff

The cost model uses precipitation data to estimate the annual direct precipitation and runoff, the amount of direct precipitation and runoff from a peak storm, and the amount of direct precipitation and runoff from a chronic storm. These data are used to properly size open storage areas, such as runoff ponds and anaerobic lagoons.

For beef feedlots, diaries, and heifer operations, the cost model includes calculations for runoff from drylots and direct precipitation into open liquid storage areas (e.g., lagoons, ponds). For swine and wet layer operations, the cost model calculates costs for

operations that have only direct precipitation into open liquid storage areas (i.e., do not have drylots from which runoff is collected).

The cost model does not use precipitation data to estimate incremental regulatory costs for dry or wet poultry operations. It is assumed that all poultry operations use total confinement and the production area is never in contact with precipitation. Dry poultry houses are cleaned out periodically and the operators may have the litter hauled off site, stacked in a shed, or piled outside at the edges of fields for spreading as a fertilizer. The costs for the best management practices (BMPs) (such as covered storage and berms) used to mitigate potential runoff from dry poultry litter are not dependent upon the amount of precipitation. The cost model assumes that wet layer operations use a lagoon to store liquid manure and that operators prevent runoff from precipitation from entering the lagoon. It is also assumed that the lagoons are sized properly to prevent overflow from rainfall events less than the 25-year/24-hour rainfall event.

As with poultry operations, the cost model does not use precipitation data to estimate the regulatory costs for swine operations. It is assumed that all swine operations subject to the rule use total confinement and the production area is never in contact with precipitation, and that operators prevent uncontaminated runoff from entering waste storage areas. The model also assumes that swine operations use either lagoons or deep pits to store liquid wastes and that the lagoons are sized properly to prevent overflow from less than the 25-year/24-hour rainfall event. The methodology for estimating the costs of constructing and operating a lagoon are presented in Section 5.4.

Runoff from drylots at beef feedlots, heifer operations, and dairies under all options is added to the volume required for liquid storage at the operation. Runoff from the drylot becomes contaminated with manure solids and must be collected to prevent clean surface water from becoming contaminated. The cost model calculates the volume of runoff that must be accommodated in the storage facility. Runoff is the only liquid waste to be stored at beef and heifer feedlots. Dairies are assumed to keep calves and heifers on site on dry lots and to collect runoff from these drylots. Veal cattle, swine, and poultry model farms assume that the animals

are kept in confinement barns rather than drylots; therefore, it is assumed that contaminated runoff is negligible for these animal types.

4.7.1 Precipitation Estimates

The annual precipitation for each region is calculated using monthly precipitation values from the National Climatic Data Center (NCDC, 1999) representing the wettest six months of the year. EPA averaged all NCDC city data for each state to approximate an average monthly state precipitation. Next, EPA calculated average regional monthly precipitation data by averaging the state precipitation estimates in each region. Then, EPA summed the average regional monthly precipitation over the wettest consecutive six-month period to obtain the "wettest six-month precipitation." The average annual regional precipitation was conservatively estimated by multiplying the wettest six-month precipitation by two (ERG, 2000a).

Annual evaporation is estimated from a map of mean annual lake evaporation (MWPS, 1997). The net regional six-month precipitation is then calculated as the difference between six-month precipitation and one-half of the annual evaporation, shown below.

$$\text{Net Six-Month Precipitation} = \text{Six-Month Precipitation} - \frac{\text{Annual Evaporation}}{2}$$

Rainfall depth for the 25-year, 24-hour rainfall event, the 10-year, 1-hour rainfall event, and the 10-year, 10-day rainfall event is estimated from map contour lines (MWPS, 1997). Table 4.7.1-1 presents the precipitation estimates for all animal groups and each region.

Table 4.7.1-1

Precipitation Estimates

Animal Type	Region	Wettest 6-Month Precipitation (in)	25-Year, 24-Hour Precipitation (in)	10-year, 1-Hour Precipitation (in)	10-year, 10-day Precipitation (in)
All	Central	6.65	4	1	7
	Mid-Atlantic	21.52	5.4	2.1	9
	Midwest	11.2	5	2	7
	Pacific	23.25	10	1.6	6
	South	25.59	8	3	12

4.7.2 Drylot Area Estimates

The cost model uses the area of the drylot to determine the quantity of runoff. Runoff from the drylot is considered to be contaminated with manure solids; therefore, it requires collection and storage. Table 4.7.2-1 presents the range of drylot area for each animal type for which runoff is calculated.

Table 4.7.2-1

Drylot Area Required by Animal Type[a]

Animal Type	Area Required per Animal (ft^2)
Calves	150-300
Heifers	250-500
Beef Cattle	300-500

[a]Midwest Plan Service - 6 (MWPS, 1995), Beef Housing and Equipment Handbook, unpaved lots with mounds, page 1.1.

The cost model assumes the area required for each animal type equals the average area of each range plus an additional 15 percent for storage and handling facilities and feed silage areas (AEA, 1999). The following equation is used to calculate total drylot area per animal:

Drylot Area (ft^2/animal) = Average Area + (0.15 × Average Area)

Table 4.7.2-2 lists the calculated drylot area per animal used in the cost model. The total drylot area for each model farm is calculated by multiplying the average area per animal type by the average number of head at the operation.

Table 4.7.2-2

Drylot Area Required by Animal Type Used in the Cost Model

Animal Type	Area Required per Animal (ft^2)
Calves	259
Heifers	431
Beef Cattle	460

4.7.3 Total Runoff

The cost model uses the precipitation and area of the drylot to determine the total amount of runoff from the drylot. The cost model assumes 40 percent of the total precipitation over the storage period will run off a drylot that is 20 percent paved (Shuyler L., 1999):

$$R = 0.4 \times P \times A$$

where:

R = Runoff volume (ft^3)
P = Precipitation for the wettest six months (ft)
A = Drylot area (ft^2).

Table 4.7.3-1 shows the volumes for the six-month runoff by model farm and by region. The cost model uses these volumes to size settling basins, ponds, and lagoons.

Table 4.7.3-1

Six-Month Runoff Volumes

Animal Type	Size Class	Wettest Six-Month Runoff (ft^3) by Region				
		Central	Mid-Atlantic	Midwest	Pacific	South
Beef	Medium 1	37,728	122,090	63,541	131,905	145,181
	Medium 2	56,286	182,145	94,797	196,788	216,594
	Medium 3	78,106	252,760	131,548	273,079	300,563
	Large 1	187,517	606,821	315,818	655,604	721,587
	Large 2	2,640,631	8,545,320	4,447,378	9,232,281	10,161,465
Dairy	Medium 1	11,471	37,122	19,320	40,106	44,143
	Medium 2	19,501	63,107	32,844	68,181	75,043
	Medium 3	27,531	89,093	46,368	96,255	105,943
	Large 1	65,616	212,338	110,510	229,408	252,497
Heifers	Medium 1	38,238	123,740	64,400	133,688	147,143
	Medium 2	59,746	193,344	100,625	208,886	229,910
	Medium 3	83,645	270,681	140,875	292,441	321,874
	Large 1	143,391	464,025	241,500	501,328	551,784

The cost model also calculates runoff volumes from the 25-year, 24-hour rainfall event (for Options 1 through 7) and the 10-year, 10-day rainfall event (for Option 1A). The volume of runoff for a single rainfall event is calculated using the equation below, which assumes that one-half inch of rain is absorbed by the drylot (MWPS, 1993):

$$R = \frac{(P - 0.5)}{(12\ in/ft) \times A}$$

where:

R = Runoff volume (ft^3)
P = Precipitation (in)
A = Drylot area (ft^2).

Table 4.7.3-2 shows the runoff volumes for a 25-year, 24-hour rainfall event by model farm and by region, and Table 4.7.3-3 shows the runoff volumes for the 10-year, 10-day rainfall event by model farm. The cost model uses these volumes to size settling basins, ponds, and lagoons.

Table 4.7.3-2

25-Year, 24-Hour Rainfall Event Runoff Values

Animal Type	Size Class	Runoff (ft^3) by Region				
		Central	Mid-Atlantic	Midwest	Pacific	South
Beef	Medium 1	49,642	69,498	63,825	134,742	106,375
	Medium 2	74,060	103,684	95,220	201,020	158,700
	Medium 3	102,772	143,880	132,135	278,952	220,225
	Large 1	246,733	345,426	317,228	669,703	528,713
	Large 2	3,474,514	4,864,320	4,467,233	9,430,824	7,445,388
Dairy	Medium 1	15,094	21,131	19,406	40,969	32,344
	Medium 2	25,659	35,923	32,991	69,647	54,984
	Medium 3	36,225	50,715	46,575	98,325	77,625
	Large 1	86,336	120,871	111,004	234,341	185,006
Heifers	Medium 1	50,313	70,438	64,688	136,563	107,813
	Medium 2	78,613	110,059	101,074	213,379	168,457
	Medium 3	110,059	154,082	141,504	298,730	235,840
	Large 1	188,672	264,141	242,578	512,109	404,297

Table 4.7.3-3

10-Year, 10-Day Rainfall Event Runoff Values

Animal	Size Class	Runoff (ft^3) by Region				
		Central	Mid-Atlantic	Midwest	Pacific	South
Beef	Medium 1	7,092	22,693	21,275	15,602	35,458
	Medium 2	10,580	33,856	31,740	23,276	52,900
	Medium 3	14,682	46,981	44,045	32,300	73,408
	Large 1	35,248	112,792	105,743	77,545	176,238
	Large 2	496,359	1,588,349	1,489,078	1,091,990	2,481,796
Dairy	Medium 1	2,156	6,900	6,469	4,744	10,781
	Medium 2	3,666	11,730	10,997	8,064	18,328
	Medium 3	5,175	16,560	15,525	11,385	25,875
	Large 1	12,334	39,468	37,001	27,134	61,669
Heifers	Medium 1	7,188	23,000	21,563	15,813	35,938
	Medium 2	11,230	35,937	33,691	24,707	56,152
	Medium 3	15,723	50,312	47,168	34,590	78,613
	Large 1	26,953	86,250	80,859	59,297	134,766

4.7.4 Runoff Solids

Runoff from drylots contains some portion of solids. Midwest Plan Service suggests 1.5 percent of the runoff by mass is solids (MWPS, 1993). EPA assumes the runoff solids have the same waste characteristics as excreted manure. To determine the mass of solids, EPA converts the total runoff volume to mass using the density of water (62.4 lb/cf). Then, EPA calculates the mass of solids in the runoff by multiplying the mass of runoff by 1.5 percent.

$$\text{Runoff solids (cf)} = \text{Runoff}_{6mo}\ \text{cf} \times 62.4\ \text{lb/cf} \times 0.015$$

where:

Runoff_{6mo}	=	Runoff from the wettest six months of the year (cf)
62.4	=	Density of water (lb/cf)
0.015	=	Proportion of runoff that is solids.

4.8 Crops and Agronomic Application Rates

The cost model estimates the amount of nutrients that may be applied to cropland. To make these estimations, the cost model uses data about representative crops and crop rotation practices typical of each farm type in each region. These data are used to calculate a regional agronomic rate for each farm type.

EPA developed crop nitrogen and phosphorus requirements to depict conditions of the model farms. Extension personnel from counties with the densest populations of animals were consulted to determine the common cropping practices. Crop yields were determined by dividing the harvested quantity by the acreage obtained in the 1997 Census of Agriculture (USDA NASS, 1999b). For some poultry operations, yields were far below expected and were changed to reflect expected yields found in the Agricultural Waste Management Field Handbook (USDA NRCS, 1996). Crop nutrient removal (uptake) was based on data provided by USDA NRCS (1998) for swine and poultry operations and USDA for cattle operations (Lander C.H., D. Moffitt, and K. Alt, 1998). The nitrogen application rates were increased to reflect the 30-percent loss of nitrogen after land application of manure (Sutton A.L., D.W. Nelson, and D.D. Jones, 1985) due to volatilization of ammonia. The average annual nitrogen and phosphorus crop removal and application rates were calculated by dividing the total crop requirements over the time to complete a full crop rotation.

$$\text{Crop Nitrogen Requirements (lb/acre)} = \text{Crop Yield (tons/acre)} \times \text{Crop Uptake (lb/ton)}_{nitrogen}$$

$$\text{Crop Phosphorus Requirements (lb/acre)} = \text{Crop Yield (tons/acre)} \times \text{Crop Uptake (lb/ton)}_{phosphorus}$$

Table 4.8-1 presents the representative crops, crop rotations, crop yields, crop uptakes, and crop nutrient (nitrogen and phosphorus) requirements for all animal types by region. Crops are not expected to vary significantly based on the size of the animal operation.

When more than one crop, in a given rotation, is grown on the land, the total crop nutrient requirement for that land is equal to the sum of the individual crop nutrient requirements. The cost model estimates that 70 percent of the nitrogen and 100 percent of the phosphorus in cattle manure that is applied to the land is available for crop uptake and utilization over time (Lander C.H., D. Moffitt, and K. Alt, 1998); therefore, the agronomic application rate is calculated as the total crop nutrient requirement divided by the appropriate utilization factor.

$$\text{Manure Application Rate}_{\text{Nitrogen}}\ (\text{lb/acre}) = \text{Total Crop Nitrogen Requirements (lb/acre)} \div 70\%$$

$$\text{Manure Application Rate}_{\text{Phosphorus}}\ (\text{lb/acre}) = \text{Total Crop Phosphorus Requirements (lb/acre)} \div 100\%$$

When more than one crop is present, the agronomic rate is presented as the average of the individual agronomic rates for each crop. These agronomic application rates for nitrogen- and phosphorus-based application scenarios are used as inputs to the cost model. Table 4.8-2 presents the total crop nutrient (nitrogen and phosphorus) requirements and manure application rates (nitrogen and phosphorus) for all animal types by region.

4.9 Excess Manure

EPA used data developed by USDA to determine the amount of excess manure at each model farm with insufficient land to land apply all of the manure generated on the farm (Category 2 facilities). These USDA data were developed as part of a national analysis of the 1997 Census of Agriculture data to estimate manure production at livestock facilities (Kellogg, R. et. al., 2000). EPA applied these data to the appropriate model farms by animal types and size classes for beef and dairy operations. Veal operations are not included in this analysis as all veal operations are considered to have sufficient cropland to land apply all of the manure generated at the farm. An alternative approach described in Section 4.9.2 was used to compute excess manure nutrients for poultry and swine operations.

Table 4.8-1

Beef and Dairy Crop Information

Animal Type	Region	Crops and Rotations		Crop Yield	Crop Uptake (lb/ton)		Crop Requirement (lb/acre)	
					Nitrogen	Phosphorus	Nitrogen	Phosphorus
Beef	Central	Crop 1 Corn-silage Winter Wheat		20 tons/acre 3 tons/acre	7.1 0.03	1.1 0.0066	142 0.1	21 0.0288
	Mid-Atlantic	Crop 1 Crop 2	Corn-silage (3-yr rotation) Alfalfa	27 tons/acre 6 tons/acre	7.1 50.4	1.1 4.7	191 302	28 28
	Midwest	Crop 1 Crop 2	Corn-silage (3-yr rotation) Alfalfa	20 tons/acre 6 tons/acre	7.1 50.4	1.1 4.7	142 302	21 28
	Pacific	Crop 1 Crop 2	Alfalfa (3 yr-rotation) Corn-silage Winter Wheat	8 tons/acre 24 tons/acre 18 tons/acre	50.4 7.1 0.03	4.7 1.1 0.0066	403 170 0.5	38 25 0.1
	South	Crop 1	Corn-silage Hay Rye	17 tons/acre 2 tons/acre 3 tons/acre	7.1 19.8 0.03	1.1 15.3 0.005	121 40 0.1	18 31 0.02
Dairy/ Heifer	Central	Crop 1	Corn-silage Winter Wheat	20 tons/acre 3 tons/acre	7.1 0.03	1.1 0.006	142 0.1	21 0.02
	Mid-Atlantic	Crop 1 Crop 2	Corn-silage (3-yr rotation) Alfalfa	17 tons/acre 4 tons/acre	7.1 50.4	1.1 4.7	121 202	18 19
	Midwest	Crop 1 Crop 2	Corn-silage (3-yr rotation) Alfalfa	17 tons/acre 4 tons/acre	7.1 50.4	1.1 4.7	121 202	18 19
	Pacific	Crop 1 Crop 2	Alfalfa (3 yr-rotation) Corn-silage Winter Wheat	8 tons/acre 24 tons/acre 18 tons/acre	50.4 7.1 0.03	4.7 1.1 0.0066403 170 0.5	403 170 0.5	38 25 0.1
	South	Crop 1	Corn-silage Hay Rye	17 tons/acre 2 tons/acre 3 tons/acre	7.1 19.8 0.03	1.1 15.3 0.005	121 40 0.1	18 31 0.02
Veal	All (based on Midwest)[a]	Crop 1	Corn-silage (50%) Soybeans (50%) Winter Wheat (100%)	138 bu/acre 42 bu/acre 46 bu/acre	0.8 (lb/bu) 3.6 (lb/bu) 1.0 (lb/bu)	0.2 (lb/bu) 0.4 (lb/bu) 0.2 (lb/bu)	110 150 47	21 15 9
Poultry	Central	Crop 1	Bermuda	8 tons/acre	150	15	215	15

Table 4.8-1 (Continued)

Animal Type	Region	Crops and Rotations		Crop Yield	Crop Uptake (lb/ton)		Crop Requirement (lb/acre)	
					Nitrogen	Phosphorus	Nitrogen	Phosphorus
	Mid-Atlantic	Crop 1	Corn	123 bushels/acre	98	18	140	18
		Crop 2	Soybean	27 bushels/acre	94	10	135	10
		Crop 3	Wheat	63 bushels/acre	64	13	91	13
	Midwest	Crop 1	Fescue	5 tons/acre	99	10	141	10
	Pacific	Crop 1	Corn chop	23 tons/acre	165	24	236	24
		Crop 2	Oats	102 bushels/acre	60	11	86	11
		Crop 3	Alfalfa	7 tons/acre	352	33	503	33
	South	Crop 1	Fescue	5 tons/acre	99	10	141	10
Swine	Central	Crop 1	Corn	162 bushels/acre	129	24	185	24
	Mid-Atlantic	Crop 1	Corn	83 bushels/acre	67	12	95	12
		Crop 2	Soybean	28 bushels/acre	100	10	143	10
		Crop 3	Rye	25 bushels/acre	26	4	38	4
	Midwest	Crop 1	Corn	135 bushels/acre	108	20	154	20
		Crop 2	Soybean	48 bushels/acre	170	17	242	17
	Pacific	Crop 1	Corn chop	23 tons/acre	160	24	228	24
		Crop 2	Oats	90 bushels/acre	53	10	76	10
		Crop 3	Alfalfa	7 tons/acre	356	33	509	33
	South	Crop 1	Bermuda	8 tons/acre	150	15	215	15

[a] Because veal operations are located predominantly in the Midwest, EPA developed only one set of crop assumptions for veal that reflect the Midwest region.

Table 4.8-2

Total Crop Nutrient Requirements and Manure Application Rates

Animal Type	Region	Total Crop Requirements (lb/acre)		Manure Application Rate (lb/acre)	
		Nitrogen	Phosphorus	N-Based	P-Based
Beef	Central	142	21	203	21
	Mid-Atlantic	247	28	353	28
	Midwest	222	25	317	25
	Pacific	287	32	410	32
	South	160	49	229	49
Dairy	Central	142	21	203	21
	Mid-Atlantic	161	18	230	18
	Midwest	161	18	230	18
	Pacific	287	32	410	32
	South	160	49	229	49
Veal	All	102	27	146	27
Swine	Central	129	24	185	24
	Mid-Atlantic	97	14	138	14
	Midwest	139	19	198	19
	Pacific	178	18	407	34
	South	150	15	215	15
Poultry	Central	150	15	215	15
	Mid-Atlantic	128	20	183	20
	Midwest	99	10	141	10
	Pacific	141	14	412	34
	South	99	10	141	10

4.9.1 Beef and Dairy

The USDA provides data on the number of farms with excess nitrogen and/or phosphorus, broken down by animal type and size class, as well as the pounds of total excess nitrogen or phosphorus produced by these farms. Appendix E of USDA's report *Manure Nutrients Relative to the Capacity of Cropland and Pastureland to Assimilate Nutrients: Spatial and Temporal Trends for the United States* presents manure nutrient production according to farm type and size for 1997. This appendix identifies the total number of operations with farm-level excess nitrogen and the total amount of excess manure in pounds of nitrogen and phosphorus. These farm counts correspond to the sum of EPA's Category 2 and 3 farms. However, to determine the excess for just the Category 2 farms, EPA used USDA's *Table E97, Part III, Farms with Potential Excess Manure Nitrogen, Assuming No Export of Manure from Farm* and *Part V, Farms with Potential Excess Manure Phosphorus, Assuming No Export of Manure from Farm*. This table contains the same data presented in Appendix E with a breakout of the amount of excess manure in pounds of nitrogen and phosphorus for farms with available cropland (Category 2) and for farms with no acres of cropland (Category 3). Table 4.9.1-1 presents the USDA data used by EPA to develop estimates of excess manure for each animal type and size class.

EPA calculated the excess manure on a nitrogen and phosphorus basis for Category 2 facilities by dividing the pounds of excess nutrients by the number of farms with excess manure and available cropland from USDA's Table E97. For example, for Fattened Cattle > 11,000 head capacity (Beef Large 2), the amount of excess nitrogen and phosphorus per farm is calculated using the following equations:

Excess Manure on Nitrogen Basis (lb/farm) = 114,675,269/186 = 616,534

Excess Manure on Phosphorus Basis (lb/farm) = 86,121,090/213 = 404,324

Table 4.9.1-2 presents the estimates of excess manure by animal type and size class.

Table 4.9.1-1

USDA Data on Manure Production at Livestock Facilities

Animal Type	Size Class	Enterprise Type	Farms with Excess Nitrogen Manure and Cropland or Pastureland Available		Farms with Excess Phosphorus Manure and Cropland or Pastureland Available	
			Number of Farms	Excess Manure Nitrogen (lbs)	Number of Farms	Excess Manure Phosphorus (lbs)
Beef	Large 2	Fattened cattle > 11,000-head capacity	186	114,675,269	213	86,121,090
	Large 1	Fattened cattle 1,300- to 11,000-head capacity	112	5,984,998	355	10,077,337
	Medium 3 Medium 2 Medium 1	Fattened cattle 650- to 1,300-head capacity	23	220,917	77	362,238
Heifer	All	Cattle other than fattened cattle and dairy cows > 300 or more animal units	965	1,718,304	1,643	2,138,529
Dairy	Large 1	Dairy farms > 700-head capacity	394	31,101,658	530	17,713,995
	Medium 3 Medium 2	Dairy farms 350- to 700-head capacity	358	8,124,258	596	5,183,144
	Medium 1	Dairy farms 0- to 350-head capacity	2,266	9,251,390	5,409	6,781,325

Source: USDA Table E97, Part III and Part V.

Table 4.9.1-2

Excess Manure Estimates by Animal Type and Size Class

Animal Type	Size Class	USDA Enterprise Type	Excess Manure on Nitrogen Basis (lb/farm)	Excess Manure on Phosphorus Basis (lb/farm)
Beef	Large 2	Fattened cattle > 11,000-head capacity	616,534	404,324
	Large 1	Fattened cattle 1,300- to 11,000-head capacity	53,437	28,387
	Medium 3 Medium 2 Medium 1	Fattened cattle 650- to 1,300-head capacity	9,605	4,704
Dairy	Large 1	Dairy farms > 700-head capacity	78,938	33,423
	Medium 3 Medium 2	Dairy farms 350- to 700-head capacity	22,693	8,697
	Medium 1	Dairy farms 0- to 350-head capacity	4,083	1,254
Heifer	Large 1 Medium 3 Medium 2 Medium 1	Cattle other than fattened cattle and dairy cows > 300 or more animal units	1,781	1,302

4.9.2 Poultry and Swine

USDA NRCS (2002) also provided information to the EPA regarding the total on-farm acreage associated with different land availability classes. On-farm acreage when combined with the average head count (Section 4.4), manure generation (Sections 4.6.2 and 4.6.3), and crop requirements (Section 4.8) can be used to estimate the excess nitrogen or phosphorus produced on an operation. Box 1 illustrates the procedure used by USDA NRCS (1998) and adopted in the poultry and swine cost model to calculate nutrient loading and land application for a typical 1,000-hog operation in the Midwest region. The animal unit (AU) conversion factor in Box 1 represents the number of animals having a combined weight of 1,000 pounds. For this example, for integrated swine operations (generally meaning farrow-to-finish farms), the average

weight of a hog is 110 pounds and the concomitant AU factor is 9.09 (1,000 lb of animals/110 lb average hog weight). Each hog AU produces 14.69 tons of manure per year with a concentration after losses of 2.8 lb P/ton manure and 2.82 lb N/ton manure. This example uses a regional recovery factor of 0.8 and nutrient uptake of 25 lb P/acre. The result is an acreage of 145 acres for application of all of the manure at agronomic phosphorus rates for a 1,000-swine farrow-to-finish operation. Operations with (some, but) less available acreage (i.e., Category 2 operations) would have excess phosphorus and would need to export the excess manure nutrients off-site. As such, the remainder of this section describes the data used for acreage available to Category 2 farms. (Note, that acreage for Category 1 operations was calculated by determining the mass of manure nutrients produced at the operation and dividing it by the manure application rate as determined by the crop nutrient needs.)

Box 1. USDA's Method for Calculating Nutrient Production and Land Application

To calculate annual nutrient production:

$$\text{Nutrient produced}\left(\frac{\text{lb}}{\text{yr}}\right) = \text{no. head / animal units conversion}\left(\frac{\text{no. head}}{\text{AU}}\right) \times \frac{\text{tons manure}}{\text{yr} - \text{AU}} \times \text{nutrient concentation}\frac{\text{lb}}{\text{ton}}$$

Substituting AWMFH values:

$$\text{P produced}\left(\frac{\text{lb}}{\text{yr}}\right) = 1{,}000 / 9.09 \times 14.69 \times 2.8 = 4{,}525\frac{\text{lb P}}{\text{yr}}$$

To calculate land required:

$$\text{Land required}\left(\frac{\text{ac}}{\text{yr}}\right) = \text{P produced}\left(\frac{\text{lb}}{\text{yr}}\right) \times \textit{regional recovery factor}\,(\%) / \text{nutrient uptake}\left(\frac{\text{lb}}{\text{ac}}\right)$$

Substituting values from average of MPS-18, USDA, and NCSU data:

$$\text{Land required (acres)} = 4{,}525 \times 0.80 / 25 = 145 \text{ acres}$$

For layers and turkeys, USDA NRCS (2002) provided information to EPA regarding the total on-farm acreage with manure applied (for Category 2 layer and turkey operations) using the 1997 Census of Agriculture data. These data were organized into the following groups:

- Operations with no excess manure using nitrogen- or phosphorus-based applications;

- Operations with no excess manure using nitrogen-based applications, but which do not have enough acres to meet phosphorus-based applications;
- Operations with excess manure using nitrogen-based applications and less than 10 acres available for manure application; and
- Operations with excess manure using nitrogen-based applications and 10 or more acres available for manure application.

EPA calculated the average acreage for Category 2 operations (using nitrogen-based applications) as the ratio of the total acreage to number of operations for farms with excess manure using nitrogen-based applications and 10 or more acres available for manure application (see Table 4.9.2-1). For example, layer operations with 500 to 750 animal units have an average of 83.3 acres (=14,998/180). Due to Census of Agriculture disclosure restrictions, USDA NRCS had to aggregate the first two groups described above in numerous instances. In these instances, EPA assumed that 80 percent of the operations from the combined group together with the Category 2 operations using nitrogen-based applications would be used for the Category 2 operations using phosphorus-based applications (see Table 4.9.2-1). Based on ratios of operations, the acreage for the largest layer size class in Table 4.9.2-1 was disaggregated to 217.1 and 531.2 acres for nitrogen-based applications and 332.5 and 813.5 acres for phosphorus-based applications.

For broilers, USDA NRCS (2002) provided information to EPA on the number of broiler facilities and on-farm acres with manure applied using the 1997 Census of Agriculture based on the following classifications:

- Operation size: ≥100,000 head, 50,000-99,999 head, and 30,000-49,999 head.
- Land availability: No excess (Category 1 farms with sufficient crop or pasture land).

  Excess, with acres (Category 2 farms with some land, but not enough land to assimilate all manure nutrients).

Table 4.9.2-1

On-Farm Acreage for Category 2 Layer and Turkey Operations

Animal Type	Size Class (AUs)	Farms with Excess Manure and 10 or More Acres Available for Manure Application Using Nitrogen-based Application			Farms with Excess Manure and 10 or More Acres Available for Manure Application Using Phosphorus-based Application		
		Number of Operations	Total Acreage	Average Acreage	Number of Operations	Total Acreage	Average Acreage
Layers	300-500	349	22,534	64.6	515	67,108	130.3
	500-750	180	14,998	83.3	249[a]	43,000[a]	172.8
	750-1000	96	11,267	117.4	124[a]	33,612[a]	271.1
	>1000	278	73,500	264.4	336[a]	136,208[a]	404.9
Turkeys	300-500	464	53,320	114.9	577[a]	121,712[a]	211.0
	500-750	289	40,584	140.4	317[a]	67,587[a]	213.2
	750-1000	139	26,516	190.8	161[a]	56,356[a]	349.2
	>1000	209	56,650	271.1	238	133,275	560.0

[a]Due to Census of Agriculture disclosure restrictions, EPA combined operations with no excess manure using nitrogen- or phosphorus-based applications and operations with no excess manure using nitrogen-based applications but not having enough acres to meet phosphorus-based applications. In these instances, EPA assumed that 80 percent of the operations from the combined group together with the Category 2 operations using nitrogen-based applications would be used for the Category 2 operations using phosphorus-based applications.

Excess, no acres (Category 3 farms with none of the 24 major crop types identified by NRCS).

- Location: Ten states or groups of states.
- Nutrient basis: Applications are based on nitrogen (N) or phosphorus (P) application rates.

Section 4.3.5 presents the number of facilities for each classification combination. Only the calculations for Category 2 acreage are presented here because Category 3 acreage is zero and Category 1 acreage is calculated using the equation presented in Section 4.10. Total on-farm acreage with manure applied (to Category 2 operations) was disaggregated using the same procedure as that described in Section 4.3.5 (to disaggregate broiler facilities) for each modeled size class and individual state. EPA disaggregated these results into regions, and then ultimately into modeled regions, as summarized in Table 4.9.2-2.

Table 4.9.2-2

On-Farm Acreage with Manure Applied for Category 2 Broiler Operations

Region	Nutrient Basis	Acreage in each Size Class				
		180,000+	125,000-179,999	75,000-124,999	50,000-74,999	37,750-49,999
Mid-Atlantic	Nitrogen	226.9	128.7	118.8	85.7	65.6
South	Nitrogen	214.4	129.5	112.5	80.3	70.3
Mid-Atlantic	Phosphorus	356.2	209.0	184.0	131.3	108.7
South	Phosphorus	230.9	139.3	124.6	90.2	77.5

For swine operations, USDA NRCS (2002) provided information to EPA on the number of swine facilities and on-farm acres with manure applied using the 1997 Census of Agriculture based on the following classifications:

- Operation size: ≥2,500 head, 1,250-2,499 head, and 750-1,249 head.
- Land availability: No excess (Category 1 farms with sufficient crop or pasture land).

  Excess, with acres (Category 2 farms with some land, but not enough land to assimilate all manure nutrients).

  Excess, no acres (Category 3 farms with none of the 24 major crop types identified by NRCS).
- Location: Eleven states or groups of states.
- Nutrient basis: Applications are based on nitrogen (N) or phosphorus (P) application rates.

Section 4.3.6 presents the number of facilities for each classification combination. Only the calculations for Category 2 acreage are presented here because Category 3 acreage is zero and Category 1 acreage is calculated using the equation presented in Section 4.10. Total on-farm acreage with manure applied (to Category 2 operations) was disaggregated using the same procedure as that described in Section 4.3.6 (to disaggregate swine facilities) for each modeled

size class and individual state. EPA aggregated these results into regions, and then ultimately into modeled regions, as summarized in Table 4.9.2-3. While USDA NRCS (2002) provided information by region, size class, and land availability category, it did not provide data to estimate acreage by operation type (i.e., farrow-to-finish, grow-finish) or the number of operations by manure storage (i.e., pit storage, lagoon, evaporative lagoon). The acreage of category 1 operations was calculated by determining the mass of manure nutrients produced at the operation and dividing it by the manure application rate as determined by the crop nutrient needs.

Table 4.9.2-3

On-Farm Acreage with Manure Applied for Category 2 Swine Operations

Region	Nutrient Basis	5,000+	2,500-4,999	1,875-2,499	1,250-1,874	750-1,249
Central	Nitrogen	323.0	107.9	n/a	n/a	n/a
Mid-Atlantic	Nitrogen	236.4	79.0	70.2	50.6	44.0
Midwest	Nitrogen	387.7	106.4	103.1	74.2	56.9
Central	Phosphorus	725.2	242.3	n/a	n/a	n/a
Mid-Atlantic	Phosphorus	525.2	175.5	181.3	130.5	151.2
Midwest	Phosphorus	895.8	289.4	285.2	205.3	145.8

4.10 Acres

Data on the amount of land available to facilities for land application of manure are limited and vary significantly by animal sector, region, and size class. This subsection presents the methodologies used to calculate the total amount of land available for land application of manure for the beef, and dairy sectors and the amount of land available for application of liquid wastes for the different land-availability categories. Please refer to Section 4.9.2 for information related to on-farm acreage available for manure application at swine and poultry facilities.

For Category 1 farms, the land requirement is calculated using the nutrients generated and the crop uptake. The same basic approach is used for Category 2 farms, but the

fraction of manure nutrients hauled off-site is subtracted from the total manure nutrients generated. For both Category 1 and 2 farms, N generation and N uptake are used for N-based nutrient management, and the corresponding P values are used for P-based nutrient management. These calculations are essential to determining the amount of excess manure nutrients generated. Note that a Category 1 farm using N-based application rates might be a Category 2 farm using P-based application rates. Category 3 farms have no available land and it is assumed that all manure nutrients are hauled off site.

4.10.1 Total Available Cropland Acres at Beef Feedlots, Dairies, Heifer and Veal Operations and Category 1 Swine and Poultry Acreage

The cost model performs a number of calculations to determine for each model farm the total acreage that is available to land apply manure and the amount of manure requiring off-site transportation. The same methodology is used for both beef and dairy animal sectors. The acreage calculations are performed for both nitrogen-based and phosphorus-based application scenarios.

Category 1 Acreage

Category 1 acreages are calculated using the agronomic application rates, number of animals, manure generation estimates, nutrient content of the manure, and manure recoverability factors:

$$\text{Category 1 Acreage} = \frac{\text{Animal Units (AUs)} \times \text{Manure Generation (tons/AU)} \times \text{Nutrient Content (lbs/ton manure)} \times \text{Recoverability Factor}}{\text{Agronomic application rate (lb/acre)}}$$

EPA defines recoverability factors as the percentage of manure, based on solids content, that would be practical to recover. Recoverability factors are developed for each region using USDA state-specific recoverability factors, and are based on the assumption that the decrease in nutrient values per ton of manure mirrors the reduction in solids content of the recoverable manure (Lander C.H., D. Moffitt, and K. Alt, 1998).

Category 2 Acreage

Category 2 acreages are calculated using Category 1 acreages, the estimate of excess manure from USDA's analysis described in Section 4.9, and acres required to land apply excess manure:

$$\text{Average Excess Nutrients (lbs/yr)} = \frac{\text{Excess Nutrients (lbs/yr)}}{\text{Number of Category 2 Facilities}}$$

$$\text{Excess Acreage} = \frac{\text{Average Excess Nutrients (lbs/yr)}}{\text{Agronomic Application Rate (lb/acre)}}$$

$$\text{Category 2 Acreage} = \text{Category 1 Acreage} \quad \text{Excess Acreage}$$

Table 4.10.1-1 presents Category 1 and 2 acreages by animal type, size group, and region.

Category 3 Acreage

Category 3 acreages, by definition, are zero.

Liquid Land Application Acres

The cost model calculates the minimum amount of acreage required to land apply all of the liquid wastewater to determine the costs of the equipment required to apply liquid waste (see Section 5.8 for a detailed discussion of the land application costs). The number of acres required to apply liquid waste from ponds and lagoons is based on two main variables: the hydraulic loading capacity of the cropland and the nutrient assimilative capacity of the crops. The cost model calculates the number of required liquid acres in four steps. The first step

Table 4.10.1-1

Category 1 and 2 Total Acreages for Beef Feedlots, Dairies, Heifer and Veal Operations Option 2

Animal	Farm Type	Size Class	Region	Category 1 Acreages		Category 2 Acreages	
				N-Based	P-Based	N-Based	P-Based
Beef	Beef	Large 1	Central	307	1930	43	579
			Mid-Atlantic	164	1327	12	326
			Midwest	182	1525	14	374
			Pacific	155	1317	25	417
			South	252	776	19	190
		Large 2	Central	4323	27175	1282	7930
			Mid-Atlantic	2305	18690	557	4423
			Midwest	2562	21479	619	5083
			Pacific	2189	18544	685	5721
			South	3552	10928	858	2586
		Medium 1	Central	62	388	14	164
			Mid-Atlantic	33	267	6	101
			Midwest	37	307	6	116
			Pacific	31	265	8	116
			South	51	156	9	59
		Medium 2	Central	92	579	45	355
			Mid-Atlantic	49	398	22	232
			Midwest	55	458	24	267
			Pacific	47	395	23	246
			South	76	233	34	136
		Medium 3	Central	128	804	80	580
			Mid-Atlantic	68	553	41	387
			Midwest	76	635	46	445
			Pacific	65	549	41	399
			South	105	323	63	226
Dairy	Flush	Large 1	Central	519	1991	130	401
			Mid-Atlantic	428	2132	85	313
			Midwest	469	2337	126	518
			Pacific	240	1242	48	182
			South	372	697	27	8

Table 4.10.1-1 (Continued)

Animal	Farm Type	Size Class	Region	Category 1 Acreages		Category 2 Acreages	
				N-Based	P-Based	N-Based	P-Based
Dairy (cont.)	Flush	Medium 1	Central	91	348	71	288
			Mid-Atlantic	75	373	57	305
			Midwest	82	409	64	340
			Pacific	42	217	32	177
			South	65	122	47	96
		Medium 2	Central	154	592	42	179
			Mid-Atlantic	127	634	29	161
			Midwest	139	695	41	222
			Pacific	71	369	16	94
			South	110	207	11	28
		Medium 3	Central	218	835	106	422
			Mid-Atlantic	180	895	81	421
			Midwest	197	981	98	507
			Pacific	101	521	45	245
			South	156	293	57	113
	Hose	Large 1	Central	519	1991	130	401
			Mid-Atlantic	428	2132	85	313
			Midwest	469	2337	126	518
			Pacific	240	1242	48	182
			South	372	697	27	8
		Medium 1	Central	91	348	71	288
			Mid-Atlantic	75	373	57	305
			Midwest	82	409	64	340
			Pacific	42	217	32	177
			South	65	122	47	96
		Medium 2	Central	154	592	42	179
			Mid-Atlantic	127	634	29	161
			Midwest	139	695	41	222
			Pacific	71	369	16	94
			South	110	207	11	28
		Medium 3	Central	218	835	106	422
			Mid-Atlantic	180	895	81	421
			Midwest	197	981	98	507
			Pacific	101	521	45	245
			South	156	293	57	113

Table 4.10.1-1 (Continued)

Animal	Farm Type	Size Class	Region	Category 1 Acreages		Category 2 Acreages	
				N-Based	P-Based	N-Based	P-Based
Heifers	Heifers	Large 1	Central	74	432	65	370
			Mid-Atlantic	61	458	53	387
			Midwest	61	458	53	387
			Pacific	38	295	33	254
			South	61	174	53	147
		Medium 1	Central	20	115	11	53
			Mid-Atlantic	16	122	8	51
			Midwest	16	122	8	51
			Pacific	10	79	6	37
			South	16	46	8	19
		Medium 2	Central	31	180	22	118
			Mid-Atlantic	25	191	17	120
			Midwest	25	191	17	120
			Pacific	16	123	11	82
			South	25	72	18	46
		Medium 3	Central	43	252	34	190
			Mid-Atlantic	35	267	28	197
			Midwest	35	267	28	197
			Pacific	22	172	18	131
			South	36	101	28	74
Veal	Flush	Medium 1	Central	100	100	0	0
			Mid-Atlantic	100	100	0	0
			Midwest	100	100	0	0
			Pacific	100	100	0	0
			South	100	100	0	0
		Medium 2	Central	100	100	0	0
			Mid-Atlantic	100	100	0	0
			Midwest	100	100	0	0
			Pacific	100	100	0	0
			South	100	100	0	0
		Medium 3	Central	100	100	0	0
			Mid-Atlantic	100	100	0	0
			Midwest	100	100	0	0
			Pacific	100	100	0	0
			South	100	100	0	0

calculates the hydraulic loading rate using standard engineering equations (Tchobanoglous, George and F.L. Burton, eds., 1991). The second step calculates the minimum acreage required to apply the liquid manure at the hydraulic loading rate. The third step calculates the minimum acreage required to apply the liquid manure at the liquid-nutrient loading rate. The fourth and final step compares the acreage required under the hydraulic loading and liquid-nutrient loading scenarios and selects the maximum number of acres as the acres required for liquid land application. Each of these steps is described below.

Step 1) Calculate the Hydraulic Loading Rate

The cost model uses the following equation to calculate the amount of wastewater that can be applied and used by the crops and soil per acre per year. Using this equation in combination with the total amount of liquid wastewater generated per year, the cost model calculates the total number of acres needed to apply all of the liquid waste.

Hydraulic Loading Rate (ft/yr) = Evapotranspiration Rate - Precipitation Rate + Percolation Rate

Evapotranspiration Rate: EPA calculated the evapotranspiration rate using data found in Metcalf and Eddy for select cities in the United States that correspond to the five regions used in this analysis. Evapotranspiration rates for cities located in the same region were averaged together. Table 4.10.1-2 presents the evapotranspiration rate used in the cost model by region.

Precipitation Rate: To best estimate the hydraulic loading rate, Metcalf and Eddy suggests using precipitation data from the wettest year over the past 10 years. For this analysis, EPA used data found at the National Climatic Data Center (NCDC) web site for 1994 through 1999. The data included weighted annual rainfall for each state in the United States. The stations were averaged by state and by region. By averaging the regions and comparing the average rainfall in the United States for each year, EPA determined that 1996 was the wettest year. Table 4.10.1-3 lists the regional precipitation rates for 1996. Note, the rates used in this analysis are not weighted; each data point contributes equally to the regional weighting.

Table 4.10.1-2

Evapotranspiration Rate

Region	City	Evapotranspiration Rate (in/yr)	Regional Evapotranspiration Rate (in/yr)
Central	Paris, TX	35.7	35.7
Mid-Atlantic	Brevard, NC	24.2	25.5
	Hanover, NH	24.8	
	Seabrook, NJ	27.6	
Midwest	Central MO	35.3	35.3
Pacific	Central Valley, CA	49.4	66.1
	Southern Desert, CA	82.8	
South	Jonesboro, GA	34.4	34.4

Source: Tchobanoglous, G. et al.1991.

Table 4.10.1-3

1996 Average Regional Precipitation

Region	Annual Precipitation Rate (in/yr)
Central	17.87
Mid-Atlantic	57.13
Midwest	33.89
Pacific	39.96
South	53.00

Source: NCDC (http://www.ncdc.noaa.gov).

Percolation Rate: The following equation, taken from Metcalf & Eddy, is used to calculate the rate at which liquid moves through the soil.

Percolation rate (in/yr) = Soil Permeability (in/hr) × Average Time of Irrigation (hr/day) × Days of Irrigation (day/yr) × Percolation Reduction (%)

Soil Permeability: EPA identified the principal state soil type for each model farm. Using USDA's soil descriptions for each of these state soils (USDA NRCS, 2001b), EPA then identified the soil's permeability (e.g., rapid, very rapid) and matched it to established USDA soil permeability ranges (USDA NRCS, 2001a). Following the procedure suggested in Metcalf and Eddy. EPA used the minimum

value in the range as the soil permeability. Table 4.10.1-4 presents the values for each region.

Table 4.10.1-4

Regional Soil Permeability

Animal	Region	Soil Type	Permeability Class	Permeability Range (in/hr)	
Beef	Central	Houston Black (TX)	Slow	0.06	0.2
	Mid-Atlantic	Hazleton (PA)	Moderately Rapid to Rapid	2	20
	Midwest	Harney (KS)	Moderately Slow	0.2	0.6
	Pacific	San Joaquin (CA)	Very Slow	0.0015	0.06
	South	Myakka (FL)	Moderately Rapid to Rapid	2	20
Dairy	Central	Houston Black (TX)	Slow	0.06	0.2
	Mid-Atlantic	Honeoye (NY)	Moderate	0.6	2
	Midwest	Antigo (WI)	Moderately Rapid	2	6
	Pacific	San Joaquin (CA)	Very Slow	0.0015	0.06
	South	Myakka (FL)	Moderately Rapid to Rapid	2	20

Average Time of Irrigation: EPA assumed this to be the length of one working day (10 hr/day as per the cost model).

Days of Irrigation: EPA assumed that farms irrigate cropland weekly and they are not permitted to irrigate while the land is frozen. Table 4.10.1-5 shows the days of irrigation assumed for this analysis.

Percolation Reduction: EPA assumed the percolation reduction to be 4 percent based on the recommended value for preliminary design in Metcalf and Eddy.

Table 4.10.1-6 presents the results of the hydraulic loading rate calculations for Option 2.

Table 4.10.1-5

Days of Irrigation

Animal	Region	Freeze-Free Days[a] (days/yr)	Days Between Applications (days)	Annual Application (applications/yr)
Beef	Central	191	7	27
	Mid-Atlantic	161	7	23
	Midwest	171	7	24
	Pacific	257	7	37
	South	320	7	46
Dairy	Central	226	7	32
	Mid-Atlantic	153	7	22
	Midwest	141	7	20
	Pacific	256	7	37
	South	320	7	46

[a]From ERG, 2000a

Table 4.10.1-6

Maximum Design Hydraulic Loading Rate Based on Annual Permeability Evaluation

Animal	Region	Annual Evapotranspiration[a] (in/yr)	Annual Precipitation[b] (in/yr)	Design Permeability (in/hr)	Design Permeability[c] (in/yr)	Percolation Reduction	Design Percolation Rate (in/yr)	Hydraulic Loading Rate (in/yr)	Hydraulic Loading Rate (ft/yr)
Beef	Central	35.7	17.87	0.06	16	4%	1	18	1.54
	Mid-Atlantic	25.5	57.13	2.00	460	4%	18	0	0.00
	Midwest	35.3	33.89	0.20	49	4%	2	3	0.28
	Pacific	66.1	39.96	0.00	1	4%	0	26	2.18
	South	34.4	53	2.00	914	4%	37	18	1.50
Dairy	Central	35.7	17.87	0.06	19	4%	1	19	1.55
	Mid-Atlantic	25.5	57.13	0.60	131	4%	5	0	0.00
	Midwest	35.3	33.89	2.00	403	4%	16	18	1.46
	Pacific	66.1	39.96	0.00	1	4%	0	26	2.18
	South	34.4	53	2.00	914	4%	37	18	1.50

[a]Metcalf and Eddy. Midwest set equal to Central due to lack of data.
[b]Based on regional averaging of 1996 NCDC State Average Precipitation Data.
[c]Assuming 10 hrs of irrigation, every 7 days during freeze-free period.

Step 2) **Calculate the Minimum Acreage Required to Apply the Liquid Manure at the Hydraulic Loading Rate**

The following equation calculates the minimum acreage required to apply the liquid manure at the hydraulic loading rate. The liquid manure volume is obtained from the cost model. Table 4.10.1-7 presents the results of the hydraulic loading rate based on the acreage calculations.

Hydraulic Acres Required (acres) = Liquid Manure Volume (cf/yr) / Hydraulic Loading Rate (ft/yr) x Conversion (1 acre/43,560 sf)

Step 3) **Calculate the Minimum Acreage Required to Apply the Liquid Manure at the Liquid-Nutrient Loading Rate**

The following equation calculates the amount of liquid manure that can be applied per acre of cropland, accounting for the amount of nitrogen or phosphorus that can be used by the crops.

Liquid-Nutrient Acres Required (acres) = Total Volume of Liquid (cf/yr) × Nutrient Concentration in Liquid $_{AgWaste}$ (lb/cf)/ Crop Nutrient Requirements (lb/acre)

The crop nutrient requirements are the same as the values used to calculate the total available acreage, and vary by animal type and region. Nitrogen and phosphorus values for lagoon/pond water are fixed at 0.01249 lb/cf and 0.00359 lb/cf, respectively (USDA NRCS, 1996).

Table 4.10.1-7

Minimum Number of Acres Required to Apply All Liquid at the Hydraulic Loading Rate Under Option 2

Region	Animal Type	Farm Type	Size Class	Lagoon or Pond Liquid (cf/yr)	Hydraulic Loading Rate (ft/yr)	Area Required for Application (sf/yr)	Area Required for Application (acres/yr)
Central	Beef	Beef	Medium 1	118,477	1.54	76,913	1.77
			Medium 2	214,838	1.54	139,468	3.20
			Large 1	518,928	1.54	336,878	7.73
			Large 2	8,649,791	1.54	5,615,272	128.91
Mid-Atlantic	Beef	Beef	Medium 1	383,402	0.00	NC	NC
			Medium 2	695,235	0.00	NC	NC
			Large 1	1,679,299	0.00	NC	NC
			Large 2	27,991,506	0.00	NC	NC
Midwest	Beef	Beef	Medium 1	199,540	0.28	711,734	16.34
			Medium 2	361,832	0.28	1,290,612	29.63
			Large 1	873,984	0.28	3,117,396	71.57
			Large 2	14,568,070	0.28	51,962,543	1,192.90
Pacific	Beef	Beef	Medium 1	414,223	2.18	189,996	4.36
			Medium 2	751,125	2.18	344,526	7.91
			Large 1	1,814,298	2.18	832,182	19.10
			Large 2	30,241,750	2.18	13,871,287	318.44
South	Beef	Beef	Medium 1	455,913	1.50	304,425	6.99
			Medium 2	826,722	1.50	552,024	12.67
			Large 1	1,996,898	1.50	1,333,382	30.61
			Large 2	33,285,436	1.50	22,225,569	510.23

Table 4.10.1-7 (Continued)

Region	Animal Type	Farm Type	Size Class	Lagoon or Pond Liquid (cf/yr)	Hydraulic Loading Rate (ft/yr)	Area Required for Application (sf/yr)	Area Required for Application (acres/yr)
Central	Dairy	Flush	Medium 1	574,229	1.55	370,374	8.50
		Hose		51,664	1.55	33,323	0.76
		Flush	Medium 2	1,103,816	1.55	711,953	16.34
		Hose		79,755	1.55	51,442	1.18
		Flush	Large 1	2,843,910	1.55	1,834,301	42.11
		Hose		178,824	1.55	115,340	2.65
Mid-Atlantic	Dairy	Flush	Medium 1	622,389	0.00	NC	NC
		Hose		99,824	0.00	NC	NC
		Flush	Medium 2	1,198,086	0.00	NC	NC
		Hose		174,026	0.00	NC	NC
		Flush	Large 1	3,134,713	0.00	NC	NC
		Hose		469,627	0.00	NC	NC
Midwest	Dairy	Flush	Medium 1	588,965	1.46	403,302	9.26
		Hose		66,400	1.46	45,469	1.04
		Flush	Medium 2	1,132,661	1.46	775,606	17.81
		Hose		108,601	1.46	74,366	1.71
		Flush	Large 1	2,932,891	1.46	2,008,338	46.11
		Hose		267,805	1.46	183,383	4.21
Pacific	Dairy	Flush	Medium 1	627,992	2.18	288,048	6.61
		Hose		105,427	2.18	48,357	1.11
		Flush	Medium 2	1,209,054	2.18	554,571	12.73
		Hose		184,993	2.18	84,853	1.95
		Flush	Large 1	3,168,545	2.18	1,453,353	33.36
		Hose		503,459	2.18	230,927	5.30

Table 4.10.1-7 (Continued)

Region	Animal Type	Farm Type	Size Class	Lagoon or Pond Liquid (cf/yr)	Hydraulic Loading Rate (ft/yr)	Area Required for Application (sf/yr)	Area Required for Application (acres/yr)
South	Dairy	Flush	Medium 1	635,570	1.50	424,387	9.74
		Hose		113,006	1.50	75,457	1.73
		Flush	Medium 2	1,223,888	1.50	817,223	18.76
		Hose		199,828	1.50	133,430	3.06
		Flush	Large 1	3,214,307	1.50	2,146,278	49.27
		Hose		549,221	1.50	366,730	8.42
Central	Heifers	Heifers	Medium 1	74,048	1.54	48,070	1.10
			Medium 2	138,840	1.54	90,132	2.07
			Large 1	277,680	1.54	180,264	4.14
Mid-Atlantic	Heifers	Heifers	Medium 1	239,626	0.00	NC	NC
			Medium 2	449,299	0.00	NC	NC
			Large 1	898,597	0.00	NC	NC
Midwest	Heifers	Heifers	Medium 1	124,712	0.28	444,834	10.21
			Medium 2	233,836	0.28	834,064	19.15
			Large 1	467,671	0.28	1,668,128	38.29
Pacific	Heifers	Heifers	Medium 1	258,890	2.18	118,747	2.73
			Medium 2	485,418	2.18	222,651	5.11
			Large 1	970,836	2.18	445,303	10.22
South	Heifers	Heifers	Medium 1	284,946	1.50	190,266	4.37
			Medium 2	534,273	1.50	356,748	8.19
			Large 1	1,068,546	1.50	713,496	16.38

NC - Not calculated.

Table 4.10.1-8 presents the results of the liquid-nutrient loading rate based acreage calculations for Option 2 for beef feedlots, dairies, and heifer and veal operations.

Step 4: Compare the Acreage Required Under Hydraulic Loading and Liquid-Nutrient Loading Scenarios

The cost model uses the maximum number of acres calculated using hydraulic loading and liquid-nutrient loading to determine the number of acres needed to apply all liquid manure.

4.10.2 Swine and Poultry Operations

Please refer to Section 4.9.2 for information related to on-farm acreage available for manure application.

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5.0 TECHNOLOGY COST EQUATIONS

Technology cost equations calculate the direct capital and annual costs for installing, operating, and maintaining a particular technology or practice for an animal feeding operation. Each cost module determines an appropriate design of the system component based on the characteristics of the model farm and the specific regulatory option. Waste volumes generated in the wastewater, manure, and runoff input modules described in Section 4.0 are used to size equipment and properly estimate the direct capital costs for purchasing and installing equipment and annual operating and maintenance costs.

Estimates of capital and annual cost components are based on information collected from vendors, literary references, EPA site visits, and/or estimates based on engineering judgment. The following subsections describe each technology cost equation used as a basis for the regulatory options and specifically discuss the following:

- Description of the technology or practice;
- Design;
- Costs; and
- Results for component costs for the technology or practice.

Section 6 discusses the prevalence of the technology or practice in use at CAFOs. Appendix A contains output tables of capital and annual costs (in 1997 dollars) for each technology or practice component. Section 7.0 provides examples of how these component costs are used to calculate model farm costs.

5.1 Earthen Settling Basins

Earthen settling basins are used at animal feeding operations to remove manure solids, soil, and other solid materials from wastewater prior to storage (e.g., a pond) or further treatment (e.g., a lagoon). The cost model assumes that beef feedlots and heifer operations use earthen basins to collect runoff. Because high wastewater flows from flushing operations could cause erosion in an earthen basin, dairies and veal operations use concrete settling basins

(discussed in Section 5.2) to collect barn and milking parlor wastewater. The cost model includes costs for an earthen settling basin for beef feedlots and heifer operations for all regulatory options.

5.1.1 Technology Description

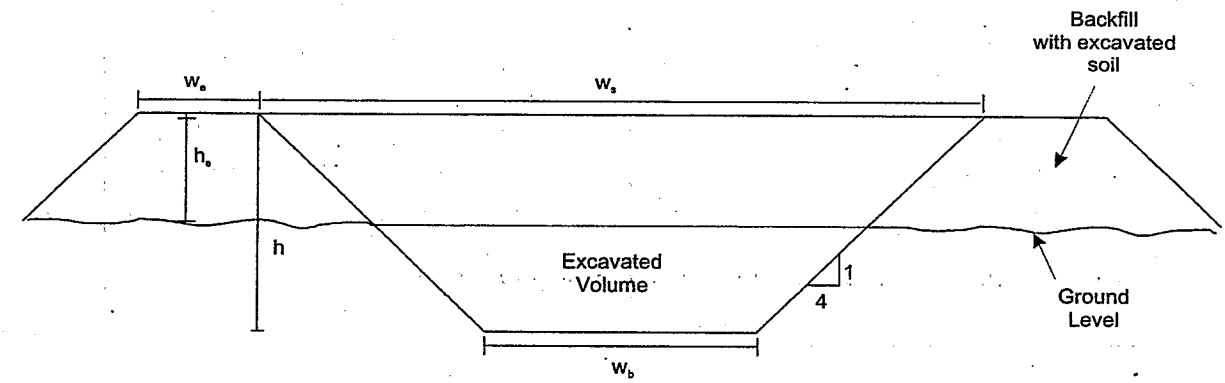
An earthen basin is a shallow basin that is designed to accumulate solids. The cost model assumes that earthen basins receive runoff from beef feedlots and heifer operations. The basin allows solids to settle and liquids to drain. Generally, the basin is designed to handle a wastewater flow velocity less than 1.5 feet per second, which is slow enough to allow solids to settle. Periodic removal of the accumulated solids is necessary; therefore, access to the earthen basin must be provided for a front-end loader or tractor. (The costs for periodic solids removal are included in the annual costs, which are presented as a percentage of the total capital costs.)

5.1.2 Design

Earthen basins are designed to capture runoff from the beef feedlot and are rectangular in shape. The four sides are sloped at a 4:1 (horizontal:vertical) ratio to prevent erosion and allow for front-end-loader access to remove solids. Earthen basins are constructed of soils that have a significant clay content (usually at least 10 percent). Figure 5.1.2-1 presents a cross-section of the basin.

The earthen basin is constructed by excavating part of the volume required and building embankments to construct the remaining basin volume. The variables in Figure 5.1.2-1 are defined as follows:

h_e	=	height of embankment
h	=	height (depth) of basin
w_e	=	width of embankment
w_b	=	width at bottom of basin
w_s	=	width at surface of basin
l_b	=	length at bottom of basin
l_s	=	length at surface of basin.



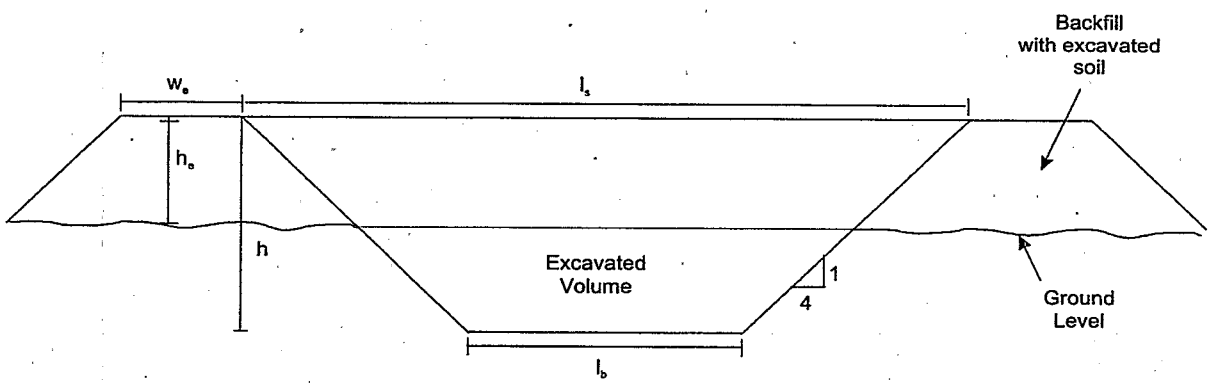


Figure 5.1.2-1. Cross-Section of an Earthen Basin

Table 5.1.2-1 summarizes the default design criteria used in the cost model.

Table 5.1.2-1

Design Parameters for Earthen Basins

Parameter	Value
Total height (depth) required (h)	4 feet
Side slopes (horizonal:vertical) (s)	4:1
Bottom width (w_b)	12 feet
Width of embankment (w_e)	6 feet

Source: Midwest Plan Service Structures and Environment Handbook, 1987.(MWPS, 1987)

The remainder of this subsection describes the methods used to calculate the earthen basin influent and effluent flows, volume, other dimensions, and excavation and embankment volumes, as listed on Figure 5.1.2-1.

Earthen Basin Influent and Effluent Flows

The design volume of the earthen basin is based on the peak runoff entering the basin, which is set equal to the peak runoff from a 10-year,1-hour rainfall event under all regulatory options. Section 4.7 describes the details of the runoff calculation. In addition, it is assumed that runoff contains 1.5 percent solids (MWPS, 1993). EPA assumes that all of the solids from the drylot are manure solids. Using these assumptions, the total amount of water and solids entering the earthen basin are calculated as follows:

$$\text{Water Entering, cubic feet} = (\text{Peak}) \times (1 - 0.015)$$

$$\text{Solids Entering, cubic feet} = (\text{Peak}) \times (0.015)$$

where:

Peak = Peak runoff during 10-year,1-hour storm event (cubic feet).

The cost model assumes that earthen basins have a settling efficiency of 50 percent, and the moisture content of the settled solids is 80 percent (Fulhage, C.D. and D.L. Pfost, 1995). The amounts of water and solids in the settled solids and basin effluent are calculated from the following equations:

$$\text{Settled Solids, cubic feet} = \text{Solids Entering} \times 0.5$$

$$\text{Water in Settled Solids, cubic feet} = \text{Settled Solids} \times \left[\frac{0.8}{(1-0.8)}\right]$$

$$\text{Solids Exiting, cubic feet} = \text{Solids Entering} - \text{Settled Solids}$$

$$\text{Water Exiting, cubic feet} = \text{Water Entering} - \text{Water in Settled Solids}$$

The above equations are used to calculate the amount of solids and water that leave the earthen basin and enter a storage pond (see Section 5.5), not the volume of the basin.

Earthen Basin Volume

The required volume of the basin is calculated from the following equation (MWPS, 1987):

$$\text{Volume}_{basin} = \text{Surface Area} \times h$$

where:

Surface Area	=	Peak ÷ 4
h	=	Basin depth (Table 5.1.2-1 value).

Because solids from the basin are removed frequently to prevent significant accumulation, the cost model does not include accumulated solids in the volume calculations. Table 5.1.2-2 summarizes the earthen basin design volumes calculated for all regulatory options by model farm.

Table 5.1.2-2

Earthen Basin Volume by Model Farm for All Regulatory Options

Animal Type	Size Class	Earthen Basin Volume (ft^3) by Region				
		Central	Mid-Atlantic	Midwest	Pacific	South
Beef	Medium 1	777	3,399	3,159	2,196	5,565
	Medium 2	1,367	5,297	4,923	3,506	8,505
	Medium 3	2,036	7,516	7,008	5,029	11,979
	Large 1	5,511	18,635	17,459	12,675	29,381
	Large 2	83,534	268,341	251,528	184,330	419,522
Heifer	Medium 1	777	3,453	3,212	2,250	5,645
	Medium 2	1,474	5,645	5,244	3,747	9,066
	Medium 3	2,223	8,077	7,543	5,404	12,862
	Large 1	4,121	14,145	13,236	9,600	22,351

NA - Not applicable. No regulatory options include this component for this model farm.

Earthen Basin Dimensions

The cost model assumes that the earthen basin has four sloped sides with a rectangular base. To determine the dimensions of the basin, the design volume of the basin from Table 5.1.2-2 is used with the design parameters shown in Table 5.1.2-1. The following equation is used to determine the length of the basin:

$$Volume_{basin} = \frac{1}{2} h \left[A_1 + A_2 + (A_1 A_2)^{0.5}\right]$$

$$Volume_{basin} = \frac{1}{2} h \left[l_b w_b + l_s w_s + (l_b w_b l_s w_s)^{0.5}\right]$$

where:

A_1 = Area of the bottom base $= l_b w_b$
A_2 = Area of the top (surface area) $= l_s w_s$.

Earthen Basin Floor Surface Area

The surface area of the floor of the basin is calculated to determine the area for compaction. The surface area includes the bottom area plus the area of the four trapezoids that make up the sides of the basin. Figure 5.1.2-2 depicts the surfaces of the sloped sides.

The surface area of the sloped sides is calculated using the formula for the area of a trapezoid.

$$\text{Area of Side} = \tfrac{1}{2}\, HS\, (a + b)$$

where:

HS	=	Height of the side (see equation below)
a	=	Bottom width (l_b or w_b)
b	=	Top width (l_s or w_s).

The height of the side is calculated using the Pythagorean Theorem:

$$HS = (h^2 + (4h)^2)^{0.5}$$

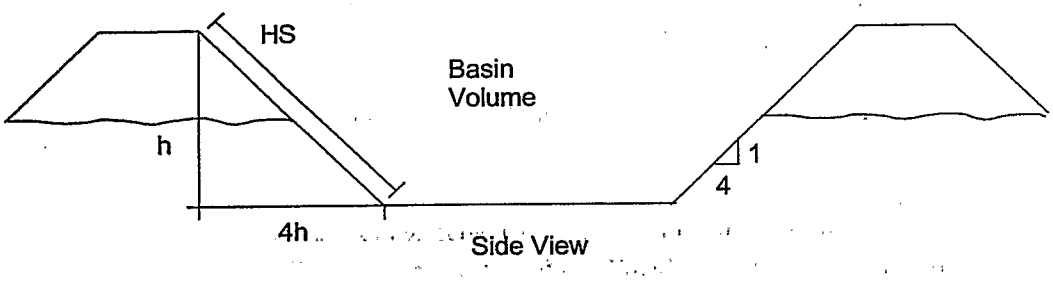
The total surface area of the basin is:

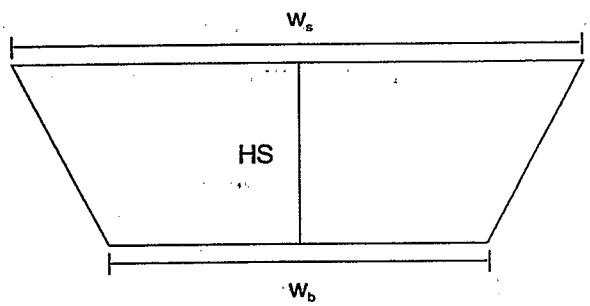
$$\text{Surface Area}_{basin} = l_b w_b + 2\,[0.5 \times HS\,(l_b + l_s)\,] + 2\,[0.5 \times HS\,(w_b + w_s)]$$

Earthen Basin Excavation and Embankment Volumes

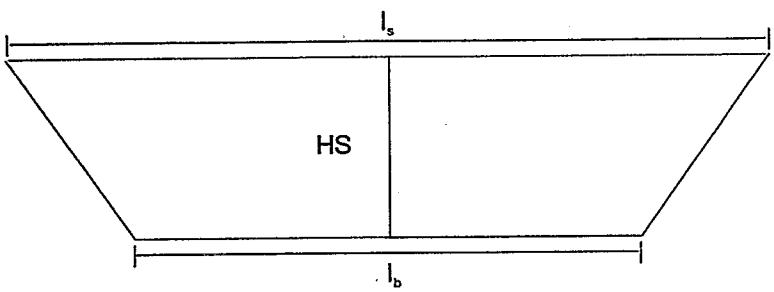
Earthen basins are constructed by excavating a portion of the necessary volume and building embankments around the perimeter of the basin to make up the total design volume. The cost model performs an iteration to maximize the use of excavated material used in constructing the embankments that minimizes the costs for construction. The excavation volume is represented by the following equation:

$$Vol_{excavated} = 0.5\,(h\text{-}h_e)\,[l_b w_b + l_s w_s + (l_b w_b l_s w_s)^{0.5}]$$





Surface of Sloped Side



Surface of Sloped Side

Figure 5.1.2-2. Sloped Sides of Earthen Basin

The excavated soil is used to build the embankments. Because the soil will settle somewhat, the cost model assumes that an extra 5 percent of volume is required. The embankment volume is represented by the following equation:

$$Vol_{embankment} = 2\,[(1.05\,h_e w_e + s\,(1.05\,h_e)^2)\,(l_b + 2\,sh)] + 2\,[(1.05\,h_e w_e + (1.05\,s)^2\,h_e^2)\,(w + 2sh)]$$

The cost model calculates the dimensions of the basin that yields the desired volume.

5.1.3 Costs

Capital costs to construct and install the earthen basin consist of mobilization, excavation, and compaction. Table 5.1.3-1 lists the unit costs for each of these elements.

Table 5.1.3-1

Unit Costs for Earthen Basins

Unit	Cost (1997 dollars)	Source[a]
Backhoe mobilization	$204.82/event	Means, 1999 (022 274 0020)
Excavation	$2.02/yd^3	Means, 1999 (022 238 0200)
Compaction	$0.41/yd^3	Means, 1996 (022 226 5720)

[a]Information taken from Means Construction Data. The numbers in parentheses refer to the division number and line number.

The excavation cost is calculated using the following equation:

$$\text{Excavation Cost (\$)} = \text{Excavation Unit Costs (\$ / yd}^3) \times \frac{\text{Volume}_{excavated}\ (ft^3)}{27\ (ft^3 / yd^3)}$$

The total volume of soil that is compacted includes the surface area times a 1-foot compaction depth plus the entire volume of the embankment because it is compacted as placed.

$$Volume_{compacted}\ (ft^3) = [Surface\ Area_{basin}\ (ft^2) \times 1\ ft] + Volume_{embankment}\ (ft^3)$$

$$\text{Compaction Cost (\$)} = \text{Compaction Unit Costs (\$ / yd}^3\text{)} \times \frac{\text{Volume}_{\text{compacted}}\ (\text{ft}^3)}{27\ (\text{ft}^3 / \text{yd}^3)}$$

Total Capital Costs

The total capital cost for the earthen basin is calculated using the following equation:

$$\text{Capital Cost} = \text{Mobilization Cost} + \text{Excavation Cost} + \text{Compaction Cost}$$

Total Annual Costs

Based on best professional judgement, it is estimated that annual operating and maintenance costs are 5 percent of the total capital costs.

$$\text{Annual Cost} = 0.05 \times (\text{Capital Cost})$$

5.1.4 Results

Appendix A, Table A-1 presents the cost model results for constructing an earthen basin.

5.2 Concrete Settling Basins

Concrete settling basins, also called concrete sedimentation basins, are used at animal feeding operations to remove manure solids, soil, and other solid materials from wastewater prior to storage (e.g., a pond) or further treatment (e.g., a lagoon). Dairies use solids separation to increase the storage volume available for wastewater in lagoons or to reduce the moisture content of the waste to make it more suitable for transport, disposal, composting, and other uses, such as bedding materials. The cost model includes concrete settling basins in all options for dairies to collect barn and milking parlor wastewater because the higher wastewater

flows characteristic of dairies could cause significant erosion in an earthen basin. Concrete settling basins were not included in the cost analysis for beef feedlots, heifer operations, swine operations, or poultry operations.

5.2.1 Technology Description

The settling basin is a shallow basin or pond that is designed to accumulate solids. The purpose of a settling basin is to slow wastewater flow sufficiently to allow solids to settle and liquids to drain. In general, reducing the flow velocity to less than 1.5 feet per second is enough to allow solids to settle. Access to the settling basin must be provided for periodic removal of solids. Solids separators can have a solids separation efficiency of between 30 percent (for mechanical separators) and 60 percent (gravity settling basins) (Fulhage, C. D. and D.L. Pfost, 1995). EPA estimated that most solids separators used in this industry are gravity settling basins, and used a settling efficiency of 50 percent.

Settling basins may be constructed from a variety of materials, including concrete. Concrete construction offers the advantage of added durability and stability of side slopes. Also, concrete construction facilitates the removal of solids with heavy equipment such as a front-end loader, which may drive onto a concrete settling basin floor. A concrete basin design is also advantageous in areas where soils are not suitable for earthen construction (e.g., areas where soils have a high sand content). Concrete basins are preferable to earthen basins to prevent erosion when high-velocity wastewater flows are anticipated, such as at flush dairies.

5.2.2 Design

Wastes entering the concrete settling basin include manure from the mature dairy cows, wastewater from the milk parlor, and flush or hose water from the freestall barns. A settling basin is designed to handle peak wastewater flows (NRAES, 1989); for a dairy operation, the peak flows are assumed to occur during the flushing of one freestall barn. Settling basin size depends upon the surface loading rate (i.e., the hydraulic load per unit of basin surface area) for

agricultural wastewater; basin depth may be adjusted to allow for solids accumulation. It is assumed that wastewater flows to the settling basin via gravity.

The concrete settling basin design consists of a rectangular basin with a sloped ramp for front-end loader access (see Figure 5.2.2-1). The basin is 3 feet deep, allowing for 1 foot of solids accumulation. Rectangular concrete basins are typically designed with a 3:1 length-to-width ratio (NRAES, 1989). The sloped access ramp forms one side of the basin; however, it is longer than the other sides to allow the basin to have sufficient volume. The access ramp is sloped 1 inch fall per 1 foot run (MWPS, 1987). The concrete thickness is 6 inches (USDA NRCS, 1995). The sub-base for the concrete floor and access ramp consists of 6 inches of compacted gravel fill and 4 inches of graded sand fill. The concrete is shaped with wooden forms and reinforced with steel (#4 bars).

Concrete Basin Volume and Surface Area

The required area and volume of the basin are calculated from the Midwest Plan Service (MWPS, 1987) formulas below:

$$\text{Surface Area}_{basin} = \text{Peak} \div 4$$

$$\text{Volume}_{basin} = \text{Surface Area} \times h$$

where:

h = Basin depth = 3 ft (Recommended depth is 2 feet plus depth required for solids storage. Depth of solids should not exceed 1.5 feet; therefore, EPA assumes 1 foot.) (Fulhage, C. D. and D.L. Pfost, 1995).

Peak = Flow from flushing of confinement barn.

Using the Pythagorean Theorem,

$$\text{Ramp Length} = (h^2 + \text{Run}^2)^{½}$$

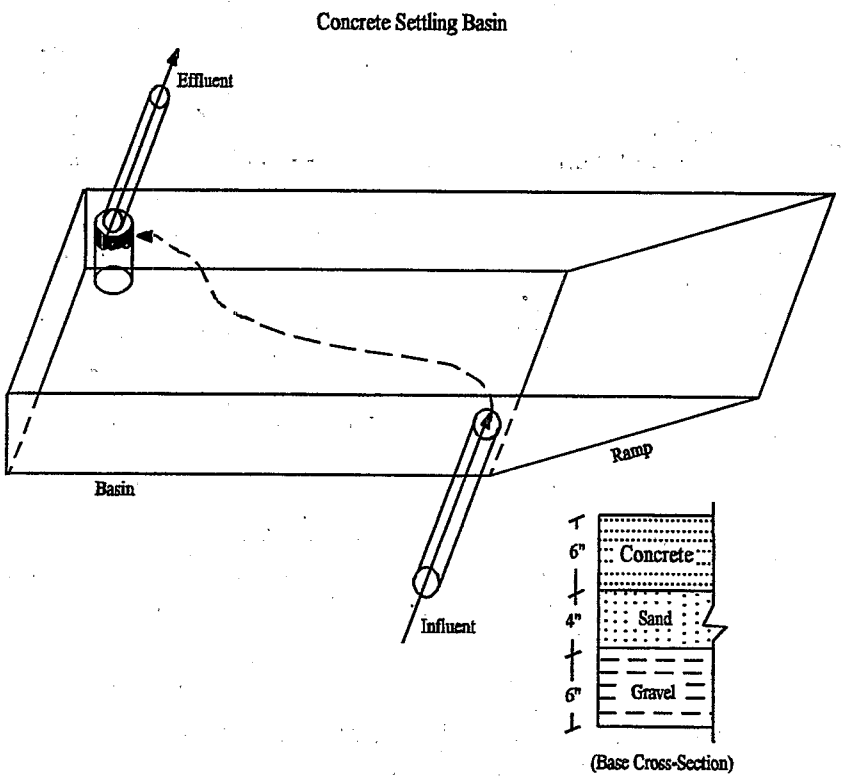


Figure 5.2.2-1. Concrete Settling Design

where:

Run	=	h × 12 in/ft × (1 ft run ÷ 1 in fall)
Surface Area of Ramp	=	Ramp Length × Basin Width
Volume Along Access Ramp	=	0.5 Fall × Run × Basin Width.

Additional basin length is needed to account for the slope of ramp.

$$\text{Length} = 0.5 \times \text{Run}$$

$$\text{Length}_{\text{settling basin}} \text{ (including access ramp)} = \text{Theoretical Length} + \text{Additional Length}$$

$$\text{Length}_{\text{settling basin}} \text{ (excluding access ramp)} = \text{Length of Basin} - \text{Run}$$

Table 5.2.2-1 summarizes of the concrete basin volumes calculated for flush and hose dairies by size group. Note that the basin design does not vary by region or regulatory option.

Table 5.2.2-1

Concrete Basin Volume by Model Farm for All Regulatory Options

Animal Type	Size Class	Concrete Basin Volume (ft^3)
Dairy - Flush	Medium 1	7,520
	Medium 2	12,784
	Medium 3	18,048
	Large 1	43,014
Dairy - Hose	Medium 1	416
	Medium 2	515
	Medium 3	614
	Large 1	825

5.2.3 Costs

The capital costs to construct and install the concrete settling basin include mobilizing the backhoe used for excavation, excavating soil, compacting the ground surface, hauling gravel and sand to the lot, purchasing the gravel and sand, grading the sand, the form work, reinforcement, and concrete for the walls, slab (including reinforcement), and finishing the slab. Table 5.2.3-1 presents the unit costs for each of these components.

Table 5.2.3-1

Unit Costs for Concrete Settling Basin

Unit	Cost (1997 dollars)	Source[a]
Backhoe mobilization	$204.82/event	Means 1999 (022 274 0020)
Excavating	$2.02/yd^3	Means 1999 (022 238 0200)
Hauling of material	$4.95/yd^3	Means 1996 (022 266 0040)
Compaction	$0.41/yd^3	Means 1996 (022 226 5720)
Gravel fill (6")	$9.56/yd^3	Means 1998 (022 308 0100)
Sand fill	$48.55/yd^3	Richardson 1996 (3-5 p1)
Grading sand	$1.73/ft^3	Means 1999 (025 122 1100)
Wall form work	$4.90/ft^2	Building news 1998 (03110.65)
Wall reinforcement bars	$0.45/ft	Richardson 1996 (3-5 p9)
Ready mix concrete	$63.70/yd^3	Means 1998 (033 126 0200)
Slab on grade	$116.29/yd^3	Means 1999 (033 130 4700)
Finishing slab (concrete)	$0.33/ft^2	Means 1999 (033 454 0010)

[a]For Means Construction Data, the numbers in parentheses refer to the division number and line number.

Mobilization

The mobilization costs are a fee per event (i.e., fee to mobilize all equipment on site). These costs are for moving the appropriate heavy machinery and equipment.

Excavation

The excavation cost is calculated from the following equations:

$$\text{Volume}_{\text{excavated}} = \text{Volume}_{\text{basin}} + \text{Volume}_{\text{ramp}} + \text{Volume}_{\text{subsurface}}$$

$$\text{Excavation Cost} = \text{Excavation Unit Costs (\$ / yd3)} \times \frac{\text{Volume}_{\text{excavated}}\ \text{(ft3)}}{27\ \text{ft}^3 / \text{yd}^3}$$

Compaction

The total volume to be compacted includes the surface area of the basin and the ramp times a 1-foot compaction depth.

$$\text{Volume}_{\text{compacted}} = [\text{Surface Area}_{\text{basin}}\ (\text{ft}^2) + \text{Surface Area}_{\text{ramp}}\ (\text{ft}^2)] \times 1\ \text{ft}$$

Hauling

The total volume of gravel and sand needed is equal to the volume underneath the settling basin and the ramp.

$$\text{Volume}_{\text{gravel}}\ (\text{yd}^3) = [\text{Surface Area}_{\text{basin}}\ (\text{ft}^2) + \text{Surface Area Ramp}\ (\text{ft}^2)] \times 0.5\ \text{ft} \times \left(\frac{1\ \text{yd}^3}{27\ \text{ft}^3}\right)$$

$$\text{Volume}_{\text{sand}}\ (\text{yd}^3) = [\text{Surface Area}_{\text{basin}}\ (\text{ft}^2) + \text{Surface Area Ramp}\ (\text{ft}^2)] \times 0.33\ \text{ft} \times \left(\frac{1\ \text{yd}^3}{27\ \text{ft}^3}\right)$$

The volume of the material to be hauled includes the sand plus the gravel.

Reinforcement

The concrete wall form work is calculated as follows:

$$\text{Area}_{\text{wall forms}} = \text{Area}_{\text{settling basin}} + \text{Area}_{\text{basin end}} + \text{Area}_{\text{ramp sides}}$$

Assuming that reinforcements are spaced every 12 inches along the length and width of the basin, the total length of reinforcement is calculated as follows:

$$\text{Length}_{\text{reinforcement}} = 2 \text{ bars/ft} \times [\text{Surface Area}_{\text{basin}} + \text{Surface Area}_{\text{ramp}}]$$

The concrete volume for the walls and slab are calculated as follows:

$$\text{Volume}_{\text{concrete}} = \text{Area}_{\text{wall forms}} \times \text{Concrete Thickness}$$

$$\text{Volume}_{\text{concrete slab}} = [\text{Area}_{\text{floor}} + \text{Area}_{\text{ramp}}] \times \text{Concrete Depth}$$

The area of concrete to be finished is:

$$\text{Area}_{\text{concrete}} = [\text{Area}_{\text{floor}} + \text{Area}_{\text{ramp}}]$$

Total Capital Costs

The cost for construction of the concrete settling basin is calculated by summing the components above and multiplying them by the unit costs listed in Table 5.2.3-1. The total capital cost is:

Capital Cost = Mobilization + Excavation + Compaction + Hauling (sand and gravel) + Gravel Fill + Sand Fill + Grading Sand + Walls (form work, reinforcement, concrete) + Concrete Slab + Slab Finishing

Total Annual Costs

Based on best professional judgement, it is assumed that annual operating and maintenance costs are 5 percent of the total capital costs.

$$\text{Annual Cost} = 0.05 \times (\text{Capital Cost})$$

5.2.4 Results

Appendix A, Table A-2 presents the cost model results for constructing a concrete gravity settling basin.

5.3 Berms

Beef feedlots, dairies, heifer, and swine and dry poultry operations use berms to contain stormwater runoff and process water that fall within the animal handling and feeding areas and to divert clean stormwater that falls outside these areas. Because the handling and feeding areas contain manure, runoff from these areas needs to be contained and diverted to a waste management storage facility (e.g., a lagoon or a pond). Berms surrounding the handling and feeding area act as a physical barrier between the containment area and adjacent "clean" land. Berms are costed for all beef feedlots, heifer operations, and dairies for all regulatory options, but not costed for veal operations because they are assumed to be indoor operations.

Stormwater is diverted around poultry and swine storage structures by constructing berms on two adjacent sides up-gradient from the storage facility or lagoon. Berms are not included in the cost analysis for swine operations with pit systems.

5.3.1 Technology Description

Berms are earthen structures that divert clean runoff away from pollutant sources and channel runoff that falls within the area containing pollutant sources. Runoff that falls within

the containment area at beef and dairy operations may become contaminated from contact with animal feed and fecal matter deposited in the feedlot or handling area. This runoff is channeled by the berms to a waste management storage facility (e.g., a pond or lagoon).

5.3.2 Design

The design of a berm system for a specific operation depends on the size of the outdoor feedlot area, lagoon, or dry waste storage area. The feedlot area is dependent upon the number of animals contained on drylots at the facility.

Beef Feedlots and Dairies

The cost model assumes for beef feedlots and dairies that berms are constructed as a 3-foot-high, 6-foot-wide compacted soil mound that surrounds the feedlot and animal handling areas. EPA assumes the feed storage area is part of the animal handling areas. Figure 5.3.2-1 depicts the cross-section of the berm assumed for this cost model.

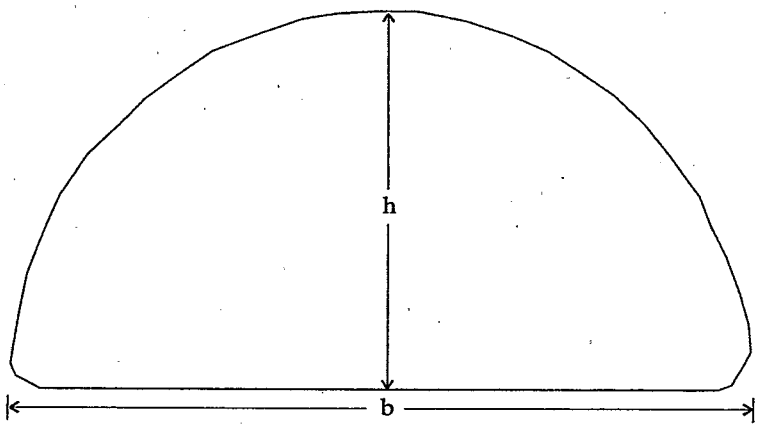


Figure 5.3.2-1. Cross-Section of Berm

The area of the cross-section of the berm is calculated using the following equation:

$$Area_{berm} = \frac{2}{3} \times b \times h$$

where:

b = Base width (6 feet)
h = Total height (3 feet).

The total length of the berm system for beef feedlots and dairies varies according to the size of the feedlot area. The area required for each animal varies by animal type, because different sized animals require a different amount of space. Table 5.3.2-1 provides the recommended area per animal for a drylot, not including handling and storage areas. The beef and dairy cost model calculated the average area per animal on a drylot using the ranges presented in Table 5.3.2-1, and added 15 percent for handling areas (AEA, 1999).

Table 5.3.2-1

Space Requirements Assumed for Animals Housed on Drylots[a]

Animal Type	Drylot Area (ft^2/animal)	Handling Area (ft^2/animal)	Total Area (ft^2/animal)
Beef cattle	400	60	460
Mature dairy cows	400	60	460
Heifers	375	56	431
Calves	225	34	259

[a]Source: MWPS, 1993; AEA, 1999.

The total perimeter of the berm is calculated as follows:

$$L = 4 \times (Area_{feedlot} \times Head)^{0.5}$$

where:

L = Total perimeter (length of four sides of a square area) (feet)
$Area_{feedlot}$ = Total area of drylot and handling areas per animal (ft^2) (Table 5.3.2-1 value)
Head = Average Head (Table 4.3.1-1 value).

Table 5.3.2-2 summarizes the perimeters of the berm calculated for all model farms. Note that the berm design does not vary by region or regulatory option.

Swine and Poultry Operations

For swine and poultry operations, berms were constructed in accordance with the standards of the American Society of Agricultural Engineers (ASAE, 1998). ASAE specifies a berm with a 1-foot top width, a height of 3 feet, and a 2:1 side slope. Assuming a trapezoidal shape, the berm cross-sectional area is determined by:

$$Area_{berm} = \frac{1}{2} \times H_{berm} \times (W_{bermbot} + W_{bermtop})$$

where:

H_{berm} = height of berm
$W_{bermbot}$ = width of berm bottom
$W_{bermtop}$ = width of berm top.

Table 5.3.2-2

Berm Perimeter by Beef and Dairy Model Farm for All Regulatory Options

Animal Type	Size Class	Berm Perimeter (ft)
Beef	Medium 1	1,650
	Medium 2	2,016
	Medium 3	2,374
	Large 1	3,679
	Large 2	13,806
Heifers	Medium 1	1,661
	Medium 2	2,077
	Medium 3	2,457
	Large 1	3,217
Dairy (Heifers and Calves)	Medium 1	910
	Medium 2	1,186
	Medium 3	1,410
	Large 1	2,176

With a side slope of 2:1 (H:V), a height of 3 feet (H_{berm}), and a top width of 1 foot ($W_{bermtop}$), the bottom width ($W_{bermbot}$) is 13 feet, and the cross-sectional area ($Area_{berm}$) is 21 square feet. The cross-sectional area is then multiplied by berm length (L_{berm}) to obtain cubic yardage for construction. Berm length is determined by the dimensions of the solid or liquid storage structure.

For solid poultry waste, the berm length is calculated from the dimensions of the litter storage shed (see 5.14). Shed width is assumed to be 68 feet and shed length is the same as the length of the litter stack. For liquid storage systems, lagoons or evaporative ponds, berm length is determined after a subroutine is executed to determine the lagoon or evaporative pond dimensions (see 5.4.5). Lagoons and evaporative ponds are assumed to be square, and berm length is calculated from the top width of these structures.

The two adjoining berms for swine and poultry operations are designed to extend 10 feet beyond each of two adjacent sides of the storage structure. The berms meet to form a corner, but since the berms are 13 feet wide at the base, there is substantial overlap at the corner. Based on a mathematical analysis of the extent of this overlap, it was determined that berm length should be calculated in the following manner to adjust for the overlap:

For lagoons and evaporative ponds: $L_{berm} = (2 \times W_{lagoontop} + 30)$

For solid storage structures: $L_{berm} = (Volume_{stack}/320 + 98)$

where:

$W_{lagoontop}$	=	Width of top of lagoon or evaporative pond
$Volume_{stack}$	=	Volume of litter stack
320	=	The cross-sectional area of the litter stack.

A more detailed discussion of berm and other calculations used for swine and poultry operations can be found in *Swine and Poultry Cost Model QA/QC Report* (Tetra Tech, 2002).

5.3.3 Costs

To construct the berm, the volume of material to construct the berm is excavated along the perimeter of the containment area. The excavated soil is mounded to form the berm and the soil is compacted. Table 5.3.3-1 presents unit costs for constructing the berm. A fixed earth moving cost of $2.60 per cubic yard was used in the calculation of similar expenses for berms at swine and poultry operations.

Table 5.3.3-1

Unit Costs for Constructing Berms

Unit	Cost (1997 Dollars)	Source[a]
Compaction	$0.41/yd^3	Means, 1996 (022 226 5720)
Excavation	$2.02/yd^3	Means, 1999 (022 238 0200)

[a]Information taken from Means Construction Data. The numbers in parentheses refer to the division number and line number. Different years were selected for the different components based on consultation with industry experts and best professional judgement.

The total volume of the berm for beef feedlots and dairies is calculated using the following equation:

$$\text{Volume}_{\text{berm system}} = \text{Area}_{\text{berm}} \times L \times 1.25 \times 1.05$$

where:

$\text{Area}_{\text{berm}}$	=	Cross-sectional area of berm (square feet)
L	=	Total length of berm around containment area (feet)
1.25	=	Factor accounting for volumetric expansion on soil for cut/fill (AEA, 1999)
1.05	=	Factor accounting for 5% settling after compaction.

$$\text{Compact Cost} = \frac{\$0.41/\text{yd}^3 \times \text{Volume}}{27\ \text{ft}^3/\text{yd}^3}$$

$$\text{Excavation Cost} = \frac{\$2.02/\text{yd}^3 \times \text{Volume}}{27\ \text{ft}^3/\text{yd}^3}$$

The volume of berms for swine and poultry operations is calculated using the following equation:

$$\text{Volume}_{berm} = \text{Area}_{berm} \times L_{berm}$$

With a cross-sectional area of 21 square feet, berm volume is:

$$\text{Volume}_{berm} = 21 \times L_{berm}$$

Total Capital Cost

The total capital cost for beef feedlots and dairies, therefore, is $2.43 per cubic yard of berm. To convert this cost to a cost per foot, the volume is divided by the berm area, taking into account the factors for expansion and settling as follows:

$$\text{Capital Cost} = \text{Cost / Linear Foot} = \frac{\$2.43/\text{yd}^3 \times \frac{2}{3} \times 6 \times 3 \times 1.25 \times 1.05}{27\ \text{ft}^3/\text{yd}^3} = \$1.41/\text{ft}$$

The cost of $1.41 per linear foot of berm is the cost included in the cost model.

A fixed earth moving cost of $2.60 per cubic yard was used to calculate the cost of berms for swine and poultry operations. This fixed cost was multiplied by the berm volume to determine total capital cost using the following equation:

$$\text{Capital Cost} = \text{Volume}_{berm}/27 \times 2.60$$

where the 27 converts volume from cubic feet to cubic yards.

Total Annual Costs

Based on best professional judgement, the total annual cost for berm maintenance is estimated at 2 percent of the total capital costs for all animal types.

$$\text{Annual Cost} = 0.02 \times (\text{Capital Cost})$$

5.3.4 Results

Appendix A, Table A-3 presents the cost model results for constructing and maintaining berms.

5.4 Lagoons

Anaerobic lagoons are used at dairies and veal, wet layer, and swine operations to collect process water and flush water, which contain manure waste. Anaerobic microbiological processes promote decomposition, thus providing treatment for wastes with high biochemical oxygen demand (BOD), such as animal waste. Manure, process water, and runoff are routed to the lagoon where the mixture undergoes treatment. New lagoons also provide storage capacity until the waste can be applied to cropland as fertilizer or irrigation water, or be transported off site. Section 5.9 discusses the costs associated with transporting waste off site, including solids and liquids.

Lagoons are included in all options for dairies and veal operations, except Option 6 which replaces the lagoon with an anaerobic digester and a pond for large dairies. Options 1, 2, 4, 5A, and 6 require zero discharge of manure, litter, or process wastewater pollutants from the production area with the exception of overflows from a facility designed to hold all process wastewater, including the direct precipitation and runoff from a 25-year, 24-hour rainfall event. CAFOs that already have storage in place are assumed to have sufficient capacity. Under Options 1, 2, and 4, CAFOs that have no storage on site are costed for the installation of naturally lined lagoons with 180 days of storage. Under Option 7, CAFOs are costed for the installation of

naturally lined lagoons with a storage capacity that varies based on land application timing restrictions. For Options 3A/3B and 3C/3D, CAFOs expected to have a direct hydrologic connection from ground water to surface water are costed for the installation of anaerobic lagoons with an artificial liner to prevent seepage of wastewater into ground water.

Lagoons are assumed as part of the baseline scenario for wet layer operations and some swine operations with liquid-based systems. Other swine operations have pit storage or evaporative pond systems under baseline conditions, and all other poultry operations have solid-based manure management systems. Thus, lagoon construction is generally not included as a cost for swine and poultry operations, with five exceptions. Under Option 1A, increased storage is provided to handle chronic rainfall at wet layer operations and at swine operations with liquid or evaporative pond systems. Increased storage is provided for all swine facilities under Option 7, and secondary lagoons are included as part of the cost to recycle flush water at Category 2 liquid swine operations for all but Option 5. The cost model also includes construction of new, lined and covered anaerobic lagoons under Option 5 for swine operations currently using evaporative ponds. This alternative is less expensive than covering the evaporative ponds. In addition, secondary lagoons with storage for 20 days are constructed in conjunction with liner installation for liquid and evaporative pond systems.

5.4.1 Technology Description

Anaerobic lagoons provide storage for animal wastes while decomposing and liquefying manure solids. Anaerobic processes degrade high biochemical oxygen demand (BOD) wastes into stable end products without the use of free oxygen. Nondegradable solids settle to the bottom as sludge, which is periodically removed. The liquid is applied to on-site cropland as fertilizer or irrigation water, or it is transported off site. The sludge can also be land applied as a fertilizer and soil amendment. Anaerobic lagoons can handle high pollutant loading rates while minimizing manure odors. Properly managed lagoons have a musty odor.

Lagoons reduce the concentrations of both nitrogen and phosphorus in the liquid effluent. Phosphorus settles to the bottom of the lagoon and is removed with the lagoon sludge. Influent nitrogen is reduced through volatilization to ammonia.

Anaerobic lagoons are typically at least 6 to 10 feet in depth, although 8 to 20 foot depths are not unusual. Deeper lagoons typically have a smaller surface area to depth ratio, allow less area for volatilization, provide a more thorough mixing of lagoon contents by rising gas bubbles, and minimize odors.

Anaerobic lagoons offer several advantages over other methods of storage and treatment. Anaerobic lagoons can handle high loading rates and provide a large volume for long-term storage of liquid wastes. Lagoons treat the manure by reducing nitrogen and phosphorus in the effluent and allow manure to be handled as a liquid. Lagoons are typically located at a lower elevation than the animal barns; gravity is used to transport the waste to the lagoon, which minimizes labor.

Anaerobic lagoons are appropriate for use at operations that collect high BOD waste, such as milking parlor flush or hose water and flush barn water. Typically, dairies and veal operations operate in this manner and have lagoons for wastewater storage. The cost model assumes all dairies and veal operations use anaerobic lagoons, some swine and poultry operations require a lagoon, and beef feedlot and heifer operations use a storage pond (discussed in Section 5.5). The cost model also assumes that swine operations use either pit (Mid-Atlantic and Midwest regions), anaerobic lagoon (Mid-Atlantic and Midwest regions), or evaporative pond systems (Central region), while all wet layer operations use anaerobic lagoons. Broiler, turkey, and dry layer operations are assumed to not use anaerobic lagoons.

Based on site visits, EPA assumes all veal operations have sufficient storage, such as lagoons, currently in place. However, not all dairies are expected to have liquid storage currently in place. In addition, naturally lined lagoons are more prevalent at dairies and veal operations than synthetically lined lagoons. Section 6 provides EPA's estimates of the percentage of dairies and veal operations that would require the installation of a lagoon, a lagoon with a liner

(for Options 3A/3B and 3C/3D), or a lagoon with additional capacity under Option 7. Also contained in Section 6.0 are EPA's estimates of the percentage of swine and wet layer operations that would require increased storage under Option 1A, liners under Options 3B and 3C, and increased storage for swine facilities under Option 7.

5.4.2 Design of Anaerobic Lagoons at Dairies and Veal Operations

The design of anaerobic lagoons for dairies and veal operations is described below. Considerations specific to the design of anaerobic lagoons and evaporative ponds for swine and poultry operations are discussed in Section 5.4.5.

Anaerobic lagoons are designed based on volatile solids loading rates (VSLR). Volatile solids represent the amount of wastes that will decompose. The cost model assumes the lagoon receives runoff directly from the calf and heifer drylots, wastewater from the barns, wastewater from the parlor, and manure from the parlor and flush barns. The manure supplies the volatile solids into the lagoon. Lagoons are typically constructed by excavating a pit and building berms around the perimeter. The berms are constructed with an extra 5 percent in height to allow for settling. The sides of the lagoon are typically sloped with a 2:1 or 3:1 (horizontal:vertical) ratio.

Considerations are also made to avoid ground water and soil contamination. Options 1, 2, 4, 5, 5A, and 7 assume the bottom and sides of the lagoon are constructed of soil that is at least 10 percent clay compacted with a sheepsfoot roller. Options 3A/3B and 3C/3D require additional ground water protection; therefore, CAFOs that are located in areas of high risk for ground-water contamination have costs for installation of an synthetic liner over a compacted clay liner.

Lagoons are designed using the following steps:

1) Determine the necessary storage volume of the lagoon. Lagoons are designed to contain the following volumes (see Figure 5.4.2-1):

   — Sludge Volume: Volume of accumulated sludge between cleanouts (depends on the type and amount of animal waste),

   — Minimum Treatment Volume: Volume necessary to allow anaerobic decomposition to occur,

   — Manure and Wastewater: Milk parlor and flush barn wastewater and manure and runoff from drylots,

   — Net Precipitation: Annual precipitation minus the annual evaporation,

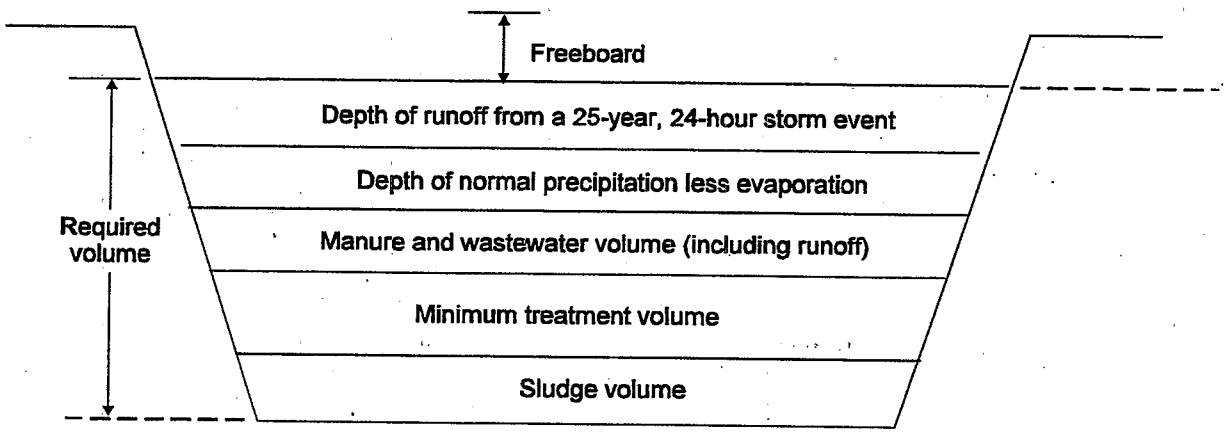
   — Design Storm: The depth of the peak (e.g., 25-year, 24-hour) rainfall event,

   — Freeboard: A minimum of one foot of freeboard, and

   — Dilution volume (for swine and poultry operations).

2) Determine the dimensions of the lagoon, given the required storage volume depending on the regulatory option.

3) Determine the costs for constructing the lagoon, using the dimensions calculated in Step 2.



Source: Agricultural Waste Handbook, USDA, 1996.

Figure 5.4.2-1. Cross-Section of an Anaerobic Lagoon

Step 1) Determination of Lagoon Volume

The lagoon volume is determined by the following equation:

Pond Volume = Sludge Volume + Minimum Treatment Volume + Manure and Wastewater + Runoff + Net Precipitation + Design Storm + Freeboard

The determination of each volume is discussed below.

Sludge Volume

The amount of sludge that accumulates between lagoon cleanouts varies based on the type and amount of animal waste. As manure decomposes in the lagoon, portions of the total solids do not decompose. A layer of sludge accumulates on the floor of the lagoon, which is proportional to the quantity of total solids that enter the lagoon. The sludge accumulation period is equal to the storage retention time of the lagoon. The rate of sludge accumulation is 0.0729 ft^3/lb solids for dairy cattle (USDA NRCS, 1996). The calculation of the separator solids is based on a 50 percent settling rate. The calculation of the runoff solids is discussed in Section 4.7.

Sludge Volume = Sludge Accumulation × (Separator Solids + Runoff Solids)

where:

Sludge Volume	=	Volume of accumulated sludge in the lagoon between cleanouts (depends on the type and amount of animal waste), ft^3
Sludge Accumulation	=	0.0729 ft^3/lb
Separator Solids	=	Amount of solids entering the lagoon from the separator, lb
Runoff Solids	=	Amount of solids entering the lagoon from runoff, lb.

Minimum Treatment Volume (MTV)

The minimum treatment volume is the minimum volume of the lagoon to insure anaerobic treatment for a given volatile solids loading. The minimum treatment volume is based on the volatile solids loading rate (VSLR), which varies with regional temperature. The minimum treatment volume is calculated using the influent daily volatile solids loading from all sources, and a regional volatile solids loading rate per 1,000 ft^3. The influent daily volatile solids loadings is calculated using the manure volatile solids and settling basin efficiency. The quantity of volatile solids (VS) entering the lagoon is calculated using the following equation:

$$\text{Influent VS} = \text{Manure VS} - (\text{Manure VS} \times \text{Settling Basin Efficiency})$$

where:

Influent VS	=	Daily volatile solids loading from all sources entering the lagoon, lbs/day
Manure VS	=	Volatile solids excreted as part of the manure, lbs/day (see Technical Development Document for manure characteristics)
Settling Basin Efficiency	=	0.50 (i.e., percent of solids that settled in the settling basin).

Therefore, the minimum treatment volume is calculated as follows:

$$\text{MTV} = \frac{\text{Influent VS}}{\text{VSLR}}$$

where:

MTV	=	Minimum treatment volume (i.e., minimum volume required for treatment to occur in the lagoon), ft^3
Influent VS	=	Daily volatile solids loading from all sources entering the lagoon, lbs/day
VSLR	=	Volatile solids loading rate, lb VS/1000 ft^3/day.

The VSLR varies by region, as shown in Figure 5.4.2-2, because the rate of solids decomposition in anaerobic lagoons is a function of temperature (USDA NRCS, 1996).

Manure and Wastewater Volume

Lagoons are designed to store manure and wastewater that is generated over a specific period of time, typically 90 to 365 days. For all options except Option 7, the storage period used in the cost model is 180 days.

Figure 10-22 Anaerobic lagoon loading rate

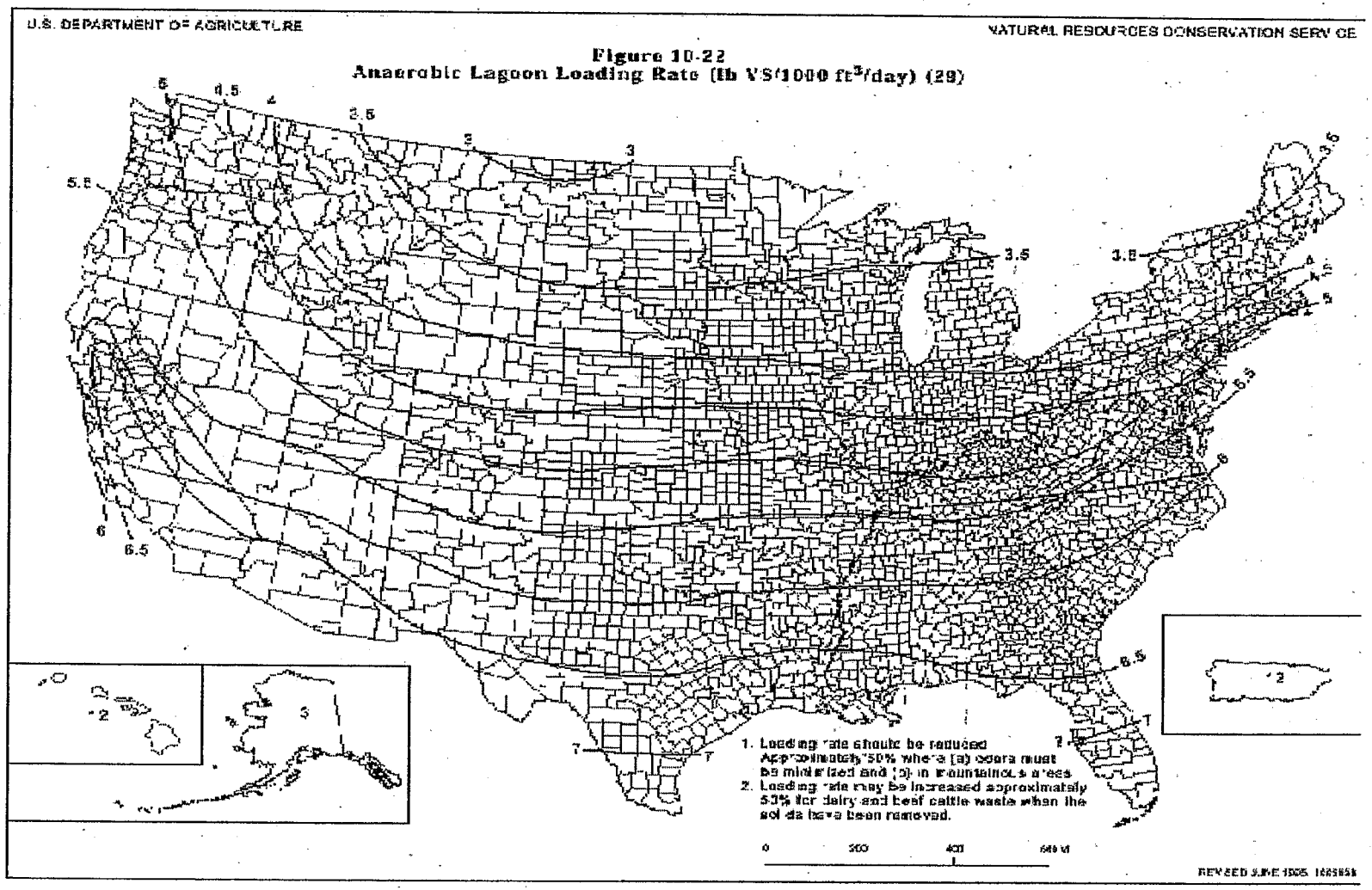


Figure 5.4.2-2. Volatile Solids Loading Rate (Source: USDA, 1996)

All of the manure and wastewater that is flushed or hosed from the dairy parlor or barn is washed to a concrete settling basin (or separator) before it enters the lagoon (see Section 5.2). To calculate the influent to the lagoon over the storage period, the daily effluent from the separator is multiplied by the number of days of storage required. It is assumed that the barn flush water is recycled back to the barns from the lagoon; therefore, only one storage volume of barn flush water is added to the total influent over the whole storage period. It is assumed that the settling basin has a 50-percent solids removal efficiency, and the removed solids have a moisture content of 80 percent (based on best professional judgement). The following equations are used to calculate the influent to the lagoon:

$$\text{Lagoon Influent} = (\text{Parlor Wash} + \text{Barn Wash} + \text{Manure Water}) \times \text{Storage Days}$$

where:

Lagoon Influent	=	Effluent from the separator entering the lagoon, gallons, gal
Parlor Wash	=	Wastewater that is flushed or hosed from the parlor, gallons per day, gpd
Barn Wash	=	Wastewater that is flushed or hosed from the barn, gpd
Manure Water	=	The portion of manure that enters the lagoon that is not solid, gpd
Storage Days	=	Retention time of the lagoon (varies by option).

See Section 4.5 for more information regarding calculating the parlor wash and barn wash and Section 4.6 for manure water.

$$\text{Recycled Barn Water} = \text{Barn Wash} \times (\text{Storage Days} - 1)$$

where:

Recycled Barn Water	=	Wastewater recycled from the lagoon to use as barn flush water, gpd
Barn Wash	=	Wastewater that is flushed or hosed from the barn, gpd
Storage Days	=	Retention time of the lagoon (varies by option).

Lagoon Storage = [(Parlor Wash + Barn Wash + Manure Water) × Storage Days] - Recycled Barn Water

where:

Lagoon Storage	=	Separator wastewater entering the lagoon for storage, gal
Parlor Wash	=	Wastewater that is flushed or hosed from the parlor, gpd
Barn Wash	=	Wastewater that is flushed or hosed from the barn, gpd
Manure Water	=	The portion of manure that enters the lagoon that is not solid, gpd
Storage Days	=	Retention time of the lagoon (varies by option).
Recycled Barn Water	=	Wastewater recycled from the lagoon to use as barn flush water, gpd.

Lagoon Solids = Manure Solids - (Manure Solids × Separator Efficiency)

where:

Lagoon Solids	=	Solids entering the lagoon from the separator, ft^3
Manure Solids	=	Manure solids entering the separator, ft^3
Separator Efficiency	=	0.50 (i.e., percent of solids that settled in the separator).

Net Precipitation

The lagoon depth is increased to allow for the six-month precipitation minus the six-month evaporation, as discussed in Section 4.7. The net precipitation contribution to the lagoon depth is equal to the average precipitation minus the average evaporation.

Design Storm

The depth of the peak storm event is added to the depth of the lagoon. For all options except Option 1A, this peak rainfall event is the 25-year, 24-hour rainfall. For Option 1A, a sensitivity analysis done by EPA to account for chronic rainfall, the peak storm is defined as the 25-year, 24-hour rainfall plus the 10-year, 10-day rainfall (see Section 8.0).

Peak Precipitation = 25-year, 24-hour Rainfall or 25-year, 24-hour + 10-year, 10-day Rainfall

where:

Peak Precipitation	=	Precipitation depth that falls directly on the lagoon from the peak rainfall event, inches
25-Yr, 24-Hr Rainfall	=	Depth of the 25-year, 24-hour peak rainfall (used for Option 1 through 7), inches
10-Yr, 10-Day Rainfall	=	Depth of the 10-year, 10-day chronic rainfall (used for Option 1A), inches.

Freeboard

A minimum of one foot of freeboard is added to the depth.

Runoff

The amount of runoff from the drylot entering the lagoon is determined from the net precipitation and area of the drylot, as discussed in Section 4.7. The amount of runoff is determined by estimating the precipitation for the number of days of storage assumed for each option. New lagoons are costed under Options 1 through 6 for 180 days of storage. Option 7 storage requirements are presented in Table 5.4.2-1. In addition, the runoff contribution to the lagoon is reduced by the amount of water retained by the solids that settle out in the basin. The solids entering the lagoon are 1.5 percent of the total runoff from the drylot (MWPS, 1993). The peak storm runoff is also included in the storage requirements. Section 4.7 describes the details of the precipitation and runoff calculations.

Table 5.4.2-1

Lagoon Storage Capacities at Dairies for Option 7

Region	Estimated Storage Capacity for Option 7 (days)	Estimated Existing Storage Capacity (days)	Additional Lagoon Capacity Costed for Existing Ponds (days)
Central	180	60	120
Mid-Atlantic	225	30	195
Midwest	225	90	135
Pacific	135	30	105
South	45	30	15

Source: EPA, 2000a and ERG, 2002.

$$\text{Influent Runoff Solids}_{6\text{-month}} = \text{Runoff}_{6\text{-month}} \times \%\ \text{Runoff Solids}$$

where:

$\text{Influent Runoff Solids}_{6\text{-month}}$	=	Amount of solids entering the lagoon from the drylot (i.e., solids exiting the settling basin), ft^3
$\text{Runoff}_{6\text{-month}}$	=	Amount of the total runoff entering the lagoon from the drylot, ft^3
% Runoff Solids	=	1.5% (i.e., the percent of runoff entering the lagoon that consists of solids).

Step 2) Dimensions and Configuration of the Lagoon

The lagoon is designed in the shape of an inverted pyramid with a flat bottom, containing the required volume. The depth of the lagoon is set as follows:

$$h = \text{Initial Depth} + \text{Net Precipitation} + \text{Freeboard}$$

where:

h	=	Depth of the lagoon, ft
Initial Depth	=	10 ft

Net Precipitation	=	Six-month precipitation depth that falls directly on the pond minus the amount that evaporates from the pond, ft
Freeboard	=	1 ft.

For dairies and veal operations, the initial depth of the lagoon is set at 10 feet, based on discussions with industry consultants. This initial depth is assumed to include depth for the runoff and solids. This depth is used as the starting value for the dimensions calculations using the required volume of the lagoon. The lagoon is assumed to be square, and the final depth and length is solved by iteration, knowing the lagoon volume and the other variables in the equation.

Lagoon Excavation and Embankment Volumes

Lagoons are constructed by excavating a portion of the necessary volume and building embankments around the perimeter of the lagoon to make up the total design volume. The cost model performs an iteration to maximize the use of excavated material used in constructing the embankments that minimizes the costs for construction. The excavation volume is represented by the following equation:

$$Volume_{extracted} = C_1 (h-h_e) [l_b w_b + l_s w_s + (l_b w_b l_s w_s)^{0.5}]$$

where:

$Volume_{extracted}$	=	Total volume of soil extracted from the lagoon, ft^3
C_1	=	constant equaling ½ for dairy cost model
h	=	Depth of the lagoon, ft
h_e	=	Height of embankment, ft
l_b	=	Length of the base of the lagoon, ft
W_b	=	Width of the base of the lagoon, ft
l_s	=	Length of the top of the lagoon, ft
W_s	=	Width of the top of the lagoon, ft.

The excavated soil is used to build the embankments. Because some settling of the soil will occur, it is assumed that an extra 5 percent of volume is required. The embankment volume is represented by the following equation:

$$Volume_{embankment} = 2\,[(1.05\,h_e w_e + s\,(1.05\,h_e)^2)\,(l_b + 2\,sh)] + 2\,[(1.05\,h_e w_e + (1.05\,s)^2\,h_e^2)\,(w + 2sh)]$$

where:

$Volume_{embankment}$	=	Total volume of soil used for the embankment, ft^3
h_e	=	Height of embankment, ft
w_e	=	Width of embankment, ft
l_b	=	Length of the base of the lagoon, ft
s	=	Slope of sidewalls
w	=	Width of the floor of lagoon.

The dimensions of the basin which yield the desired volume are calculated by the cost model using these equations.

Lagoon Liners

For Options 3A/3B and 3C/3D, lagoons are designed with a synthetic liner for those operations located in areas requiring ground water protection. The costs assume that clay is brought on site in a truck (locally) and applied as a slurry to the lagoon basin. The liner system consists of clay soil with a synthetic liner cover. The dimensions are equal to the surface area of the floor and sides of the lagoon.

The surface area of the floor of the lagoon is calculated to determine the area for compaction and for the lagoon liner. The surface area includes the bottom area plus the area of the four trapezoids that make up the sides of the lagoon.

The surface area of the sloped sides is calculated using the formula for the area of a trapezoid.

$$\text{Area of Side}_l = \tfrac{1}{2}\,HS \times (l_b + l_s)$$

$$\text{Area of Side}_w = \tfrac{1}{2}\,HS \times (w_b + w_s)$$

where:

Area of Side_l	=	Area of length side of the lagoon, ft^2
Area of Side_w	=	Area of width side of the lagoon, ft^2
HS	=	Height of the side on the lagoon (see equation below), ft
l_b	=	Bottom length of the lagoon, ft
l_s	=	Top length of the lagoon, ft
w_b	=	Bottom width of the lagoon, ft
w_s	=	Top width of the lagoon, ft.

The height of the side is calculated using the Pythagorean Theorem.

$$HS = (h^2 + (4h)^2)^{0.5}$$

where:

HS	=	Height of the side on the lagoon, ft
h	=	Depth of the lagoon, ft.

The total surface area of the basin is:

$$\text{Surface Area}_{lagoon} = l_b\, W_b + 2\,[\text{Area of Side}_l] + 2\,[\text{Area of Side}_w]$$

where:

$\text{Surface Area}_{lagoon}$	=	Total surface area of the pond floor, including the bottom and sides, ft^2
l_b	=	Bottom length of the pond, ft
w_b	=	Bottom width of the pond, ft
Area of Side_l	=	Area of length side of the pond, ft^2
Area of Side_w	=	Area of width side of the pond, ft^2.

5.4.3 Costs for Constructing a Dairy Lagoon

The construction of the storage lagoon includes a mobilization fee for the heavy machinery, excavation of the lagoon area, compaction of the ground and walls of the lagoon, and the construction of conveyances to direct runoff from the drylot area to the storage lagoon. Table 5.4.3-1 presents the unit costs used to calculate the capital and annual cost for constructing the storage lagoon.

Table 5.4.3-1

Unit Costs for Storage Lagoon

Unit	Cost (1997 dollars)	Source
Mobilization	$205/event	Means 1999 (022 274 0020)[a]
Excavation	$2.02/yd^3	Means 1999 (022 238 0200)[a]
Compaction	$0.41/yd^3	Means 1996 (022 226 5720)[a]
Flush Wash Conveyance	$11,025/system	ERG, 2000c
Hose Wash Conveyance	$7,644/system	ERG, 2000c
Clay Liner (shipped & installed)	$0.24/ft^2	AEA, 1999
Synthetic Liner (installed)	$1.50/ft^2	Tetra Tech, 2000c

[a]Information taken from Means Construction Data. The numbers in parentheses refer to division and line numbers.

The calculations for the cost associated with these items are shown below.

Mobilization

The mobilization costs are for transporting the heavy machinery and equipment. The Means Construction Data reports that this cost is $205/event.

Excavation

To calculate the lagoon excavation costs, the volume of material that is excavated is first calculated, as described previously. The excavated material is expected to be used to construct embankments around the lagoon, which will provide additional storage other than that volume which is excavated; therefore, the excavated volume is not equal to the lagoon volume. Instead, it is equal to the pond volume minus the storage that the embankments provide.

The excavation cost is calculated with the following equation:

$$\text{Excavation} = \text{Cost} \times \text{Volume}_{\text{excavated}} \div \text{Conversion Factor}$$

where:

Excavation Cost	=	Total cost to excavate the lagoon, $ $2.02/yd^3 (i.e., cost per the volume of soil excavated)
$Volume_{excavated}$	=	Amount (volume) of soil excavated, ft^3
Conversion Factor	=	27 ft^3/yd^3 (conversion from ft^3 to yd^3).

Compaction

To calculate compaction costs, the volume for compaction is calculated, as described in Section 5.1.3. The compaction cost is calculated using the following equation:

$$\text{Compaction} = \text{Cost} \times \text{Volume}_{compacted}\ (ft^3) \div \text{Conversion Factor}$$

where:

Compaction Cost	=	Total cost to compact the lagoon, $ $0.41/yd^3 (i.e., cost per volume of soil compacted)
$Volume_{compacted}$	=	Amount (volume) of soil compacted, ft^3
Conversion Factor	=	27 ft^3/yd^3 (conversion from ft^3 to yd^3).

Conveyance

The conveyance costs are for constructing conveyances to direct runoff from the drylot area to the lagoon. According to the Means Construction Data, this cost is $11,025/system for flush wash conveyance and $7,644/system for hose wash conveyance.

Clay and Synthetic Liners

To calculate liner costs, the surface area of the basin flow and sidewalls is calculated, as described previously. The liner cost includes both clay and synthetic liners, and is calculated using the following equations:

$$\text{Clay Liner} = \text{Cost} \times \text{Surface Area}$$

where:

Clay Liner	=	Cost to install a clay liner, $
Cost	=	$0.24/ft^2 (i.e., cost per the surface area of the pond)
Surface Area	=	Surface area of the basin floor and the sidewalls, ft^2.

$$\text{Synthetic Liner} = \text{Cost} \times \text{Surface Area}$$

where:

Synthetic Liner	=	Cost to install a synthetic liner, $
Cost	=	$1.50/ft^2 (i.e., cost per the surface area of the pond)
Surface Area	=	Surface area of the basin floor and the sidewalls, ft^2.

Total Capital Costs

The total capital cost for construction of the naturally lined storage lagoon is the following:

$$\text{Capital Cost} = \text{Mobilization} + \text{Excavation} + \text{Compaction} + \text{Conveyance}$$

The total capital cost for construction of the synthetically lined lagoon is the following:

$$\text{Capital Cost} = \text{Mobilization} + \text{Excavation} + \text{Compaction} + \text{Conveyance} + \text{Clay Liner} + \text{Synthetic Liner}$$

Total Annual Costs

Based on best professional judgement, annual operating and maintenance costs for both naturally lined and synthetically lined lagoons are estimated at 5 percent of the capital costs.

$$\text{Annual Cost} = 5\% \times \text{Capital Cost}$$

5.4.4 Dairy Lagoon Results

The cost model results for constructing a naturally lined lagoon, a synthetically lined lagoon, and additional lagoons for extra capacity (Option 7) at dairies are presented in Appendix A, Table A-4, Table A-5 , and Tables A-6a and 6b, respectively.

5.4.5 Design of Lagoons and Evaporative Ponds for Swine and Poultry Operations

Basic volume requirements for liquid storage are determined by calculating the manure volume generated for the storage period and multiplying that number by a dilution factor. The dilution factor is intended to address process dilution, net direct precipitation (precipitation minus evaporation over lagoon surface), freeboard (1 foot), and storage for the 25-year, 24-hour rainfall event.

Design

The basic design steps employed for dairy and veal lagoons are also used for swine and poultry lagoons. Unique lagoon dimensions are calculated for each model facility based upon the required storage volume. The cost model applies berms on two sides of liquid storage structures to eliminate runoff into storage facilities (see Section 5.3).

USDA's design approach provides storage for manure, clean water used in dilution, accumulated solids and wastewater, net precipitation (precipitation - evaporation), the 25-year 24-hour rainfall event, and 1 foot of freeboard (USDA NRCS, 1996). In cases where there are watersheds draining to the lagoon, USDA adds volume for runoff. Basic volume requirements for storage of liquid wastes from swine and wet layer operations are determined by calculating the manure volume generated for the storage period and multiplying that number by a dilution factor. The dilution factor is intended to address process dilution, net direct precipitation (precipitation minus evaporation over lagoon surface), freeboard (1 foot), and storage for the 25-year 24-hour rainfall event. Solids accumulation is assumed to not occur since it is assumed that waste is agitated and mixed before application to fields.

The suitability of the modeled lagoons to handle all inputs was tested in an exercise to determine if overflows would occur due to chronic and 25-year, 24-hour rainfall events. No capacity problems were found in this testing, so it is concluded that lagoons designed using the cost model approach are reasonable approximations of those designed using USDA's approach.

The storage period for lagoons is assumed to be six months, except for those options and scenarios where storage is increased. The required storage volume ($Volume_{storage}$) is therefore calculated as:

$$Volume_{storage} = Volume_{manure} \times dilution/2$$

where:

$Volume_{manure}$	=	annual volume of manure produced
dilution	=	dilution factor (ranges from 1 to 3)
2	=	12 months/6 months storage.

The cost model addresses five cases for which lagoon construction costs are included: (1) Option 1A, where increased storage is provided to handle chronic rainfall events at wet layer operations and at swine operations with liquid or evaporative pond systems, (2) increased storage for all swine facilities under Option 7, (3) the construction of secondary lagoons for settling as part of the installation of flush-water recycling systems for Category 2 liquid swine facilities under all options other than Option 5, (4) the replacement of evaporative ponds with lined and covered lagoons under Option 5, and (5) the construction of a secondary lagoon with storage for 20 days in conjunction with liner installation for liquid and evaporative pond systems. In all other cases, the storage facility is designed for the purpose of deriving costs for liners, covers, and diversions only, and lagoon construction costs are not included.

Under Option 1A, the storage volume is increased to handle chronic rainfall, ranging from 5 to 11 inches (see Table 5.4.5-1). The extra lagoon for flush-water recycling systems is designed to handle storage for 20 days, the same design volume used for extra lagoons constructed when liners are added to existing lagoons and evaporative ponds. Increased storage under Option 7 is set to 90 days for the Mid-Atlantic region and 135 days for the Midwest and

Central regions. Lagoons constructed to replace evaporative ponds are designed to handle the same volume as the evaporative ponds, and then 6 inches of depth is removed to account for the covers which keep direct precipitation from entering the lagoon.

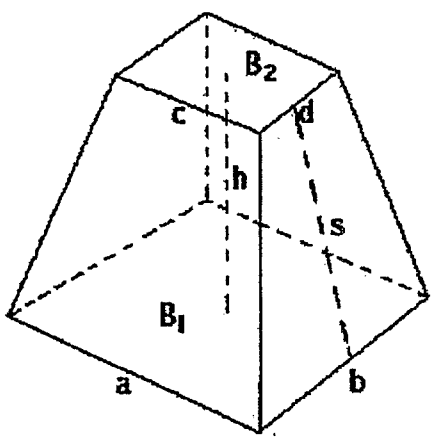
Table 5.4.5-1

Chronic Rainfall Amounts for Option 1A for Swine and Poultry

Region	Chronic Rainfall Amount (inches)
Central	5
Mid-Atlantic	11
Midwest	7
South	10

Dimensions and Configuration

The shape assumed for lagoons and evaporative ponds is an upside-down frustrum, which is a pyramid with the top chopped off. The shape and parameters of a frustrum are given in Figure 5.4.5-1. The cost model assume that lagoons and evaporative ponds are square (a=b and c=d).



Area and Volume of the Frustrum of a Pyramid

$$\text{Area} = B_1 + B_2 + A_s$$
$$= ab + cd + (a+b+c+d) \cdot \frac{s}{2}$$

$$\text{Volume} = \frac{1}{3} h \left(B_1 + B_2 + \sqrt{B_1 B_2}\right)$$
$$= \frac{1}{3} h \left(ab + cd + \sqrt{abcd}\right)$$

Figure 5.4.5-1. Frustrum

Because lagoons have sloping sides, the minimum volume associated with a lagoon 12 feet deep with side slopes (H:V) of 2 is 9,216 cubic feet. For an evaporative pond with a depth of 4 feet and side slopes of 2, the minimum volume is 341 cubic feet. Since the cost model calculates lagoon dimensions from lagoon volume, which can be very small for secondary lagoons, there is the potential that calculations result in negative bottom widths and lengths if the depth and side slopes are fixed values. To prevent these negative values from occurring, an analysis of lagoon dimensions resulting from various volumes, lagoon depths, and side slopes was conducted. The results from this analysis are presented in Table 5.4.5-2. When applying the information contained in Table 5.4.5-2 to the design of anaerobic lagoons in the cost model, the default depth is 12 feet, and a preference is given to maintaining a depth of at least 10 feet wherever possible, but no less than 6 feet (see Table 5.4.5-3). This approach is consistent with USDA guidelines specifying that the minimum acceptable depth for anaerobic lagoons is 6 feet, but in colder climates at least 10 feet is recommended to assure proper operation and odor control (USDA NRCS, 1996). USDA also recommends that internal slopes be no less than 1.5:1 (H:V) for liquid storage (USDANRCS, 1996).

According to the American Society of Agricultural Engineers standards (ASAE, 1998), a minimum lagoon depth of 5 feet is necessary for construction of anaerobic lagoons, and approximately 20 feet is considered the maximum depth to ensure proper biological activity.

Table 5.4.5-2

Relationships Among Depth, Side Slope, Volume, And Bottom Width of Lagoons

Depth	Side Slope	Volume Below Which Calculations Result In Negative Value for Bottom Width of Lagoon
12	4	36,864
12	3	20,736
12	2	9,216
11	4	28,395
11	3	15,972
11	2	7,099
10	4	21,334
10	3	12,000
10	2	5,334
9	4	15,552
9	3	8,748
9	2	3,888
8	4	10,923
8	3	6,144
8	2	2,731
7	4	7,318
7	3	4,116
7	2	1,830
6	4	4,608
6	3	2,592
6	2	1,152
6	1	288
5	4	2,667
5	3	1,500
5	2	667
5	1	167
4	4	1,365
4	3	768
4	2	342
4	1	86

Table 5.4.5-3

Depth and Side Slopes for Lagoons and Evaporative Ponds

Volume (cubic feet)	Lagoons		Evaporative Ponds	
	Depth	Slope	Depth	Slope
> 0 and < 342	NA	NA	4	1
>=342	NA	NA	4	2
>0 and <167	4	1	NA	NA
>=167 and <288	5	1	NA	NA
>=288 and <1,152	6	1	NA	NA
>=1,152 and <1,830	6	2	NA	NA
>=1,830 and <2,731	7	2	NA	NA
>=2,731 and <3,888	8	2	NA	NA
>=3,888 and <5,334	9	2	NA	NA
>=5,334 and <7,099	10	2	NA	NA
>=7,099 and <9,216	11	2	NA	NA
>=9,216	12	2	NA	NA

NA: Not applicable.

Because some of the modeled lagoons are very small, a depth of 4 feet is allowed for volumes less than 167 cubic feet, and a depth of 5 feet is allowed for volumes of 167-287 cubic feet. This allowance for shallow anaerobic lagoons is particularly important in calculations of the costs for extra storage.

Lagoon dimensions are calculated from volume using the following basic equations:

$$W_{lagoonbottom}=[(-2h^2s)+((4\times(h^4)\times(s^2))-4\times h\times((4/3)\times(h^3)\times(s^2)-Volume_{storage}))^{0.5}]\div 2h$$

$$L_{lagoonbottom}=W_{lagoonbottom}$$

$$W_{lagoontop}=W_{lagoonbottom}+(2\times s\times depth)$$

$$L_{lagoontop}=L_{lagoonbottom}+(2\times s\times depth)$$

where:

$W_{lagoonbottom}$	=	Width of bottom of lagoon or evaporative pond, ft
$W_{lagoontop}$	=	Width of top of lagoon or evaporative pond, ft
$L_{lagoonbottom}$	=	Length of bottom of lagoon or evaporative pond, ft
$L_{lagoontop}$	=	Length of top of lagoon or evaporative pond, ft
s	=	Slope of sidewalls
h	=	Depth of the lagoon, ft.

To simulate increased storage volume for chronic rainfall under Option 1A, the cost model increases the top width (and length since it is assumed to be square) of the lagoon with the following equation:

$$W_{lagoontop} = W_{lagoontop} + (2 \times s \times chronic \div 12)$$

where:

$W_{lagoontop}$	=	Width of top of lagoon or evaporative pond, ft
s	=	Slope of sidewalls
chronic	=	Chronic rainfall, in
12	=	12 inches per foot
2	=	Two sides.

The equation essentially builds additional storage above the existing lagoon, resulting in a wider, longer, and deeper lagoon. The new top width and length are used to calculate the new lagoon volumes, liner areas, berm dimensions, and cover areas for Option 1A. The increase in lagoon volume is calculated by subtracting the original volume from the new volume.

An additional 20 days of storage is provided by both the extra lagoons for flush-water recycling systems and the extra lagoons constructed when liners are added to existing lagoons and evaporative ponds. This additional storage volume ($Volume_{20\text{-day storage}}$) is calculated with the following equation:

$$Volume_{20\text{-day storage}} = Volume_{annual} \times 20 \div 365 \div 7.481 \div 27$$

where:

$Volume_{annual}$	=	12-month storage volume in gallons
20/365	=	Fraction of year covered by 20 days
7.481 converts to cubic feet		
27 converts to cubic yards.		

Increased storage under Option 7 is set to 90 days for the Mid-Atlantic region and 135 days for the Midwest and Central regions. The storage volume is calculated using the same equation as above, with the exception that 20 is replaced with 90 or 135.

Under Option 5, the cost model builds a new lagoon to replace evaporative ponds since this approach is less expensive than covering the large but shallow evaporative ponds. First, the dimensions of the new lagoon are determined using the basic equations from above. Then, lagoon depth is decreased by 6 inches. The typical annual rainfall in the central region where evaporative ponds are used is 1 foot, and 6 inches is selected since the storage period is six months. The lagoon bottom width and length remain the same, but the width and length of the lagoon top are then recalculated using the following equations:

$$W_{lagoontop} = W_{lagoontop} - (2 \times s)$$
$$L_{lagoontop} = L_{lagoontop} - (2 \times s)$$

where:

$W_{lagoontop}$	=	Width of top of lagoon or evaporative pond, ft
$L_{lagoontop}$	=	Length of top of lagoon or evaporative pond, ft
s	=	Slope of sidewalls.

Volume is then calculated using the frustrum equation with the original bottom dimensions, the new depth, and the new top dimensions.

Lagoon Liners

The surface area of lagoons and evaporative ponds for swine and poultry operations is calculated using the same basic equations described in Section 5.4.2 for dairies and veal operations. The cost for a lagoon is calculated using the same costs shown in Table 5.4.3-1.

5.4.6 Costs for Lagoons at Swine and Poultry Operations

Capital Costs

The excavation cost of $2.60 per cubic yard for swine and poultry operations is multiplied by the volume or volume change (e.g., Option 1A) to determine total excavation costs. When a liner is present, unit liner costs are the same as shown in Table 5.4.3-1, and are multiplied by liner area to determine total liner cost.

$$\text{Capital Cost} = \text{Excavation Cost} \times \text{Volume Excavated} + \text{Liner Cost}$$

where:

Excavation Cost	=	$2.60 per cubic yard
Volume Excavated	=	Volume or volume change of lagoon
Liner Cost	=	Clay liner + synthetic liner.

Annual Costs

The annual maintenance and operation cost is assumed to be 2 percent of the capital costs.

$$\text{Annual Cost} = 2\% \times \text{Capital Cost}$$

5.5 Ponds

Waste storage ponds are frequently used at animal feeding operations to contain wastewater and runoff from contaminated areas. Manure and runoff are routed to the storage pond where the mixture is held until it can be used for irrigation or can be transported elsewhere. Solids settle to the bottom of the pond as sludge, which is periodically removed and land applied on site or off site. The liquid can be applied to cropland as fertilizer/irrigation, used for dust control, reused as flush water for animal barns, or transported off site. Section 5.9 discusses the costs associated with transporting waste off site, including the solids and liquids.

Ponds are included in all regulatory options for beef feedlots, heifer operations, and as a holding pond for effluent from an anaerobic digester in Option 6. Options 1, 2, 4, 5A, and 6 require zero discharge of manure, litter, or process wastewater pollutants from the production area with the exception of overflows from a facility designed to hold all process wastewater, including the direct precipitation and runoff from a 25-year, 24-hour rainfall event. CAFOs that already have storage ponds in place are assumed to have sufficient capacity. CAFOs that have no storage on site are costed for the installation of naturally lined ponds with 180 days of storage. Under Option 7, CAFOs are costed for the installation of naturally lined ponds with a storage capacity that varies based on land application timing restrictions. For Options 3A/3B and 3C/3D, CAFOs expected to have a direct hydrologic connection from ground water to surface water are given costs for the installation of storage ponds with a liner to prevent seepage of wastewater into ground water.

5.5.1 Technology Description

Storage ponds provide a location for long-term storage of water and are appropriate for the collection of runoff. Ponds are typically located at a lower elevation than the animal pens or barns; gravity is used to transport the waste to the pond, which minimizes labor. Although ponds are an effective means of storing waste, no treatment is provided. Because ponds are open to the air, odor can be a problem.

Although ponds are not designed for treatment, there is some reduction of nitrogen and phosphorus in the liquid effluent due to settling and volatilization. Influent phosphorus settles to the bottom of the pond and is removed with the sludge. Influent nitrogen is reduced through volatilization to ammonia. Pond effluent can be applied to cropland as fertilizer/irrigation, reused as flush water for the animal barns, or transported off site. The sludge can also be land applied as a fertilizer and soil amendment.

Storage ponds are appropriate for use at operations that collect runoff and do not collect process water or manure flush water. Typically, beef feedlots and heifer operations operate in this manner and have storage ponds for runoff collection. All cost options for beef feedlots and heifer operations include a storage pond. Dairies and veal operations typically operate lagoons (discussed in Section 5.4) to provide treatment for the barn and milking parlor flush water; however, a storage pond is included in the costs for large dairies under Option 6, where the pond receives effluent from an anaerobic digester.

Not all beef feedlots and heifer operations are expected to have liquid storage currently in place. In addition, ponds without a synthetic or clay liner are currently more prevalent at beef feedlots and heifer operations than are lined ponds. Section 6.0 provides EPA's estimates of the percentage of beef feedlots and heifer operations that are costed for the installation of a pond, a pond with a liner (for Options 3A/3B and 3C/3D), or a pond with additional capacity (for Option 7).

5.5.2 Design

The cost model assumes only direct precipitation or runoff that has gone through a settling basin (or separator) enters the storage pond. Runoff will contain a portion of manure solids from the beef drylots. Ponds are typically constructed by excavating a pit and using the excavated soil to build embankments around the perimeter. An additional 5 percent is added to the required height of the embankments to allow for settling. The sides of the pond are sloped with a 1.5:1 or 3:1 (horizontal:vertical) ratio.

Considerations are also made to avoid ground-water and soil contamination. Options 1, 2, 4, 5A, 6, and 7 assume the bottom and sides of the pond are constructed of soil that is at least 10 percent clay compacted with a sheepsfoot roller. Under Options 3A/3B and 3C/3D, some CAFOs will require additional ground-water protection; therefore, a synthetic liner is included in the lagoon costs in addition to a compacted clay liner.

Storage ponds are designed using the following steps:

1) Determine the necessary pond volume. Storage ponds are designed to contain the following volumes (see Figure 5.5.2-1):

   — Sludge Volume: Volume of accumulated sludge between clean-outs (depends on the type and amount of animal waste),

   — Runoff: The runoff from drylots for normal and peak precipitation,

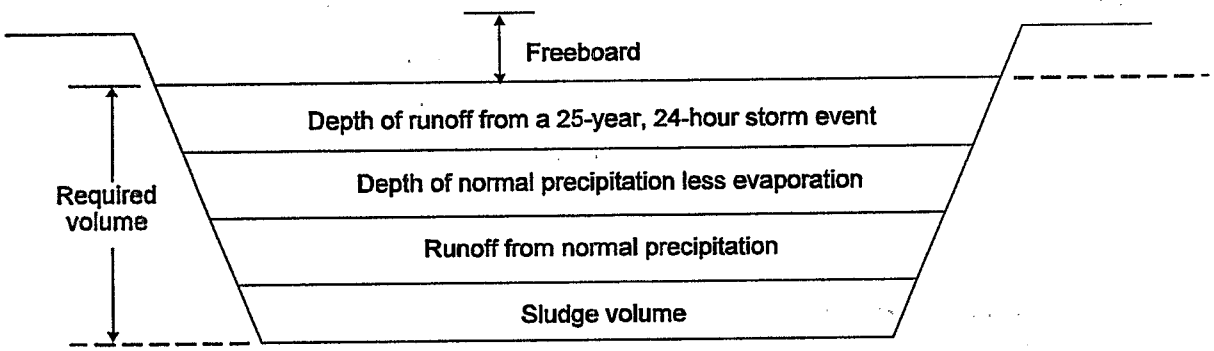
   — Net Precipitation: Annual precipitation minus the annual evaporation,

   — Design Storm: The depth of the peak (e.g., 25-year, 24-hour) rainfall event, and

   — Freeboard: A minimum of 1 foot of freeboard.

2) Determine the dimensions and configuration of the pond, depending on the regulatory option.

3) Determine the costs for constructing the pond, using the dimensions calculated in Step 2.



Source: Agricultural Waste Handbook, USDA, 1996.

Figure 5.5.2-1. Cross-Section of a Storage Pond

Step 1) Determination of Pond Volume

The pond volume is determined by the following equation:

Pond Volume = Sludge Volume + Runoff + Net Precipitation + Design Storm + Freeboard

The determination of each volume is discussed below.

Sludge Volume

The amount of sludge that accumulates between pond cleanouts varies based on the type and amount of animal waste. As manure decomposes in the pond, portions of the total solids do not decompose. A layer of sludge accumulates on the floor of the pond, which is proportional to the quantity of total solids that enter the pond. The sludge accumulation period is equal to the storage retention time of the pond. A rate of sludge accumulation is not available for beef cattle but is estimated to be the same as dairy cattle: 0.0729 cubic feet per pound (ft^3/lb) (USDA NRCS, 1996). The calculation of the separator solids is discussed in Section 5.2, assuming 50-percent settling rate. The calculation of the runoff solids is discussed in Section 4.7.

Sludge Volume = Sludge Accumulation × Runoff Solids

where:

Sludge Volume	=	Amount of sludge that accumulates between pond cleanouts, ft^3
Sludge Accumulation	=	0.0729, ft^3/lb
Runoff Solids	=	Quantity of total solids that enter the pond following separation, pounds, lb.

Runoff

The amount of runoff entering the pond is determined from the net precipitation and area of the drylot, as discussed in Section 4.7. The amount of runoff is determined by estimating the precipitation for the number of days of storage assumed for each option. New ponds are costed under Options 1 through 6 for 180 days of storage. Option 7 storage requirements are presented in Table 5.5.2-1. In addition, the runoff contribution to the pond is reduced by the amount of water retained by the solids that settle out in the basin. The solids entering the earthen basin are 1.5 percent of the total runoff (see Section 4.7 for more information), while the solids entering the pond are 50 percent of the basin solids (i.e., the efficiency of the settling basin is assumed to be 50 percent).

Table 5.5.2-1

Pond Storage Capacities at Beef Feedlot and Heifer Operations for Option 7

Region	Estimated Storage Capacity for Option 7 (days)	Estimated Existing Storage Capacity (days)	Additional Pond Capacity Costed for Existing Ponds (days)
Central	180	50	130
Mid-Atlantic	225	80	145
Midwest	225	190	35
Pacific	135	30	105
South	45	45	0

Source: ERG, 2000a and ERG 2002.

$$\text{Influent Runoff Solids}_{6\text{-month}} = \text{Total Runoff Solids}_{6\text{-month}} \times (1\text{-Settling Basin Efficiency})$$

where:

$\text{Influent Runoff Solids}_{6\text{-month}}$	=	Amount of solids entering the pond (i.e., solids exiting the settling basin), ft^3
$\text{Total Runoff Solids}_{6\text{-month}}$	=	Amount of the total runoff entering the settling basin that consists of solids, ft^3
Settling Basin Efficiency	=	50% (i.e., percent of solids that settled in the settling basin).

$$\text{Settled Solids}_{6\text{-month}} = \text{Total Runoff Solids}_{6\text{-month}} \times \text{Settling Basin Efficiency}$$

where:

$\text{Settled Solids}_{6\text{-month}}$	=	Amount of solids that settled in the settling basin from the runoff entering the basin, ft^3
$\text{Total Runoff Solids}_{6\text{-month}}$	=	Amount of the total runoff entering the settling basin that consists of solids, ft^3
Settling Basin Efficiency	=	50% (i.e., percent of solids that settled in the settling basin).

Note that:

$$\text{Total Runoff Solids}_{6\text{-month}} = \text{Influent Runoff Solids}_{6\text{-month}} + \text{Settled Solids}_{6\text{-month}}$$

For the cost model calculations, it is assumed that settled solids have a moisture content of 80 percent (based on best professional judgement); therefore, the runoff entering the pond is:

$$\text{Influent}_{\text{runoff}} = \left[\left(\frac{\text{Runoff}_{6\text{-month}}}{180 \text{ days}}\right) \times \text{Storage Days}\right] - \left[\frac{\text{Settled Solids}_{6\text{-month}} \times \text{Solids}_{\text{moisture}}}{1 \text{ Solids}_{\text{moisture}}}\right] + \text{Peak Rainfall Runoff}$$

where:

$\text{Influent}_{\text{runoff}}$	=	Amount of runoff entering the pond from the settling basin and drainage area, ft^3
$\text{Runoff}_{6\text{-month}}$	=	Total runoff entering the settling basin calculated using the average monthly precipitation amounts from the wettest six-month consecutive period (see Section 4.7), ft^3

180 days	=	Number of storage days for runoff
Storage Days	=	Required number of storage days for the specific option, days
$Solids_{6\text{-month}}$	=	Amount of solids that settled in the settling basin from the runoff entering the basin, ft^3
$Solids_{moisture}$	=	80% (i.e., moisture content percentage in the settled solids)
Peak Rainfall Runoff	=	Total runoff from the peak rainfall event (either 25-year, 24-hour or 25-year, 24-hour plus 10-year, 10-day).

Section 4.7 describes the details of the precipitation and runoff calculations.

Net Precipitation

The pond depth is increased to allow for direct net precipitation, as discussed in Section 4.7. The net precipitation contribution to the pond depth is equal to the average precipitation minus the average evaporation.

Design Storm

The depth of the peak rainfall event is added to the depth of the pond to account for direct precipitation. For all options except 1A, this peak rainfall event is the 25-year, 24-hour rainfall. For Option 1A, a sensitivity analysis conducted by EPA to account for chronic rainfall, the peak storm is defined as the 25-year, 24-hour rainfall plus the 10-year, 10-day rainfall. Precipitation information for these storms was also extracted from the NCDC database.

Peak Precipitation =25-Yr, 24-Hr Rainfall or 25-Yr, 24-Hr + 10-Yr, 10-Day Rainfall

where:

Peak Precipitation	=	Precipitation depth that falls directly on the pond from the peak rainfall event, inches
25-Yr, 24-Hr Rainfall	=	Depth of the 25-year, 24-hour peak rainfall, inches
10-Yr, 10-Day Rainfall	=	Depth of the 10-year, 10-day chronic rainfall, inches.

Freeboard

A minimum of 1 foot of freeboard is added to the depth.

Step 2) Dimensions and Configuration of Pond

The pond is designed approximately in the shape of an inverted frustum (i.e., an inverted pyramid with a flat bottom), containing the required volume. The initial depth of the pond is set as follows:

$$h = \text{Initial Depth} + \text{Net Precipitation} + \text{Freeboard} + \text{Peak Precipitation}$$

where:

h	=	Depth of the pond, ft
Initial Depth	=	10 ft
Net Precipitation	=	Six-month precipitation depth that falls directly on the pond minus the amount that evaporates from the pond, ft
Freeboard	=	1 foot
Peak Precipitation	=	Precipitation depth that falls directly on the pond from the peak rainfall event, ft.

The initial depth of the pond is set at 10 feet, based on discussions with industry consultants. This initial depth is assumed to include depth for the runoff and solids. This depth is used as the starting value for the dimensions calculations using the required volume of the pond. The pond is assumed to be square, and the final depth and length is solved by iteration, knowing the pond volume and the other variables in the equation.

Pond Dimensions

For the cost model calculations, it is assumed that the pond has four sloped sides with a rectangular base. To determine the dimensions of the pond, the design volume of the pond is used with the design parameters discussed previously. The following equation is used to determine the length of the basin:

$$\text{Pond Volume} = \tfrac{1}{2}\, h\, [A_1 + A_2 + (A_1\, A_2)^{0.5}]$$

$$\text{Pond Volume} = \tfrac{1}{2}\, h\, [l_b\, W_b + l_s\, W_s + (l_b W_b l_s W_s)^{0.5}]$$

where:

Pond Volume	=	Necessary volume of the pond calculated in Step 1), ft^3
h	=	Depth of the pond, ft
A_1	=	Area of the bottom base of the pond, assuming the pond is square (this equals $l_b\, W_b$)
A_2	=	Area of the top (surface area) of the pond, assuming the pond is square (this equals $l_s\, W_s$)
l_b	=	Length of the base of the pond, ft
W_b	=	Width of the base of the pond, ft
l_s	=	Length of the top of the pond, ft
W_s	=	Width of the top of the pond, ft.

Pond Excavation and Embankment Volumes

Ponds are constructed by excavating a portion of the necessary volume and building embankments around the perimeter of the pond to make up the total design volume. The cost model performs an iteration to maximize the use of excavated material used in constructing the embankments that minimizes the costs for construction. The excavation volume is represented by the following equation:

$$\text{Volume}_{\text{excavated}} = 0.5\, (h\text{-}h_e)\, [l_b w_b + l_s w_s + (l_b w_b l_s w_s)^{0.5}]$$

where:

$\text{Volume}_{\text{excavated}}$	=	Total volume of soil extracted from the pond, ft^3
h	=	Depth of the pond, ft
h_e	=	Height of embankment, ft
l_b	=	Length of the base of the pond, ft
W_b	=	Width of the base of the pond, ft
l_s	=	Length of the top of the pond, ft
W_s	=	Width of the top of the pond, ft.

The excavated soil is used to build the embankments. Because some settling of the soil will occur, it is assumed that an extra 5 percent of volume is required. The embankment volume is represented by the following equation:

$$Volume_{embankment} = 2\,[(1.05\,h_e w_e + s\,(1.05\,h_e)^2)\,(l_b + 2\,sh)] + 2\,[(1.05\,h_e w_e + (1.05\,s)^2\,h_e^2)\,(w + 2sh)]$$

where:

$Volume_{embankment}$	=	Total volume of soil used for the embankment, ft^3
h_e	=	Depth embankment, ft
w_e	=	Width embankment, ft
l_b	=	Length of the base of the pond, ft
s	=	slope of walls of pond, ft/ft
w	=	width of the base of the pond, ft.

The dimensions of the basin which yield the desired volume are calculated by the cost model.

Pond Liners

For Options 3A/3B and 3C/3D, ponds are designed with a synthetic liner for those operations located in areas requiring ground water protection. The liner consists of clay soil with a synthetic liner cover. The dimensions of the liner are equal to the surface area of the floor and sides of the pond.

The surface area of the floor of the pond is calculated to determine the area for compaction and for the pond liner. The surface area includes the bottom area plus the area of the four trapezoids that make up the sides of the pond.

The surface area of the sloped sides is calculated using the formula for the area of a trapezoid.

$$\text{Area of Side}_l = \tfrac{1}{2}\,HS \times (l_b + l_s)$$

$$\text{Area of Side}_w = \tfrac{1}{2}\,HS \times (w_b + w_s)$$

where:

Area of $Side_l$	=	Area of length side of the pond, ft^2
Area of $Side_w$	=	Area of width side of the pond, ft^2
HS	=	Height of the side on the pond (see equation below), ft
l_b	=	Bottom length of the pond, ft
l_s	=	Top length of the pond, ft

w_b	=	Bottom width of the pond, ft
w_s	=	Top width of the pond, ft.

The height of the side is calculated using the Pythagorean Theorem.

$$HS = (h^2 + (4h)^2)^{0.5}$$

where:

HS	=	Height of the side on the pond, ft
h	=	Depth of the pond, ft.

The total surface area of the basin is:

$$\text{Surface Area}_{pond} = l_b\, W_b + 2\,[\text{Area of Side}_l] + 2\,[\text{Area of Side}_w]$$

where:

$\text{Surface Area}_{pond}$	=	Total surface area of the pond floor, including the bottom and sides, ft^2
l_b	=	Bottom length of the pond, ft
w_b	=	Bottom width of the pond, ft
Area of Side_l	=	Area of length side of the pond, ft^2
Area of Side_w	=	Area of width side of the pond, ft^2.

5.5.3 Costs

The construction of the storage pond includes a mobilization fee for the heavy machinery, excavation of the pond area, compaction of the ground and walls of the pond, and the construction of conveyances to direct runoff from the drylot area to the storage pond. Table 5.5.3-1 presents the unit costs used to calculate the capital and annual cost for constructing storage ponds.

Table 5.5.3-1

Unit Costs for Storage Pond

Unit	Cost (1997 dollars)	Source
Mobilization	$205/event	Means 1999 (022 274 0020)[a]
Excavation	$2.02/yd^3	Means 1999 (022 238 0200)[a]
Compaction	$0.41/yd^3	Means 1996 (022 226 5720)[a]
Conveyance	$7,644/event	ERG, 2000c
Clay Liner (shipped & installed)	$0.24/ft^2	AEA, 1999
Synthetic Liner (installed)	$1.50/ft^2	Tetra Tech, 2000c

[a]Information taken from Means Construction Data. The numbers in parentheses refer to division and line numbers.

The calculations for the costs associated with these items are shown below:

Mobilization

The mobilization costs are $205/event (i.e., $205 to mobilize all equipment on site). These costs are for moving the appropriate heavy machinery and equipment.

Excavation

To calculate the pond excavation costs, the volume of material that is excavated is first calculated, as described previously. The excavated material is expected to be used to construct embankments around the pond, which will provide additional storage other than that volume which is excavated; therefore, the excavated volume is not equal to the pond volume. Instead, it is equal to the pond volume minus the storage that the embankments provide.

The excavation cost is calculated with the following equation:

$$\text{Excavation} = \text{Cost} \times \frac{\text{Volume}_{\text{excavated}}}{\text{Conversion Factor}}$$

where:

Excavation Cost	=	Total cost to excavate the pond, $
	=	$2.02/yd^3 (i.e., cost per the volume of soil excavated)
$Volume_{excavated}$	=	Amount (volume) of soil excavated, ft^3
Conversion Factor	=	27 ft^3/yd^3 (i.e., conversion from ft^3 to yd^3).

Compaction

To calculate compaction costs, the volume for compaction is calculated, as described in Section 5.1. The compaction cost is calculated with the following equation:

$$\text{Compaction} = \text{Cost} \times \frac{\text{Volume}_{\text{compacted}}\ (\text{ft}^3)}{\text{Conversion Factor}}$$

where:

Compaction Cost	=	Total cost to compact the pond, $
	=	$0.41/yd^3 (i.e., cost per volume of soil compacted)
$Volume_{compacted}$	=	Amount (volume) of soil compacted, ft^3
Conversion Factor	=	27 ft^3/yd^3 (i.e., conversion from ft^3 to yd^3).

Conveyance

The conveyance costs are for constructing conveyances to direct runoff from the drylot area to the storage pond. According to the Means Construction Data, this cost is $7,644/event.

Clay and Synthetic Liners

To calculate liner costs, the surface area of the basin floor and sidewalls is calculated, as described in Section 5.1. The liner cost includes both a clay and synthetic liner, and is calculated using the following equations:

Clay Liner = Cost × Surface Area

where:

Clay Liner	=	Cost to install a clay liner, $
Cost	=	$0.24/ft^2 (i.e., cost per the surface area of the pond)
Surface Area	=	Surface area of the basin floor and the sidewalls, ft^2.

Synthetic Liner = Cost × Surface Area

where:

Synthetic Liner	=	Cost to install a synthetic liner, $
Cost	=	$1.50/ft^2 (i.e., cost per the surface area of the pond)
Surface Area	=	Surface area of the basin floor and the sidewalls, ft^2.

Total Capital Costs for Naturally Lined and Synthetically Lined Ponds

The total capital cost for construction of the naturally-lined storage pond is the following:

Capital Cost = Mobilization + Excavation + Compaction + Conveyance

The total capital cost for construction of the synthetically lined pond is the following:

Capital Cost = Mobilization + Excavation + Compaction + Conveyance + Clay Liner + Synthetic Liner

Total Annual Costs

Based on best professional judgement, annual operating and maintenance costs for both naturally lined and synthetically lined storage ponds are estimated at 5 percent of the total capital costs.

Annual Cost = 5% × Capital Cost

5.5.4 Results

The cost model results for constructing a naturally lined storage pond, a synthetically lined storage pond, and additional ponds for extra capacity (Option 7) are presented in Appendix A, Table A-7, Table A-8, and Tables A-9a and 9b, respectively.

5.6 Nutrient Management

The cost model assumes that as part of the regulation, CAFOs will be required to conduct certain practices to appropriately manage their nutrients. These practices include: the development of a nutrient management plan, soil sampling, manure sampling, recordkeeping and reporting costs, purchase of nitrogen fertilizer, lagoon depth marker, establishment of setback areas, and calibration of a manure spreader. Each of these are described in this section. The sum of the nutrient management costs are presented for beef feedlots, dairies, heifer and veal operations in Appendix A, Tables A-10a and 10b. Tables A-10c through A-10g present costs for buffers at swine and poultry operations.

5.6.1 Nutrient Management Plan Development and Associated Costs

The cost model assumes that all but Category 3 animal feeding operations covered by this regulation will need to develop and implement a nutrient management plan for their operation. To this end, there is an initial cost for the owner/operator of the farm to be trained in nutrient management planning. Further, for all but Category 3 farms, it is assumed that the owner/operator develops or updates their nutrient management plan every 5 years.

On-Farm Nutrient Management Plan (NMP) Development

The cost to develop an on-farm NMP is calculated by multiplying the farm size (number of tillable acres) by a NMP rate in dollars per acre. NMP rates vary depending on the level of services (e.g., soil sampling, manure sampling, and analysis). EPA selected a NMP rate of $5 per tillable acre, assuming that costs for soil and manure testing were estimated separately

from NMP development and the higher costs for NMP development are usually attributed to testing costs. While the final regulation requires that NMPs be rewritten at a minimum of every 5 years; therefore, the cost models for all operations include costs to revise the NMP every 5 years. Costs for an annual review of the NMP are included under the recordkeeping requirements for all facilities.

EPA also assumes that there will be a one-time fixed cost for documenting the manure generation, collection, storage, and treatment systems at animal operations that require nutrient management planning. EPA assumes that this documentation will be prepared by a nutrient management specialist as the first step in the nutrient management planning development process. Labor hours for both the farmer and the nutrient management specialist are required. EPA assumes this documentation will require 8 hours of time by the farmer at $10 per hour and 16 hours of time by the nutrient management specialist at $55 per hour. This cost is:

One-time Fixed Cost = (8 hours × $10/hr) + (16 hours × $55/hr)
= $960.

5.6.2 Soil Sampling

As part of nutrient management planning requirements, the cost model includes costs for soil sampling and analysis to determine the nutrient balance of the soil prior to manure application. Costs associated with soil sampling include a fixed cost for equipment purchase and soil sampling costs every 3 years.

Soil Sampler

The one time capital cost for equipment was estimated to be $25 for a soil auger (ASC Scientific, 1999). Category 3 facilities do not incur this cost since they have no land.

Soil Sampling

The cost model assumes that on-farm soil sampling will occur at least once every 3 years. EPA selected a soil sampling rate of one composite sample per 20 tillable acres, based upon a review of federal and state soil sampling recommendations. A composite soil sample was estimated to take 1 hour because of the distance between samples, and labor costs for soil sampling were estimated to be $10/hr. Costs for soil analysis for major nutrients and important soil characteristics were estimated at $10 per sample based on a review of costs by state NRCS labs. Category 3 facilities do not incur this cost since they have no land.

5.6.3 Manure Sampling

As part of nutrient management planning requirements, the cost model includes costs for manure sampling and analysis to determine the nutrient balance of the manure prior to application to cropland. Costs associated with manure sampling apply to all facilities and include a fixed cost for equipment purchase and semiannual manure sampling costs.

Manure Sampler

The one-time cost for equipment to sample liquid manure waste is estimated at $30 for a manure sampler. The manure sampler consists of a hollow conduit long enough to extend to the bottom of the lagoon, pit, or other storage structure. In the case of solid manure, a shovel or similar device is sufficient to obtain a representative sample and therefore no cost is assumed.

Manure Sampling

Manure sampling costs are based on sampling twice per year. The cost of manure sampling includes the labor required and the manure nutrient analysis. For all poultry and swine facilities, 1 hour is required to sample the main storage area. For dry poultry, an additional 0.25 hour per house is required to collect a composite sample from each house. Beef feedlots and

dairies are assumed to have two samples of the liquid waste and two samples of solid waste collected per year, for a total of four samples per year.

Labor rates are estimated at $10/hr. Manure analysis was estimated at $40 per sample based on a review of costs by state soil conservation service labs.

5.6.4 Recordkeeping and Reporting

As part of implementing a nutrient management plan, the cost model assigns annual costs to each facility for recordkeeping and reporting time. Recordkeeping costs ($880/year) for all facilities include the cost of recording animal inventories, manure generation, field application of manure and other nutrients (amount, rate, method, incorporation, dates), manure and soil analysis compilation, crop yield goals and harvested yields, crop rotations, tillage practices, rainfall and irrigation, lime applications, findings from visual inspections of feedlot areas and fields, lagoon emptying, and other activities on a monthly basis.

EPA estimated that large facilities incur an additional cost of $140/ year to maintain records of manure that is transferred to a third party. The average number of transfers per large CAFO is 16,900, based on excess manure estimates in Simons (2002). Using the 100-ton transfer estimate from Simons (2002), the average annual number of transfers per CAFO of 169 (16,900 ÷ 100). It should not require more than five minutes per transfer to record the four data items: the name of the recipient, the data of the transfer, the quantity of manure, and its nutrient content. Therefore, the annual burden estimate will be approximately 14 hours (169 transfers × 5 minutes/transfer ÷ 60 minutes/hour). The additional $8.50 cost per 20-ton load to weight a truck (Simons, 2002) is not a required cost of the rule and, therefore, is excluded from the offsite transfer cost estimate.

Records may include manure spreader calibration worksheets, manure application worksheets, maintenance logs, soil and manure test results, and documentation of corrective actions taken in response to findings from visual inspections. EPA assumed 8 hours were needed to prepare an annual report on animal inventories, manure generation, and overall manure

application. Monthly write-ups and field observations are assumed to require 3 hours each (72 hours annually). Thus, a total of 80 hours annually was estimated for recordkeeping at $10/hour. Other costs associated with recordkeeping, including obtaining signed certifications of proper manure application from off-site manure recipients, were estimated at 10 percent of labor costs.

5.6.5 Commercial Nitrogen Fertilizer

The nitrogen-to-phosphorus ratio in manure is typically much lower (approximately 2:1) than harvested crop nutrient removal ratios (approximately 6:1). Therefore, facilities that must land apply their manure on a phosphorus basis rather than a nitrogen basis incur additional costs because a commercial source of nitrogen must be applied to their fields (termed sidedressing) to compensate for the nitrogen not supplied through manure application. The cost model assumes a cost of 12.3¢ per pound of additional nitrogen is required, based upon the cost data shown in Table 5.6.5-1. No veal operations are assumed to need commercial fertilizer. Appendix A, Table A-11 presents the cost model results for purchasing commercial nitrogen fertilizer for beef feedlots, dairies, heifer, and veal operations.

Table 5.6.5-1

Retail Cost of Nitrogen Fertilizer

Fertilizer	Retail Cost Per Pound of Nitrogen
Anhydrous Ammonia	14¢
Urea	12¢
Ammonium Nitrate	11¢
U.S. Average	12.3¢

Source: The Fertilizer Institute, 1999.

5.6.6 Lagoon Depth Marker

EPA believes that all facilities with liquid waste impoundments should have a gauge to measure the remaining storage capacity. A lagoon depth marker can be manufactured by purchasing PVC pipe, fittings, and cement to construct a length of incrementally marked pipe long

enough to reach the bottom of the lagoon and extend above the freeboard. EPA estimated that building and installing a lagoon depth marker would cost $30.

5.6.7 Establishment of Setback Areas

The final rule requires either (1) a 100-foot manure application setback from surface waters, sinkholes, open tile drain inlets, or (2) a 30-foot vegetated buffer from surface waters, sinkholes, open tile drain inlets, or (3) one or more NRCS field practices providing an equal or better level of protection (a certified CNMP is deemed to meet this requirement).

However, EPA believes that in addition to manure application setbacks from surface waters, operations should also establish buffer strips or their equivalent to control erosion and treat field runoff. Thus, EPA estimated the costs of 100-foot buffer strips for fields used for manure application that are adjacent to streams, discussed below.

The costs of the buffer should be thought of as an allowance for the AFO to implement site specific field control practices such as conservation management. In other words, controls other than buffer strips may be more effective in certain situations (Sims J., A. Leytem, F. Coale, 2000), and this cost basis is considered an allowance that can be used to implement other runoff control practices.

Initial Fixed Costs

EPA calculated the ratio of stream length to land area based on national estimates of land area (3 million square miles of land in the contiguous United States (ESRI,1998) and stream miles (3.5 million miles of streams (USEPA, 2000). This ratio was converted to miles per acre (0.00144 mile of stream per acre of land). EPA then calculated the amount of land needed for buffer construction by multiplying the average acres of cropland for each model farm by the ratio of stream miles per acre of land, which determined the length of stream on each farm. EPA further assumed that the farm is square and the stream runs down the middle of the farm, and the width of the buffer (on both sides of the stream) is 100 feet. The cost of 100-foot buffers was

based on information collected from a total of 914 filter strip projects in 28 states with an average cost of $106.62/ac (1999 dollars; USEPA, 1993). The net loss of tillable land to establish a buffer was estimated at 3.5 percent of the cropland (0.00144 mile of stream per acre × 5,280 feet per mile × 200 ft^2 of buffer per foot of stream length ÷ 43,560 ft^2/ac). Thus, the cost for stream buffers was estimated at approximately $3.72/ac of total cropland.

Annual Costs

EPA assumed that the land taken out of production for installation of buffer strips was previously farmed. The rental value for land taken out of production was added to standard O&M costs. The rental value for cropland used as a stream buffer was estimated at $64.00/ac/yr based on analysis by North Carolina State University (NCSU, 1998).

5.6.8 Manure Spreader Calibration

EPA assumed that regular calibration of the manure spreader is part of implementing the nutrient management plan. To meet this need, EPA assumed that Category 1 and 2 facilities will purchase two calibration scales to weight the manure spreader before and after land application.

In cases where states require calibration of manure spreaders at broiler and turkey facilities, EPA assumed that calibration scales (or an equivalent calibration technology or method) are available to the facility, and therefore no costs were assumed. Solid manure spreaders can be calibrated in a number of ways, some of which are based on volume instead of weight. Liquid-based systems can also be calibrated in terms of volume. Section 8 of the Technical Development Document describers methods for calibration of manure spreaders in greater detail.

Weighing the spreader before and after application is the ideal methodology for wet or dry manure calibration because it is relatively quick and produces accurate results. This approach is unsuitable for manure application devices such as umbilical applicators. Instead, the volume of manure injected must be first be determined. The procedure includes collecting

pumped material into a bucket to determine the flow rate, which decreases initial calibration costs. Some operations that handle their manure in a drier form may be able to use a less expensive calibration method. For example, spreading manure on a tarp and weighing it on a less expensive hanging balance would reduce initial calibration costs.

Fixed One-Time Costs

EPA assumed the one-time cost for equipment is $500 for a scale to weigh the manure spreader (one under each wheel at $250 each).

Annual Costs

EPA estimated the cost for manure spreader calibration to be $100 based on 4 hours of labor, at $10 per hour, for both wet and dry applicators and 2 hours of tractor time at $30 per hour. EPA assumed that the time required for calibration included gathering required equipment, loading manure, weighing the spreader before and after land application, and applying manure to a known area of cropland. Category 3 facilities do not incur this cost since they have no land.

5.7 Screen Solid-Liquid Separation for Swine Operations

Solid-liquid separation systems are used by many livestock operations as a way to manage waste. Solid-liquid separation is the partial removal of organic and inorganic solids from a mixture of animal wastes and process-generated wastewater (known as liquid manure). Separating the solids from the liquid manure makes the liquids easier to pump and handle. The cost model assigns costs to swine operations for screen separation.

5.7.1 Technology Description and Design

Typically, screens are used to separate the solids from the liquids. As the liquids pass through the screen, the solids accumulate, and are eventually collected. After collection, the solids may be handled more economically for hauling, composting, refeeding or generating biogas (methane). EPA assumes that the separator efficiency is 30 percent and that the solids content of the separated manure is 23 percent.

The approach taken in the cost model is to separate the solid from the liquid portion of the manure to concentrate the nutrients thus reducing the costs associated with hauling the excess nutrients. Both Category 2 and 3 swine facilities are given costs for solid-liquid separation with screens.

5.7.2 Costs

Costs for solid/liquid separation are estimated as a one-time, fixed cost and an annual cost, based on the following calculations. Costs include a tank with sufficient capacity to store solids for six months, a mechanical solids separator, piping, and labor for installation.

Capital Cost

The following equation determines the initial cost to install a separator on a swine operation:

$$Sepinitial = (Solids \times Safety \times Tankcost) + Separator + Pipelen \times Pipecost + Seplabor \times Labor$$

where:

Sepinitial	=	Initial cost ($) to install a separator system
Solids	=	Volume of solids separated from the manure every 6 months, gal
Safety	=	Safety factor providing additional storage for the separator (115%)
Tankcost	=	Cost of installing a steel storage tank ($0.18/gallon)

Separator	=	Cost of a separation device was estimated at $13,000 for medium-sized operations and $28,000 for large operations, (USDA NRCS, 2002a)
Pipelen	=	Pipe length needed to connect the lagoon to the separator (250 feet)
Pipecost	=	Cost of pipe ($2.13/foot)
Seplabor	=	Time required to install the pipe and separator (4 hours)
Labor	=	Labor rate per hour ($10).

Annual Costs

The annual cost of operation and maintenance of solid-liquid separation systems was estimated to be 2 percent of the total cost of installing the system.

5.8 Land Application

The purchase of land application equipment is a primary component of the compliance costs for beef feedlots and dairies estimated by the cost model. The cost model estimates costs for the purchase of irrigation equipment to apply liquid from ponds and lagoons to the fields. The model assumes that all facilities already have equipment to apply solid manure and, therefore, includes no cost for this. As described in Section 4.10, the cost model calculates the total crop acreage used for application of liquid waste based on the nutrient assimilative capacity of the crops and the total waste generated, and uses this total acreage to cost irrigation equipment. The cost model includes no costs for application equipment for swine and poultry operations.

The cost model uses two forms of irrigation, center pivot and traveling gun. Center pivot irrigation is ideal for applying liquid waste to a large number of acres but is not as cost-effective for smaller acreage. Therefore, the cost model estimates costs for center pivot irrigation for facilities applying liquid manure to crop acreage greater than or equal to 30 acres and for traveling gun irrigation for facilities applying liquid manure to less than 30 acres.

5.8.1 Center Pivot Irrigation

Center pivots are a method of precisely irrigating virtually any type of crop over large areas of land. This technology is more expensive than other methods of irrigation, and therefore, costs included in the cost model for center pivot irrigation are conservative. A center pivot can effectively distribute liquid animal waste and supply nutrients to cropland at agronomic rates because they have a high level of control. The center pivot design is flexible and can be adapted to a wide range of site and wastewater characteristics. Center pivots are also advantageous because they can distribute the wastewater quickly, uniformly, and with minimal soil compaction. In a center pivot, an electrically driven lateral assembly extends from a center point where the water is delivered, and the lateral circles around this point, spraying water. A center pivot irrigation system is costed for all operations applying liquid manure to more than 30 acres of cropland under all regulatory options.

Technology Description

A center pivot generally uses 100 to more than 150 pounds of pressure per square inch (psi) to operate, which requires a 30- to 75-horsepower motor. The center pivot system is constructed mainly of aluminum or galvanized steel and consists of the following main components:

Pivot: The central point of the system around which the lateral assembly rotates. The pivot is positioned on a concrete anchor and contains various controls for operating the system, including timing and flow rate. Wastewater from a lagoon, pond, or other storage structure is pumped to the pivot as the initial step in applying the waste to the land.

Lateral: A pipe and sprinklers that distribute the wastewater across the site as it moves around the pivot, typically 6 to 10 feet above the ground. The lateral extends out from the pivot and may consist of one or more spans depending on the site characteristics. A typical span may be from 80 to 250 feet long, whereas the entire lateral may be as long as 2,600 feet.

Tower: A structure located at the end point of each span that provides support for the pipe. Each tower is on wheels and is propelled by either an electrically driven motor, a hydraulic drive wheel, or liquid pressure, which makes it possible for the entire lateral to move slowly around the pivot.

Figure 5.8.1-1 shows a schematic of a center pivot irrigation system.

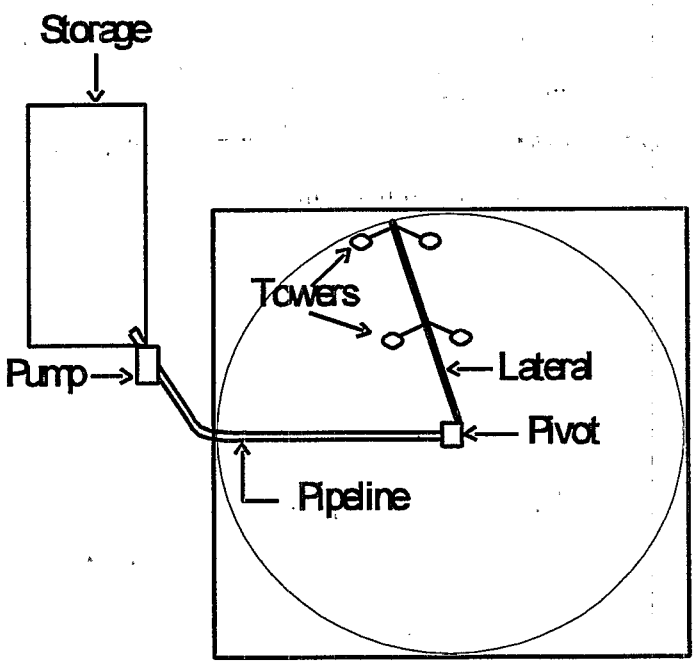


Figure 5.8.1-1. Schematic of Center Pivot Irrigation System

All regulatory options are based on the installation of irrigation equipment at beef feedlots, dairies, and heifer operations that land apply waste on site (i.e., Category 1 and 2 facilities). EPA developed frequency factors for center pivot irrigation based on the frequency factors for an unlined pond or lagoon. EPA assumed that if a facility has an unlined pond or lagoon on site, the facility would also already have some method of land application equipment to land apply the wastewater from this lagoon. These frequency factors are presented in Section 6.0. The cost model does not include costs for veal operations for center pivot irrigation because they are assumed to have sufficient storage capacity and therefore the necessary irrigation equipment.

Design

The center pivot is designed specifically for each operation, based on wastewater volume and characteristics, as well as site characteristics such as soil type, parcel geometry, and slope. The soil type (i.e., its permeability and infiltration rate) affects the selection of the water spraying pattern. The soil composition (e.g., porous, tightly packed) affects tire size selection as to whether it allows good traction and flotation. Overall site geometry dictates the location and layout of the pivots, the length of the laterals, and the length and number of spans and towers. Center pivots can be designed for sites with slopes of up to approximately 15 percent, although this depends on the type of crop cover and methods used to alleviate runoff. The costs assume a regular-shaped parcel (square), a water requirement of 7 gallons per minute per acre, and 1,000 operating hours per year.

5.8.2 Traveling Gun Irrigation

Based on industry expert opinion and literature, farms can irrigate relatively small areas using a traveling gun (USDA NRCS, 1996). Traveling guns are also useful in oddly shaped fields. These systems can be installed rapidly and are easily transported. However, the operation of traveling gun systems is more labor intensive than the operation of center pivot systems. Another disadvantage of traveling gun systems is low application efficiency. Water is sprayed high into the air, causing wind and evaporation losses up to 30 percent (Clemson Extension, 2002). The traveling gun system requires higher capital, annual, labor, and energy costs per irrigated acre than the center pivot system (Agriculture and Agri-Food Canada, 2002). Despite the disadvantages, traveling gun irrigation systems remain the best alternative for small acreages. A traveling gun system is costed for all operations with less than 30 acres of cropland under all regulatory options.

Technology Description

Traveling gun systems consist of a large sprinkler, a wheeled cart, a hose reel, and an irrigation hose. The sprinkler is also referred to as the "gun" or "big gun." The sprinkler is

moved during irrigation, hence the name "traveling gun." Traveling gun sprinklers discharge 50 to 1,000 gallons per minute with operating pressures from 60 to 120 psi (USDA NRCS,1996). A traveling gun sprinkler is mounted on a wheeled cart to allow for mobility. An irrigation hose is connected to the sprinkler on the wheeled cart and contained in a hose reel. There are two types of traveling gun operations depending on the type or irrigation hose used:

Hard-Hose - This type of traveling gun operation utilizes a hard, high-pressure, polyethylene hose. The hose is pulled out some distance from the hose reel. As the sprinkler operates, the hose reel begins to reel in the cart and sprinkler.

Soft-Hose - This system may also be called a Cable-Tow system. A soft, flexible hose similar to a fire hose is used. The entire hose must be unwound from the hose reel before use. The wheeled cart is placed in the field and anchored by a cable. A winch on the cart pulls reels the cable, pulling the cart closer to the anchor. The hose drags behind the cart and must be manually reeled after use.

The sprinkler travels a straight path, wetting a 200-400 foot wide strip of land (USDA NRCS, 1996). When one path is complete, the unit must be moved to an adjacent path to make another pass at the field. This process is repeated until the entire field is irrigated.

EPA developed frequency factors for traveling gun irrigation based on the frequency factors for an unlined pond or lagoon. These frequency factors are presented in Section 6.0. EPA assumed that if a facility has an unlined pond or lagoon on site, the facility would also already have some method of land application equipment to land apply the wastewater from this lagoon. The cost model does not include costs for veal operations because they are assumed to have sufficient storage capacity.

Design

The traveling gun is designed specifically for each operation, based on wastewater volume and characteristics, as well as site characteristics such as soil type, parcel geometry, and slope. The soil type and composition affects the selection of the water spraying volume.

5.8.3 Beef and Dairy Irrigation Costs

The only variable the cost model uses to determine costs for a center pivot and traveling gun irrigation systems are total acres irrigated.

Center Pivot

EPA derived annual and capital costs for center pivots from cost curves created from data available at a vendor web site (Zimmatic, Inc., 1999). Number of irrigated acres (61, 122, and 488) are plotted on the x-axis and costs (capital and annual) are plotted on the y-axis. Capital costs include the pivot, lateral, towers, pumps, piping, generator and power units, and erection. Annual costs include power consumption and routine maintenance of mechanical parts. Table 5.8.3-1 presents the costs for each of these points.

Table 5.8.3-1

Costs for Data Points from Center Pivot Irrigation Cost Curves

Number of Irrigated Acres	Capital Costs	Annual Costs
61	$58,741	$3,453
122	$64,130	$5,616
488	$122,414	$11,559

Source: http://www.Zimmatic.com.

Traveling Gun

Traveling gun costs are based on information provided by Kifco, Inc., an agricultural irrigation company. The cost model assumes that 250-gpm applicators would provide adequate coverage for cropland comprising less than 30 acres. Table 5.8.3-2 presents the capital costs for a 250-gpm applicator. Annual costs are estimated at five percent of the capital costs.

Table 5.8.3-2

Costs for 250-gpm Liquid Applicators

Model	Flow Rate (gpm)	Capital Cost
37M/1220	225-415	$28,990
40A/1320	250-480	$31,400

Source: (Kifco, 2002)

Total Capital Costs

A polynomial curve with a regression coefficient of 1 is drawn through the capital cost points. The cost model uses the resulting curve to estimate costs for the various acreages. The equation is:

$$y = 0.166x^2 + 57.958x + 54,588$$

where:

y = Capital cost
x = Irrigated acreage.

Total Annual Costs

A logarithmic curve with a regression coefficient of 0.9947 is drawn through the annual cost points. The cost model uses the resulting curve to estimate costs for various acreages. The equation is:

$$y = 3954 \ln(x) - 13,033$$

where:

y = Annual cost
x = Irrigated acreage.

Results

Appendix A, Tables A-12a and A-12b present the cost model results for implementing center pivot or traveling gun irrigation systems at beef feedlots, dairies, and heifer operations.

5.9 Transportation

Animal feeding operations use different methods of transportation to remove excess manure waste and wastewater from the feedlot operation. The costs associated with transporting excess waste off site are calculated using two methods: contract hauling waste or purchasing transportation equipment. EPA evaluated both methods of transportation for all regulatory options. The least expensive method for each model farm and regulatory option is chosen as the basis of the costs. Hauling at swine and poultry operations is assumed to be accomplished via contract hauling.

5.9.1 Technology Description

Many animal feeding operations use manure waste and wastewater on site as fertilizer or irrigation water on cropland; however, nutrient management plans (discussed in Section 5.6) require that facilities apply only the amount of nutrients agronomically required by the crop. When a facility generates more nutrients in its manure waste and wastewater than can be used for on-site application, they must transport the remaining manure waste and wastewater off site.

Beef feedlots, dairies, swine operations, and poultry operations are divided into three categories, as discussed in Section 1.3. Category 1 operations have sufficient cropland to agronomically apply all of their generated waste on site. Category 2 operations do not have sufficient cropland and may only agronomically apply a portion of their generated waste. Category 3 operations have no cropland and must transport all of their waste off site. The number

of operations in each category depends on the nutrient application requirements, because more land is required for nitrogen-based application than for phosphorus-based application.

The amount of excess waste that requires transport depends on the nutrient basis used for land application, as well as the practices and technologies employed at the facility (e.g., feeding strategies). Option 1 requires that animal waste be applied on a nitrogen basis to cropland, and Options 2 through 7 require application on a phosphorus basis as dictated by site-specific conditions. In general, the amount of waste transported off site increases under a phosphorus-based application option. Section 4.9 discusses the methodology used to determine the amount of excess waste at beef feedlots, dairies, swine operations, and poultry operations.

Manure is transported as either a solid or liquid material. The cost model assumes that solid waste is transported before liquid waste because it is less expensive to haul solid waste. This assumption means that operations apply liquid manure (i.e., lagoon and pond effluents) to cropland on site before solid waste.

In addition, some operations are located in states that already require them to apply manure to cropland on an agronomic nitrogen basis; therefore, these operations will not incur additional transportation costs under the N-based scenario. The percentage of facilities that are expected to incur transportation costs was based on EPA's Interim Final Report: *State Compendium: Programs and Regulatory Activities Related to Animal Feeding Operations - Interim Final Report* (EPA, 1999) and is discussed in detail in Section 6.0 of this report.

Contract Hauling

One method evaluated for transporting manure waste off site is contract hauling, whereby the operation hires an outside firm to transport the excess waste. This method is advantageous to facilities that do not have the necessary capacity to store excess waste on site or the cropland acreage to agronomically apply the material. In addition, this method is useful for operations that do not generate enough excess waste to warrant purchasing their own waste transportation trucks. Contract haulers can transport waste from multiple operations.

Equipment Purchase

Another method evaluated for transporting manure waste off site is to purchase transportation equipment. In this method, the operation owner purchases the necessary trucks to haul the waste to an off-site location. Depending on the type of waste transported, a solid waste truck, a liquid tanker truck, or both types of trucks are required. In addition, the owner is responsible for determining a suitable location for the waste, as well as all costs associated with loading and unloading the trucks, driving the trucks to the off-site location, and maintaining the trucks.

5.9.2 Design and Costs of Contract Hauling

In determining costs for the contract-hauling option, the cost model considered three major factors:

1) Amount of waste transported;
2) Type of waste transported (semisolid or liquid); and
3) Location of the operation.

Additional factors that relate to these three major factors include:

- Hauling distance;
- Weight of the waste;
- Rate charged to haul waste ($/ton-mile); and
- Percentage of operations in each region and category that incur transport costs.

Using these factors, the cost model uses the following three steps to determine costs for a model farm:

Step 1) Determine constants, based on region, animal type, and waste type;

Step 2) Determine the weight of the transported waste, accounting for water losses during storage or composting; and

Step 3) Determine the annual waste transportation costs.

Each of these steps is explained in detail below.

Step 1) Determine constants, based on region, animal type, and waste type

Constants used in this evaluation include the hauling distance, the moisture content of stockpiled manure, the moisture content of composted manure, and the hauling rate ($/ton-mile).

Hauling Distance

The one-way hauling distance for a Category 2 or 3 operation depends on the region in which it is located. The one-way hauling distance considers the size of the county, whether the county has a potential for excess manure nutrients, and the proximity of other counties that have a nutrient excess. The cost model assumes that Category 3 operations have always transported all of their waste; however, the cost model also assumes that the distance required for transport would increase under the P-based scenario. Therefore, the distance assigned to Category 3, P-based facilities is an incremental distance, representing the difference in distance a facility would have to transport under the P-based option. (For more details, see *Revised Transportation Distances for Category 2 and 3 Type Operations*, Tetra Tech, 2000.)

The P-based hauling distance is reduced where feeding strategies are used to reduce swine manure-P by 40 percent. EPA assumes that if total manure P is reduced by 40 percent, facilities will not have to haul their excess manure as great a distance. The cost model counted all major animal types in determining counties with nutrient excess. (Analysis based on Kellogg, R. et al., 2000.) Table 5.9.2-1 presents the Category 2 and Category 3 hauling distances by region.

Table 5.9.2-1

Hauling Distances for Transportation

Region	One-Way Hauling Distance (miles) for Category 2			One-Way Hauling Distance (miles) for Category 3		
	N-Basis	P-Basis	P-Basis*	N-Basis	P-Basis	P-Basis*
Central	11.0	16.5	NA	0	5.5	NA
Mid-Atlantic	5.5	30.5	18	0	25.0	18
Midwest	6.5	10.0	NA	0	3.5	NA
Pacific	12.5	21.5	NA	0	9.0	NA
South	6.0	14.5	NA	0	8.5	NA

Source: For detailed information on the calculation of one-way hauling distances, see *Revised Transportation Distances for Category 2 and 3 Type Operations.* Tetra Tech, 2000.
*P-Basis when feeding strategies are used to reduce total P by 40 percent.

Moisture Content of Waste

Based on available information, the cost model assumes that the moisture content of stockpiled manure is 35.4 percent and the moisture content of composted manure is 30.8 percent (Sweeten, J.M. and S.H. Amosson, 1995).

Hauling Rate

The $/ton-mile rates for liquid and solids wastes for Category 2 and 3 beef feedlots and dairies are estimated based on information obtained from various contract haulers and presented in Table 5.9.2-2. The hauling rates used for swine and poultry operations are presented in Table 5.9.2-3.

Table 5.9.2-2

Rates for Contract Hauling for Category 2 and 3 Beef Feedlots and Dairies

Type of Waste	Category 2 Rates		Category 3 Rates	
	N-Based Application	P-Based Application	N-Based Application	P-Based Application
Solid ($/ton-mile)	0.24	0.15	0	0.08
Liquid ($/ton-mile)	0.53	0.10	0	0.26

Source: For additional detail on the calculation of contract hauling rates, see *Methodology to Calculate Contract Hauling Rates for Beef and Dairy Cost Model, ERG 2000.*

Table 5.9.2-3

Hauling Rates for Category 2 and 3 Swine and Poultry Operations

Type of Waste	Rate
Liquid - First Mile ($/gallon-mile)	0.008
Liquid - Beyond First Mile ($/gallon-mile)	0.0013
Solid - Less than 90 Miles ($/ton-mile)	0.10
Solid - 90 to 1230 Miles ($/ton-mile)	0.23
Solid - Beyond 1230 Miles ($/ton-mile)	0.18

Source: Tetra Tech, 2002.

Step 2) Determine the weight of the transported waste

The amount of waste to be transported is estimated as the sum of separated solids, lagoon's pond effluent, lagoon's pond accumulated solids, and process and rainwater not applied to land.

Step 3) Determine the annual cost of transporting the waste

The annual cost of hiring a contractor to haul the waste is based on the amount of waste (in either semisolid or liquid form), the distance traveled, and the haul rate. The following equation incorporates both the solid and liquid annual hauling costs:

$$\text{Annual Cost} = (\text{Weight of Solids} \times \text{Solid Hauling Rate} \times \text{Hauling Distance}_{\text{Round-trip}}) + (\text{Weight of Liquids} \times \text{Liquid Hauling Rate} \times \text{Hauling Distance}_{\text{Round-trip}})$$

There are no capital costs associated with contract hauling. All hauling costs for swine and poultry operations are calculated using this basic approach for contract hauling.

5.9.3 Design and Cost of Purchase Equipment Transportation Option

In determining costs for the purchase truck transportation option, the cost model considered three major factors:

1) Amount of transported waste;
2) Type of waste transported (semisolid or liquid); and
3) The location of the operation.

Additional factors that relate to these three major factors include:

- Hauling distance;
- Number of hauling trips required per year;
- The waste volume;
- Average speed of the truck;
- Cost of fuel;
- Cost of maintenance;
- Cost of purchasing the truck;
- Cost for labor for the truck driver; and
- Percentage of facilities in each region and category that incur transport costs under the proposed regulatory options.

Using these factors, the cost model completes the following six steps to determine costs for a model farm:

Step 1) Determine constants, based on region, animal type, and waste type;

Step 2) Determine the weight of the waste transported, accounting for water losses during storage or composting;

Step 3) Determine the number of trucks and number of trips required to haul all of the waste each year;

Step 4) Determine the number of hours required to transport waste each year;

Step 5) Determine the purchase cost for the trucks required to transport the waste; and

Step 6) Determine the annual cost to transport the waste.

Each of these steps is explained in detail below.

Step 1) Determine constants, based on region, animal type, and waste type

Constants used in this evaluation include the hauling distance, the average speed of the truck, the moisture content of stockpiled manure, the moisture content of composted manure, the hours spent hauling per day, the loading and unloading time, the fuel rate, the maintenance rate, the hourly hauling rate, the volume of waste the truck can haul, and the purchase price of the truck.

Hauling Distance

The one-way hauling distance for an operation depends on the region in which it is located and what category operation is being evaluated. For each region, the average distance the waste must be hauled varies according to regional factors. Table 5.9.2-1 presents these distances.

Average Speed

The average speed of the truck is estimated to be 35 miles per hour (USEPA, 1995).

Moisture Content of Waste

Based on available information, the moisture content of stockpiled manure and composted manure is estimated to be 35.4 percent and 30.8 percent, respectively Sweeten, J.M. and S.H. Amosson, 1995).

Working Schedule

The cost model estimated that one laborer requires 25 minutes to load and unload the truck and hauls waste for 7 hours per day (USEPA, 1995).

Fuel Rate

The diesel fuel is estimated to cost $1.35 per gallon (Jewell, W.J., P.E. Wright, N.P. Fleszar, G. Green, A. Safinski, A. Zucker, 1997).

Maintenance Rate

The estimated maintenance rates for liquid and solid waste trucks are $0.63 per hauling mile and $0.50 per hauling mile, respectively (Jewell, W.J., P.E. Wright, N.P. Fleszar, G. Green, A. Safinski, A. Zucker, 1997; USEPA, 1995).

Labor Rate

The rate used in the cost model for the laborer to load, unload, and haul the waste is $10 per hour.

Capacity and Prices of Trucks

The size of the solid waste trucks vary, depending on the amount of waste that is hauled. The standard sizes and purchase prices for solid waste trucks used in the cost model are (USEPA, 1995):

7-cubic-yard truck = $91,728

10-cubic-yard truck = $137,593

15-cubic-yard truck = $183,457

25-cubic-yard truck = $241,054

The size of the liquid waste trucks also varies, depending on the amount of waste that is hauled. The standard sizes and purchase prices for liquid waste trucks used in the cost model are (USEPA, 1995):

1,600-gallon truck = $84,262

2,500-gallon truck = $113,061

4,000-gallon truck = $140,792

Step 2) Determine the weight of the waste transported

The amount of waste to be transported is estimated as the sum of separated solids, lagoon's pond effluent, lagoon's pond accumulated solids, and process and rainwater not applied to land.

Step 3) Determine the number of trips required to haul all of the waste per year

To determine the number of trips per year required to haul all of the waste, the cost model performs the following calculations. First, the size of the truck is determined. Then, the maximum possible number of trips per year is calculated, given the hauling schedule and the

number of days the truck is available for transport per year. A test is then performed to see if the truck size selected is large enough to transport all of the waste requiring transport within the time frame calculated as the maximum number of trips per year. If the truck is not large enough, then the cost model assumes that multiple trucks are purchased, and recalculates the equations based on the larger capacity.

The equation for the maximum number of trips per year is:

$$\text{Maximum Trips / yr} = \frac{(\text{Haul Schedule} \times \text{Haul Days})}{(\text{Truck Loading Time} + \text{Truck Unloading Time} + \text{Truck Haul Time})}$$

The capacity of the truck is determined through an iterative process that substitutes the size of the truck (10 cubic yards (CY), 15 CY, and 25 CY) and the number of trucks (1 or 2) into the following equation until the number of trips per year is greater than the maximum number of trips per year:

$$\text{Number of Trips / yr} = \frac{\text{Solid Waste}_{\text{(as collected)}}}{(\text{Number of Trucks} \times \text{Capacity of Truck})}$$

The equation for the actual number of trips per year is:

$$\text{Actual Trips / yr} = \frac{\text{Solid Waste}_{\text{(as collected)}}}{(\text{Number of Trucks} \times \text{Capacity of Truck})}$$

(Note: The number of trucks is rounded up to the nearest whole number.)

Step 4) Determine the number of hours required to transport waste each year

The number of hours required to transport all of the waste each year is based on the hauling time, the loading and unloading time, and the actual number of hauling trips per year, as shown below:

$$\text{Transport Hours} = (\text{Truck Loading Time} + \text{Truck Unloading Time} + \text{Truck Haul Time}) \times \text{Number of Trips}$$

Step 5) Determine the purchase cost of the trucks required to transport the waste

The purchase cost of the truck(s) depends on the number of trucks needed and the cost for that size of truck, as shown below:

$$\text{Purchase Cost} = \text{Number of Trucks} \times \text{Cost of Truck}$$

Step 6) Determine the annual cost to transport the waste

The annual operating and maintenance cost for owning and operating the trucks is based on the fuel spent, the maintenance rate per mile driven, and the labor costs. This is calculated for both the liquid waste transport and the solid waste transport. The equation for the annual cost is:

$$\text{Annual Cost} = (\text{Maintenance Rate} \times \text{Hauling Distance}_{\text{Round-trip}} \times \text{Number of Trips} + \text{Transport Hours} \times \text{Labor Rate} + \text{Hauling Distance}_{\text{Round-trip}} \times \text{Number of Trips} / \text{Fuel Rate}) \times \text{Number of Trucks}$$

5.9.4 Transportation Cost Test

When evaluating costs to transport waste off site, the cost model considered purchasing a truck to transport waste and hiring a contractor to haul waste as the two scenarios for the model beef feedlots, dairies, and veal operations. Because the weight and volume of the manure directly impact the transportation costs, each scenario was also considered with composting the waste prior to hauling and without composting. This section discusses the test used to determine which scenario is least costly for each model farm.

Purpose of the Cost Test

When animal feeding operations are unable to apply all of their waste on site at the appropriate agronomic rate, the waste is transported off site to a location where the waste is applied at the agronomic rate. EPA considered two methods of off-site transport: 1) hiring a contractor to haul the waste; or 2) purchasing a truck to move the waste without third-party assistance. In addition, animal feeding operations can choose to compost their waste before hauling to reduce the weight and volume of the waste and to improve the quality of the end product (see Section 5.12). EPA assumes that operations will choose the transportation and composting pair that is least expensive. To determine which method a beef feedlot, dairy, or veal operation will choose, the cost model conducts a test that compares the costs annualized over 10 years.

For each model farm that transports waste off site under Options 1 through 4, 6, and 7, the cost model assumes that the operation uses one of four transportation scenarios:

1) Composting with contract haul;
2) Composting with purchase truck;
3) No composting with contract haul; and
4) No composting with purchase truck.

For Option 5A, only transportation scenarios with composting are considered.

Cost Test Methodology

The transportation scenario that is costed for each operation is the least costly when annualized over 10 years. To determine this, each transportation scenario is costed separately. The cost for each transportation scenario is then added to the weighted farm costs to create four possible model farm costs, with capital costs and annual costs. Each of these is annualized, using the following equation:

$$A(n) = P \times I \times (1 + I)^n / [(1 + I)^n - 1] + A$$

where:

A(n)	=	Annualized cost over n years
P	=	Capital cost
I	=	Interest rate
n	=	Number of years
A	=	Annual cost.

The least expensive annualized cost of the four transportation scenarios is selected as the preferred scenario.

5.9.5 Results

Appendix A, Table A-13a presents the cost model results for transporting manure waste using contract hauling or purchasing transport equipment when applying on a nitrogen basis for beef feedlots, dairies, and heifer operations. Appendix A, Table A-13b presents the cost model results for transporting manure waste using contract hauling or purchasing transport equipment when applying on a phosphorus basis for beef feedlots, dairies, and heifer operations. Appendix B presents the selected transportation method for each of these model farms.

5.10 Ground-Water Assessment and Monitoring

Storing or treating animal waste at or below the ground surface has the potential to contaminate ground water. Ground-water wells may be used at animal feeding operations to monitor ground-water contamination. For Option 3A/3B, a ground-water assessment is used to determine whether a direct hydrologic connection to surface water exists. Ground-water well installation and associated monitoring is then costed for all model farms where there is a direct hydrologic connection between ground water and surface water.

5.10.1 Technology Description

Manure and waste that infiltrates into the soil, and is not taken up by crops, may contaminate underlying aquifers with nutrients, bacteria, viruses, hormones, and salts. Irrigation of manure may also contaminate aquifers with salt and high levels of total dissolved solids. In turn, such manure and waste may contaminate surface water which has a direct hydrologic connection to the ground water. Ground-water wells can be installed to monitor for these pollutants.

Geologic conditions, as well as the elevation and shape of the water table, vary based on region. A hydrogeologic site investigation may occur prior to well installation to determine site conditions and to determine the number and location of samples as well as the sampling depth.

5.10.2 Design and Costs

The design for the ground-water wells does not vary according to animal type or size of facility. It is assumed that each facility determined to have a direct hydrologic connection will install four 50-foot ground-water monitoring wells, one up-gradient and three down-gradient from the manure storage facility, as shown in Figure 5.10.2-1.

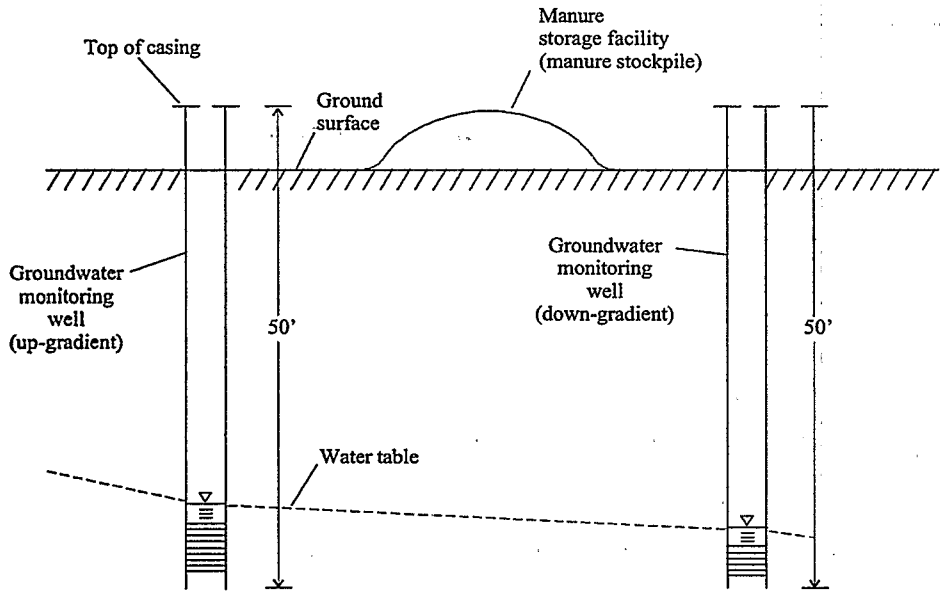


Figure 5.10.2-1. Schematic of Ground-Water Monitoring Wells

Assessment of Crop Field and Ground-Water Links to Surface Water

Because the assessment of ground-water links to surface water requires professional expertise, EPA estimates pay rates of $75 per hour for field work and report writing, and $65 per hour for research related to this task. Assessment activities include a limited review of local geohydrology, topography, proximity to surface waters, and current animal waste management practices. EPA estimates that the assessment activities would require 2 days of work at the operation, 2 days of office work, and 2 days to compile the data into a final report. In addition, EPA assumes that a farmhand spends 8 hours assisting in the assessment. EPA estimated that miscellaneous expenses, including travel time, photocopying, purchasing, maps, and report generation are 15 percent of total costs. This one-time assessment does not vary with the size or type of operation; therefore, the cost is the same for each model farm. The one-time labor cost does not vary by model farm and is calculated as follows:

geographic location, method of manure collection, and the type of waste management system. Table 5.13.2-1 summarizes the inputs used for both the covered lagoon and complete mix digesters. User-selected input values are noted with the letter "S" in brackets, [S]. Default input values that are selected are noted with an [S,d].

The representative region used for the large dairy is Tulare County, California. The model farm is assumed to have 1,450 cows, 435 heifers, and 435 calves in free stalls. The farm is evaluated for both a covered lagoon digester and a complete mix digester.

Based on the input data provided, FarmWare calculates the influent and effluent waste to and from the digester and the specific design and operating parameters. For the large dairy, the FarmWare model calculates a total manure generation of about 187,000 lb/day. With an average volatile solids (VS) production of 8.5 lb/day per 1,000 pounds of animal, the FarmWare program estimates a total VS production of about 18,000 lb/day. The model also generates the design specifications for each system as shown in Table 5.13.2-2.

A complete mix digester is a heated, constant volume, mechanically-mixed tank with a gas-impermeable collection cover. Manure waste is preheated and added daily to the digester, where it is intermittently mixed to prevent formation of a crust and to keep solids in suspension. Average manure retention times range from 15 to 20 days. The gas-tight cover maintains anaerobic conditions inside the tank and collects the biogas through attached pipes. The heat generated by burning the collected biogas is used to heat the digester (USEPA, 1997a).

A covered lagoon digester is the simplest type of methane recovery system. This digester consists of two basins, one of which is topped with a gas-impermeable cover. This floating impermeable cover is typically made of high density polyethylene (HDPE) or polypropylene. The cover may be designed as a "bank-to-bank" cover, which spans the entire lagoon surface with a fabricated floating cover, or as a "modular" cover, in which the cover comprises smaller sections. Biogas collects under the cover and is recovered for use in generating electricity. The second basin is uncovered and is used to store effluent from the digester. Often, manure waste is treated through a solids separator prior to the covered lagoon digester to ensure the solids content is less than 2 percent (USEPA, 1996).

Selection of the type of digester is dictated by the percent solids expected in the manure waste. To estimate the costs for a digester system, dairies that operate flush cleaning systems are assumed to use a covered lagoon system following a settling basin, while dairies that operate scrape systems are assumed to use a complete mix digester following a settling basin. The design of the digester and methane recovery system is based on the AgSTAR FarmWare model (EPA, 1997a). The design and cost of the concrete settling basins are discussed in Section 5.2.

5.13.2 Design

Dairy

Inputs to the FarmWare model are based on the model farm characteristics for a large dairy. The FarmWare model requires input data on the livestock type, number of animals,

5.13.1 Technology Description

Anaerobic digestion is the decomposition of organic matter in the absence of oxygen and nitrates. Under these anaerobic conditions, the organic material is stabilized and is converted biologically to a range of end products, including methane and carbon dioxide. Anaerobic treatment reduces BOD, odor, and pathogens, and generates biogas (methane) that can be used as a fuel. The methane-rich gas produced during digestion may be collected as a source of energy to offset the cost of operating the digester. Liquid and sludge from the system are applied to on-site cropland as fertilizer or irrigation water, or are transported off site.

Anaerobic digesters are specially designed tanks or concrete basins that can anaerobically decompose volatile solids in the manure to produce biogas. Manure and/or process wastewater may be routed to these digesters for storage and treatment. Depending on the waste characteristics, one of the following main types of anaerobic digesters may be used:

- Plug flow;
- Complete mix; and
- Covered lagoon.

Plug flow digesters are applicable for treating wastes with high (>10 percent) solids content, while covered lagoons are appropriate for treating wastes with low (<2 percent) solids content. Complete mix digesters are used for treating wastes with a solids content between 2 and 10 percent. The plug flow and the complete mix digesters are applicable in virtually all climates as they use supplemental heat to ensure optimal temperature. Covered lagoons generally do not use supplemental heat and are most effectively used in warmer climates (USEPA, 1996).

A plug flow digester is a constant volume, flow-through long tank with a gas-impermeable expandable cover. Manure waste is added to the digester daily, slowly pushing the older manure plugs through the tank. Average manure retention times range from 15 to 20 days. The gas-impermeable cover maintains anaerobic conditions inside the tank and collects the biogas through attached pipes (USEPA, 1997b).

At poultry operations, annual costs include both operation and maintenance costs. It is assumed that a sufficient supply of amendments is available on site. EPA estimates that mortality transportation, loading, and turning in compost bins requires 90 hours per year. The value of tractor usage is $30/hour, and the labor rate is set at $10/hour. The capital cost of the mortality composting facility is multiplied by .02 to estimate the annual maintenance cost of the facility. The total annual cost for mortality composting is therefore determined from the following equation:

$$\text{Annual Cost} = 90 \times (30 + 10) + .02 \times \text{Capital Cost}$$

5.12.4 Results

Appendix A, Table A-15 presents the cost model results for composting at each model farm.

5.13 Anaerobic Digestion with Energy Recovery

Anaerobic digesters are sometimes used at animal feeding operations to biologically decompose manure while controlling odor and generating energy. In the United States, as of 1998 there were about 94 digesters that were installed or were planned for working dairy, swine, and caged-layer poultry operations (Lusk, P., 1998). Of these 94 digesters, more than 60 percent of plug flow and complete mix digesters and 12 percent of the covered lagoon digesters have failed (Lusk, P., 1998). Many of these failures were of systems constructed prior to 1984; since that time, more simplified digester designs have been implemented, which have greatly improved reliability. Very few dairies in the United States have operable digesters with energy recovery.

Anaerobic digestion with energy recovery is used as the cost basis for Option 6. Under this option, only large dairies and large swine operations are costed for installation of an anaerobic digester, with energy recovery system.

The total capital cost for mortality composting structures varies with the size of the operation, and is calculated as follows:

$$\text{Capital Cost} = \frac{\text{Mortality Volume}}{\text{5 ft depth}} \times \$7.50 \text{ per square foot.}$$

Total Annual Costs

The volume of wheat straw required is used to determine the cost of the composting amendments. The total volume of the compost pile is used to calculate the labor costs for turning. The following equation is used to calculate the composting annual costs (Sweeten, J.M. and S.H. Amosson, 1995):

$$\text{Annual Cost} = (\$2.69/\text{ton} \times \text{Volume}_{\text{collected}}) + (\$72.68/\text{ton} \times \text{Volume}_{\text{wheat straw}}) + (\$1.75/100\text{cf} \times \text{Volume}_{\text{water}}) - (\$1.70 \times \text{Selling Weight}/2000)$$

where:

$\text{Volume}_{\text{collected}}$	=	Volume of manure collected for compost
$\text{Volume}_{\text{wheat straw}}$	=	Volume of wheat straw added to balance carbon/nitrogen ratio
$1.75	=	Cost of water per 100 cubic feet
$\text{Volume}_{\text{water}}$	=	Volume of water added to mixture
$1.70	=	Net value of compost as a fertilizer, subtracting value of manure as fertilizer (Sweeten, J.M. and S.H. Amosson, 1995)
Selling weight	=	Final composted weight of manure mixture.

Manure solids are expected to be reduced after composting; however, with the addition of the carbon amendments, the weight of compost to be transported or land applied is not significantly different than that manure that is not composted. The cost model calculates these differences, however, and considers them in calculating transportation costs, described in Section 5.9.

Table 5.12.3-1

Unit Costs for Composting

Unit	Cost (1997)	Source
Windrow turning equipment (Valoraction 510 rotary drum turner tractor attachment)	$8,914	On-Farm Composting Handbook, NRAES-54
Thermometers	$242.27 (for set of two)	Omega Engineering
Turning labor	$2.69/ton	On-Farm Composting Handbook, NRAES-54
Water	$0.00203 per gallon	EPA, Technical Development Document for Metal Products and Machinery Effluent Limitation Guidelines, in progress.
Value of manure fertilizer (based on nitrogen and phosphorus)	$4.99 per ton	Manure Quality and Economics, J.M. Sweeten, S.H. Amosson, and B.W. Auverman.
Value of composted manure (based on nitrogen and phosphorus)	$6.69 per ton	
Wheat straw	$72.68/ton	Case's Agworld.com

Capital costs for mortality composting are calculated assuming a depth of 5 feet. Then, the square footage of the composting facility is calculated from the volume. The cost model uses a construction cost of $7.50 per square foot for mortality compost facilities, based on the price of a poultry drystack/composter with concrete floor and wooden walls (USDA NRCS, 2002a). The capital cost is determined with the following equation:

$$\text{Capital Cost} = \text{MortVolume} \div 5 \times 7.50$$

Total Capital Costs

The following equation is used to calculate the windrow composting capital cost:

$$\text{Capital Cost} = \text{Windrow Turning Equipment} + \text{Thermometers}$$
$$= \$8{,}914 + \$242.27$$

The total capital costs for windrow composting is $9,156.27.

Compost Recipe

As stated in Section 5.12.1, manure must be mixed with composting amendments to obtain the proper C:N ratio and moisture content. The cost model assumes that wheat straw is used as the composting amendment. Wheat straw has a moisture content of 10 percent and a C:N ratio of 130. Manure collected from drylots has a moisture content of 35.4 percent. The carbon content is calculated from the volatile solids composition of manure. It is estimated that manure has a volatile solids composition of 564.6 lb/ton (Sweeten, J.M. and S.H. Amosson, 1995). The carbon content is calculated using the following equation (USDA NRCS, 1996):

$$\text{Carbon}_{\text{manure}} = \frac{\text{Volatile Solids}_{\text{manure}}}{1.8} = \frac{564.6}{1.8} = 314$$

The nitrogen content of manure is estimated to be 25.71 lb/ton (Sweeten, J.M. and S.H. Amosson, 1995). The carbon and nitrogen contents are converted to a percent basis. The C:N ratio of the manure is calculated using the percent composition and the volume of manure. Wheat straw and water are added to the compost mix until the C:N ratio is between 25:1 and 40:1 and the moisture content is between 40 and 65 percent. The cost model simulates this method in the composting cost module, performing an iteration to determine the proper mix of manure, wheat straw, and water.

5.12.3 Costs

Capital costs for windrow composting include turning equipment and thermometers to monitor the pile temperature. Annual costs include the labor to turn the pile and any required composting amendment (in this case, wheat straw and water). Additionally, EPA assumes that operations would be able to recoup some costs of composting by selling composted manure. EPA assumes that the cost recouped equals the difference between the selling price of uncomposted manure and composted manure. Table 5.12.3-1 presents the 1997 unit costs for these items.

50 percent (see Section 5.1). For beef and heifer feedlots, the additional volume added to the compost pile from the settling basin is the annual solids in runoff multiplied by the settling efficiency.

Volume Reduction

One of the major benefits of composting is waste volume reduction, which can reduce transportation costs. Finished compost is estimated to contain 30.8 percent moisture (Sweeten, J.M. and S.H. Amosson, 1995). This moisture content is used in the following equation to determine the weight of finished compost:

$$\text{Final Weight} = \text{Initial Weight} \times \frac{(1 - \text{Initial Moisture})}{(1 - \text{Final Moisture})}$$

Mortality Composting for Swine and Poultry Operations

The volume needed for mortality composting includes the dead animals and the other materials included in the compost mix. This mix of animals and compost ingredients is addressed in the cost model by using the factor of 2 cubic feet per pound of dead bird in the following equation:.

$$\text{MortVolume} = \text{nohead} \div \text{deadlen} \times \text{deadwt} \times \text{pctdead} \times 2 \times 1.5$$

where:

MortVolume	=	Total volume required, ft^3
Nohead	=	Number of animals
Deadlen	=	Lifespan of the animal, days/cycle
Deadwt	=	Market weight of the animal, lbs/head
Pctdead	=	Mortality rate (%/cycle expressed as a decimal fraction)
2	=	Primary plus secondary storage cubic feet per pound of dead animal (Barker, J.C., 2000)
1.5	=	Safety factor for catastrophic events.

excreted manure is the same as in the collected manure, the volume of manure collected from the drylot can be calculated using a mass balance on solids using the following equations:

$$\text{Volume Solids}_{\text{collected}} = \text{Volume Solids}_{\text{excreted}}$$

$$\text{Volume Solids} = \text{Total Volume} \times (1 - \text{Moisture})$$

$$\text{Volume}_{\text{collected}} (1 - \text{Moisture}_{\text{collected}}) = \text{Volume}_{\text{excreted}} (1 - \text{Moisture}_{\text{excreted}})$$

$$\text{Volume}_{\text{collected}} = \frac{[\text{Volume}_{\text{excreted}} (1 - \text{Moisture}_{\text{excreted}})]}{(1 - \text{Moisture}_{\text{collected}})}$$

The cost model estimates that manure collected from the drylot has a moisture content of 35.4 percent (Sweeten, J.M. and S.H. Amosson, 1995). The values of the parameters used to compute the volume of manure are contained in the manure reference table and cost run information in the cost model.

Some of the manure solids that accumulate on drylots are lost in the runoff from the feedlot before the waste is composted; therefore, the solids lost in runoff are subtracted from the total volume of manure. The amount of solids lost in runoff is estimated at 1.5 percent of the total drylot runoff (MWPS, 1985).

Settling Basins

Option 5A includes the addition of separated solids from the settling basin to the compost pile. Because wastes from dairy flush barns have a high moisture content, they are generally not composted; however, the settled solids from sedimentation basins can be added to the compost pile. Therefore, a fraction of the manure from mature dairy cows barns is added to the compost pile after some drying has occurred. For beef feedlots, only runoff enters the sedimentation basins; therefore, a fraction of the solids entering the basin as runoff is added to the compost pile.

For dairies, the cost model calculates the amount of separated solids by computing the amount of manure generated in the barn and parlor and multiplying by the settling efficiency of

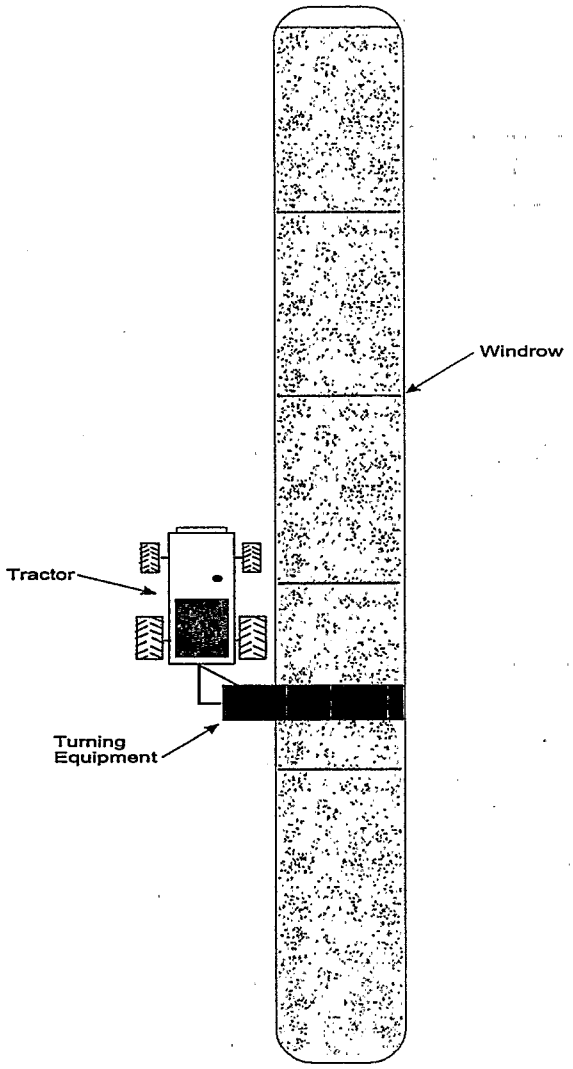


Figure 5.12.2-1. Windrow Composting

Drylots

The cost model assumes that all beef cattle, dairy calves, and heifers are kept on drylots. Manure from drylots is periodically scraped and moved to the compost pile. The amount of manure generated (as-excreted) is calculated using the information and equations in Section 4.6. The volume of manure collected from the drylot is less than the as-excreted volume because the manure moisture content decreases on the drylot. Because the volume of solids in the as-

Windrow Composting for Beef Feedlots, Dairies, and Heifer Operations

Windrow composting systems are designed for use at beef feedlots, heifer operations, and dairies. Manure and other raw materials are formed into windrows and periodically turned. The size and shape of the windrow depends on the type of turning equipment used by the site. The cost model assumes that sites use a tractor attachment for turning made by Valoraction, Incorporated (NRAES, 1992) (see Figure 5.12.2-1). This type of windrow turner can turn windrows 10 feet wide by 4.2 feet tall. Windrow composting requires less labor and equipment than other types of composting and allows greater flexibility with respect to location and composting amendments.

Beef feedlots and heifer operations can compost the manure collected from the drylots. Because dairies and veal operations use flush and hose systems, their waste is too wet for composting. However, the manure from calves and heifers kept on drylots at dairies can be composted. Separated solids from sedimentation basins can also be added to the compost pile.

A typical mortality composting facility consists of two stages, primary and secondary (USDA NRCS, 1996). The first stage consists of equally sized bins in which the dead animals and amendments are initially added and allowed to compost. The mixture is moved from the first stage to the second stage, or secondary digester, when the compost temperature begins to decline. The second stage can also consist of a number of bins, but it is usually just one bin or concrete area that allows compost to be stacked with a volume equal to or greater than the sum of the first stage bins. The design volume for each stage should be based on peak disposal requirements for the animal operation.

Volume of Manure

The cost model calculates the volume of waste transferred to the compost pile from drylots and from settling basins.

with strong odors are produced. Aerating the pile also helps to remove excess heat and trapped gases from the composting pile.

Composting time and efficiency are affected by the amount of oxygen, the energy source (carbon) and amount of nutrients (nitrogen) in the raw materials, the moisture content, and the particle size and porosity of the materials. The amounts of carbon, nitrogen, and moisture should be properly balanced in the initial compost mix. Moisture levels should be in the range of 40 to 65 percent. Water is necessary to support biological activity; however, if the moisture content is too high, water displaces air in the pore spaces and the pile can become anaerobic. Moisture content gradually decreases during the composting period. The carbon to nitrogen ratio (C:N) should be between 20:1 and 40:1. If the C:N ratio is too low, the carbon is used before all the nitrogen is stabilized and the excess nitrogen can volatilize as ammonia and cause odor problems. If the ratio is too high, the composting process slows as nitrogen becomes the limiting nutrient. Manure typically needs to be mixed with drier, carbonaceous material to obtain the desired moisture and C:N levels.

The length of time required for composting depends on the materials used, the composting management practices, and the desired compost characteristics. Composting is judged to be complete by characteristics related to its use and handling such as C:N ratio, oxygen demand, temperature, and odor. A curing period of about one month during which resistant compounds, organic acids, and large particles are further decomposed, follows composting.

5.12.2 Design

The cost methodology for all considered options included windrow composting at beef feedlots, dairies, and heifer operations. If the volume reduction resulting from composting resulted in a more cost effective option, then composting was selected as a waste management technology. The cost methodology for swine and poultry operations included mortality composting under ground water options. Each of these composting methods are described below.

50 percent (see Section 5.1). For beef and heifer feedlots, the additional volume added to the compost pile from the settling basin is the annual solids in runoff multiplied by the settling efficiency.

Volume Reduction

One of the major benefits of composting is waste volume reduction, which can reduce transportation costs. Finished compost is estimated to contain 30.8 percent moisture (Sweeten, J.M. and S.H. Amosson, 1995). This moisture content is used in the following equation to determine the weight of finished compost:

$$\text{Final Weight} = \text{Initial Weight} \times \frac{(1 - \text{Initial Moisture})}{(1 - \text{Final Moisture})}$$

Mortality Composting for Swine and Poultry Operations

The volume needed for mortality composting includes the dead animals and the other materials included in the compost mix. This mix of animals and compost ingredients is addressed in the cost model by using the factor of 2 cubic feet per pound of dead bird in the following equation:.

$$\text{MortVolume} = \text{nohead} \div \text{deadlen} \times \text{deadwt} \times \text{pctdead} \times 2 \times 1.5$$

where:

MortVolume	=	Total volume required, ft^3
Nohead	=	Number of animals
Deadlen	=	Lifespan of the animal, days/cycle
Deadwt	=	Market weight of the animal, lbs/head
Pctdead	=	Mortality rate (%/cycle expressed as a decimal fraction)
2	=	Primary plus secondary storage cubic feet per pound of dead animal (Barker, J.C., 2000)
1.5	=	Safety factor for catastrophic events.

Compost Recipe

As stated in Section 5.12.1, manure must be mixed with composting amendments to obtain the proper C:N ratio and moisture content. The cost model assumes that wheat straw is used as the composting amendment. Wheat straw has a moisture content of 10 percent and a C:N ratio of 130. Manure collected from drylots has a moisture content of 35.4 percent. The carbon content is calculated from the volatile solids composition of manure. It is estimated that manure has a volatile solids composition of 564.6 lb/ton (Sweeten, J.M. and S.H. Amosson, 1995). The carbon content is calculated using the following equation (USDA NRCS, 1996):

$$\text{Carbon}_{\text{manure}} = \frac{\text{Volatile Solids}_{\text{manure}}}{1.8} = \frac{564.6}{1.8} = 314$$

The nitrogen content of manure is estimated to be 25.71 lb/ton (Sweeten, J.M. and S.H. Amosson, 1995). The carbon and nitrogen contents are converted to a percent basis. The C:N ratio of the manure is calculated using the percent composition and the volume of manure. Wheat straw and water are added to the compost mix until the C:N ratio is between 25:1 and 40:1 and the moisture content is between 40 and 65 percent. The cost model simulates this method in the composting cost module, performing an iteration to determine the proper mix of manure, wheat straw, and water.

5.12.3 Costs

Capital costs for windrow composting include turning equipment and thermometers to monitor the pile temperature. Annual costs include the labor to turn the pile and any required composting amendment (in this case, wheat straw and water). Additionally, EPA assumes that operations would be able to recoup some costs of composting by selling composted manure. EPA assumes that the cost recouped equals the difference between the selling price of uncomposted manure and composted manure. Table 5.12.3-1 presents the 1997 unit costs for these items.

Table 5.12.3-1

Unit Costs for Composting

Unit	Cost (1997)	Source
Windrow turning equipment (Valoraction 510 rotary drum turner tractor attachment)	$8,914	On-Farm Composting Handbook, NRAES-54
Thermometers	$242.27 (for set of two)	Omega Engineering
Turning labor	$2.69/ton	On-Farm Composting Handbook, NRAES-54
Water	$0.00203 per gallon	EPA, Technical Development Document for Metal Products and Machinery Effluent Limitation Guidelines, in progress.
Value of manure fertilizer (based on nitrogen and phosphorus)	$4.99 per ton	Manure Quality and Economics, J.M. Sweeten, S.H. Amosson, and B.W. Auverman.
Value of composted manure (based on nitrogen and phosphorus)	$6.69 per ton	
Wheat straw	$72.68/ton	Case's Agworld.com

Capital costs for mortality composting are calculated assuming a depth of 5 feet. Then, the square footage of the composting facility is calculated from the volume. The cost model uses a construction cost of $7.50 per square foot for mortality compost facilities, based on the price of a poultry drystack/composter with concrete floor and wooden walls (USDA NRCS, 2002a). The capital cost is determined with the following equation:

$$\text{Capital Cost} = \text{MortVolume} \div 5 \times 7.50$$

Total Capital Costs

The following equation is used to calculate the windrow composting capital cost:

$$\text{Capital Cost} = \text{Windrow Turning Equipment} + \text{Thermometers}$$
$$= \$8{,}914 + \$242.27$$

The total capital costs for windrow composting is $9,156.27.

The total capital cost for mortality composting structures varies with the size of the operation, and is calculated as follows:

$$\text{Capital Cost} = \frac{\text{Mortality Volume}}{\text{5 ft depth}} \times \$7.50 \text{ per square foot.}$$

Total Annual Costs

The volume of wheat straw required is used to determine the cost of the composting amendments. The total volume of the compost pile is used to calculate the labor costs for turning. The following equation is used to calculate the composting annual costs (Sweeten, J.M. and S.H. Amosson, 1995):

$$\text{Annual Cost} = (\$2.69/\text{ton} \times \text{Volume}_{\text{collected}}) + (\$72.68/\text{ton} \times \text{Volume}_{\text{wheat straw}}) + (\$1.75/100\text{cf} \times \text{Volume}_{\text{water}}) - (\$1.70 \times \text{Selling Weight}/2000)$$

where:

$\text{Volume}_{\text{collected}}$	=	Volume of manure collected for compost
$\text{Volume}_{\text{wheat straw}}$	=	Volume of wheat straw added to balance carbon/nitrogen ratio
$1.75	=	Cost of water per 100 cubic feet
$\text{Volume}_{\text{water}}$	=	Volume of water added to mixture
$1.70	=	Net value of compost as a fertilizer, subtracting value of manure as fertilizer (Sweeten, J.M. and S.H. Amosson, 1995)
Selling weight	=	Final composted weight of manure mixture.

Manure solids are expected to be reduced after composting; however, with the addition of the carbon amendments, the weight of compost to be transported or land applied is not significantly different than that manure that is not composted. The cost model calculates these differences, however, and considers them in calculating transportation costs, described in Section 5.9.

At poultry operations, annual costs include both operation and maintenance costs. It is assumed that a sufficient supply of amendments is available on site. EPA estimates that mortality transportation, loading, and turning in compost bins requires 90 hours per year. The value of tractor usage is $30/hour, and the labor rate is set at $10/hour. The capital cost of the mortality composting facility is multiplied by .02 to estimate the annual maintenance cost of the facility. The total annual cost for mortality composting is therefore determined from the following equation:

$$\text{Annual Cost} = 90 \times (30 + 10) + .02 \times \text{Capital Cost}$$

5.12.4 Results

Appendix A, Table A-15 presents the cost model results for composting at each model farm.

5.13 Anaerobic Digestion with Energy Recovery

Anaerobic digesters are sometimes used at animal feeding operations to biologically decompose manure while controlling odor and generating energy. In the United States, as of 1998 there were about 94 digesters that were installed or were planned for working dairy, swine, and caged-layer poultry operations (Lusk, P., 1998). Of these 94 digesters, more than 60 percent of plug flow and complete mix digesters and 12 percent of the covered lagoon digesters have failed (Lusk, P., 1998). Many of these failures were of systems constructed prior to 1984; since that time, more simplified digester designs have been implemented, which have greatly improved reliability. Very few dairies in the United States have operable digesters with energy recovery.

Anaerobic digestion with energy recovery is used as the cost basis for Option 6. Under this option, only large dairies and large swine operations are costed for installation of an anaerobic digester, with energy recovery system.

5.13.1 Technology Description

Anaerobic digestion is the decomposition of organic matter in the absence of oxygen and nitrates. Under these anaerobic conditions, the organic material is stabilized and is converted biologically to a range of end products, including methane and carbon dioxide. Anaerobic treatment reduces BOD, odor, and pathogens, and generates biogas (methane) that can be used as a fuel. The methane-rich gas produced during digestion may be collected as a source of energy to offset the cost of operating the digester. Liquid and sludge from the system are applied to on-site cropland as fertilizer or irrigation water, or are transported off site.

Anaerobic digesters are specially designed tanks or concrete basins that can anaerobically decompose volatile solids in the manure to produce biogas. Manure and/or process wastewater may be routed to these digesters for storage and treatment. Depending on the waste characteristics, one of the following main types of anaerobic digesters may be used:

- Plug flow;
- Complete mix; and
- Covered lagoon.

Plug flow digesters are applicable for treating wastes with high (>10 percent) solids content, while covered lagoons are appropriate for treating wastes with low (<2 percent) solids content. Complete mix digesters are used for treating wastes with a solids content between 2 and 10 percent. The plug flow and the complete mix digesters are applicable in virtually all climates as they use supplemental heat to ensure optimal temperature. Covered lagoons generally do not use supplemental heat and are most effectively used in warmer climates (USEPA, 1996).

A plug flow digester is a constant volume, flow-through long tank with a gas-impermeable expandable cover. Manure waste is added to the digester daily, slowly pushing the older manure plugs through the tank. Average manure retention times range from 15 to 20 days. The gas-impermeable cover maintains anaerobic conditions inside the tank and collects the biogas through attached pipes (USEPA, 1997b).

A complete mix digester is a heated, constant volume, mechanically-mixed tank with a gas-impermeable collection cover. Manure waste is preheated and added daily to the digester, where it is intermittently mixed to prevent formation of a crust and to keep solids in suspension. Average manure retention times range from 15 to 20 days. The gas-tight cover maintains anaerobic conditions inside the tank and collects the biogas through attached pipes. The heat generated by burning the collected biogas is used to heat the digester (USEPA, 1997a).

A covered lagoon digester is the simplest type of methane recovery system. This digester consists of two basins, one of which is topped with a gas-impermeable cover. This floating impermeable cover is typically made of high density polyethylene (HDPE) or polypropylene. The cover may be designed as a "bank-to-bank" cover, which spans the entire lagoon surface with a fabricated floating cover, or as a "modular" cover, in which the cover comprises smaller sections. Biogas collects under the cover and is recovered for use in generating electricity. The second basin is uncovered and is used to store effluent from the digester. Often, manure waste is treated through a solids separator prior to the covered lagoon digester to ensure the solids content is less than 2 percent (USEPA, 1996).

Selection of the type of digester is dictated by the percent solids expected in the manure waste. To estimate the costs for a digester system, dairies that operate flush cleaning systems are assumed to use a covered lagoon system following a settling basin, while dairies that operate scrape systems are assumed to use a complete mix digester following a settling basin. The design of the digester and methane recovery system is based on the AgSTAR FarmWare model (EPA, 1997a). The design and cost of the concrete settling basins are discussed in Section 5.2.

5.13.2 Design

Dairy

Inputs to the FarmWare model are based on the model farm characteristics for a large dairy. The FarmWare model requires input data on the livestock type, number of animals,

geographic location, method of manure collection, and the type of waste management system. Table 5.13.2-1 summarizes the inputs used for both the covered lagoon and complete mix digesters. User-selected input values are noted with the letter "S" in brackets, [S]. Default input values that are selected are noted with an [S,d].

The representative region used for the large dairy is Tulare County, California. The model farm is assumed to have 1,450 cows, 435 heifers, and 435 calves in free stalls. The farm is evaluated for both a covered lagoon digester and a complete mix digester.

Based on the input data provided, FarmWare calculates the influent and effluent waste to and from the digester and the specific design and operating parameters. For the large dairy, the FarmWare model calculates a total manure generation of about 187,000 lb/day. With an average volatile solids (VS) production of 8.5 lb/day per 1,000 pounds of animal, the FarmWare program estimates a total VS production of about 18,000 lb/day. The model also generates the design specifications for each system as shown in Table 5.13.2-2.

Table 5.13.2-1

FarmWare Input Table

Input Data	Type of Digester	
	Covered Lagoon Digester	Complete Mix Digester
Climate Data		
County, State	Tulare, California [S]	
Rainfall	Determined by FarmWare [S,d]	
Recommended Minimum Lagoon Hydraulic Retention Time	42 days	
Recommended Maximum Lagoon Loading	10 lb VS/1,000 cu ft	
25-yr, 24-hr Storm	3.5 inches	
Annual Runoff Unpaved	23% of precipitation	
Annual Runoff Paved	50% of precipitation	
Annual Evaporation	55 inches	
Farm Type		
Farm Type	Dairy: Freestall [S]	
Farm Size (Farm Number)	1,450 milking cows [S] 435 heifers [S] 435 calves [S]	
Manure Collection Method	Flush parlor/ Flush freestall barn [S]	Flush parlor/ Scrape freestall barn [S]
Waste Treatment System	Methane recovery lagoon [S]	
Pretreatment	Settling basin [S]	NA

[S] = User selected input.
[d] = Default input.
NA - Not applicable.

Table 5.13.2-2

FarmWare Design Information

Design Information	Type of Digester	
	Covered Lagoon Digester	Complete Mix Digester
Waste Characteristics		
Amount of Influent Manure (lb)	1,656,696	239,325
Rainfall (lb)	14,883	NA
Amount Digested (lb)	23,642	76,285
Effluent (lb)	1,647,937	163,040
Design Parameters		
Hydraulic Retention Time (days)	42	20
Depth (ft)	20	20
Dimension (ft)	285 × 285	73 diameter
Freeboard (ft)	1	1
Slope (hor/ver)	2	NA
Total Volume (ft^3)	1,211,167	84,272

NA- Not applicable.

5.13.3 Costs

FarmWare calculates the cost to construct the digester, with or without energy recovery equipment. Option 6 costs were calculated including the cost for energy recovery equipment, the cost for water use, as well as an additional 15 percent of the capital costs estimated by FarmWare to account for contingency items.

The biogas that is collected during the digestion process may be used to produce electricity and propane. FarmWare allows the user to assign a unit value for electricity to estimate the amount of cost savings the farm would receive by recovering biogas for energy use. For Option 6 costs, a national average unit price for electricity of 7.4 cents per kilowatt hour (kWh) is used (USDOE, 1998).

The model also allows the user to assign a dollar value for benefits such as odor and pathogen reduction. For the Option 6 costs, no dollar value is assigned for these benefits.

Large Dairy - Covered Lagoon System

For this analysis, it is assumed that the cows spend 4 hours per day in the milking parlor and 20 hours per day in the barn, and the heifers and calves spend 24 hours per day in drylots. The milking parlor and the barn use a flush system for manure removal, and the wastewater is sent to a covered anaerobic lagoon through a settling basin. The manure from the feed apron and the drylots is scraped and applied to cropland.

The total lagoon digester volume is calculated to be about 1,200,000 cubic feet. With a lagoon depth of 20 feet, the linear surface dimensions are estimated to be 285 feet by 285 feet, representing a total area of about 81,225 square feet that requires an industrial fabric cover, such as an HDPE cover. Table 5.13.2-2 presents the design information for the covered lagoon digester, as determined by the FarmWare model.

The capital cost of a primary digester lagoon with cover is $111,000 and the engine generator is $80,000. Other engineering costs total $25,000. The total capital cost is $216,000. Annual costs include the FarmWare estimated operating savings, water costs for dilution water, and an estimated 15 percent of the total capital costs. The net annual operating cost is estimated to be ($63,994) per year (i.e., a net savings). This annual operating cost does not reflect additional potential decreases in transportation costs, due to the reduction in solids a digester causes. (Transportation costs are considered in Section 5.9 of this report).

Large Dairy - Complete Mix Digester System

For this analysis, it is assumed that the cows spend 4 hours per day in the milking parlor, which uses a flush system for manure removal and 20 hours per day in the freestall barn, and the heifers and calves spend 24 hours per day in drylots. The wastewater from the milking

parlor goes through a mix tank before going to the complete mix digester. The manure in the freestall barn and the drylots is scraped and applied to cropland.

The total digester volume is calculated to be about 84,000 cubic feet. With a digester depth of 20 feet, the diameter is estimated to be 73 feet, with a total area of 4,200 square feet. Table 5.13.2-2 presents the design information for the complete mix digester, as determined by the FarmWare model.

The capital costs for the complete mix digester is $127,000, the mix tank is $26,000, and the engine generator is $187,000. Other engineering costs total $25,000. The total capital cost is $364,857. Annual costs include the FarmWare estimated operating savings, water costs for dilution water, and an estimated 15 percent of the total capital costs. The net annual operating cost is estimated to be ($85,969) per year (i.e., a net savings). This annual operating cost does not reflect potential decreases in transportation costs, due to the reduction in solids a digester causes. (Transportation costs are considered in Section 5.9 of this report.)

Swine Operations

The capital and annual costs for digesters were determined from the following two equations using data from Table 5.13.3-1:

$$\text{Capital Cost} = \text{nohead} \times \text{capheadcost}$$

$$\text{Annual Cost} = \text{nohead} \times \text{annheadcost}$$

where:

Nohead	=	Number of animals
Capheadcost	=	Capital cost per animal
Annheadcost	=	Annual cost per animal.

Table 5.13.3-1

Digester Costs for Swine

Manure Type	Operation Type	Region	Capital Cost ($ per Head)	Annual Cost ($ per Head)
Pit	Grower-Feeder	Mid-Atlantic	41.3	-6.31
	Grower-Feeder	Midwest	42.1	-5.77
	Farrow-Feeder	Mid-Atlantic	39.09	-2.08
	Farrow-Feeder	Midwest	39.37	-2.42
Liquid	Grower-Feeder	Mid-Atlantic	38.73	-6.18
	Grower-Feeder	Midwest	39.45	-5.57
	Farrow-Feeder	Mid-Atlantic	33.81	-1.97
	Farrow-Feeder	Midwest	34.79	-2.13
Evaporative Pond	Grower-Feeder	Central	37.62	-5.55
	Farrow-Feeder	Central	33.81	-2.13

5.13.4 Results

Appendix A, Table A-16 presents the cost model results for constructing anaerobic digesters with methane recovery at large dairies.

5.14 Litter Storage Sheds

Litter storage is included in the costing for all dry poultry operations. Requirements for poultry litter storage structures are similar to those for mortality composting facilities in that they require a roof, foundation and floor, and suitable building materials for side walls. Storage facilities are assumed to be 68 feet wide and 8 feet tall. Litter is assumed to be stacked to the top in a trapezoidal pile 48 feet wide at the base and 32 feet wide at the top. There are aisles 10 feet wide on either side of the stack. It is assumed that poultry litter storage facilities include a roof with a 0.75 pitch, a concrete floor 16 feet wide, and a 12-foot height from floor to roof (NCSU, 1998). The width and height were designed for piling manure to its angle of repose to minimize space. The length of the structure is variable.

The size of a poultry manure storage facility was calculated based on the volume of both manure and litter produced from the various poultry operations. Manure production for all poultry types, when designing manure storage facilities, was assigned a value of 0.00169 ft^3 per bird per day (or 0.6169 ft^3 per bird per year) (NCSU, 1998). The basic equation for calculating manure production is:

$$Volume_{Manure} = 0.00169 \times Nohead \times 365$$

where:

$Volume_{Manure}$	=	Annual volume of manure, ft^3
Nohead	=	Number of animals
365	=	Days in year.

Litter production was calculated as the number of houses (25,000 chickens or 6,250 turkeys per house) multiplied by the shaving material application depth (3.0 inches), multiplied by the area of the house (16,000 ft^2), adjusted for the amount of house floor area to receive shavings (zero percent for layers, 33 percent for pullets, and 100 percent for the remaining poultry types), and multiplied by the frequency of litter storage emptying (no more than two times per year). The basic equation for calculating litter production is:

$$Volume_{Litter} = Houses \times Depth_{Shavings} \times Area_{House} \times Coverage$$

where:

$Volume_{Litter}$	=	Volume of litter in houses, ft^3
Houses	=	Number of animal houses
$Depth_{Shavings}$	=	Depth of litter, ft
$Area_{House}$	=	Area of house floor, ft^2
Coverage	=	Portion of floor covered with litter (decimal fraction).

The volumes of manure and litter production are summed to arrive at the total volume produced annually. The cost model assumes storage for six months. The volume of storage required for the facility is calculated from the following:

$$Volume_{Storage} = (Volume_{Litter} + Volume_{Manure}) \times Duration \div 12$$

where:

$Volume_{Storage}$	=	Storage facility volume
Duration	=	Time period for storage (months)
12	=	Months per year.

Assuming a height of 8 feet, the square footage of the litter storage facility is calculated from the volume. EPA uses a construction cost of $8.50 per square foot based upon the cost of a structure with concrete floors and walls since there is a risk of spontaneous combustion at a stacking height of 8 feet (USDA NRCS, 2002a). The capital cost is determined from the following equation:

$$Capital\ Cost = Volume_{Storage} \div 8 \times 8.50$$

The cost model includes no operating cost for storage facilities since manure and litter management are considered part of the baseline scenario. Appendix Tables 17a through 17c present capital costs for storage at dry poultry operations.

5.15 Lagoon Covers

The cost of lagoon covers is estimated as a technology that complies with Option 5 for Category 2 and 3 swine, layer, and veal operations. Flares are added to covered lagoons for swine and poultry operations. In addition to covering lagoons under Option 5, evaporative pond systems at swine operations are assumed abandoned and replaced with a new covered lagoon and berms. These new lagoons are designed for a volume that does not include direct precipitation since they are covered. Berms are not constructed around the abandoned evaporative pond. For wet layer operations, lagoons for egg washing waste are also covered, but flares are not added.

Design

As discussed in Section 5.4, lagoon shape is assumed to approximately be a frustrum with top length and width equal and bottom length and width equal. Lagoon cover size is estimated as the square footage of the top surface of the lagoon. Lagoon cover size is calculated as:

$$Cover = W_{lagoontop} \times L_{lagoontop}$$

where:

$W_{lagoontop}$	=	Width of top of lagoon or evaporative pond, ft
$L_{lagoontop}$	=	Length of top of lagoon or evaporative pond, ft.

Lagoons for egg wash water at wet layer operations are designed to provide storage for six months in accordance with the procedure described in Section 5.4.5 for swine and poultry operations. The volume required for egg wash water is determined from the following equation:

$$Volume_{EggWash} = Nohead \times 0.057756619$$

where:

Nohead	=	Number of layers
0.05776	=	Egg wash water volume per head per 6 months.

Layers produce an average of 256 eggs per year (USDA NASS, 1998). A value of 4.6 liters per case is used based upon the quantity of wash water used for table eggs (Hamm, D., G. Searcy, and A. Mercuri. 1974). There are 360 eggs per case (United Egg, 2002), so 0.000451238 cubic feet of water is used per egg (4.6/360 × 0.03531435 cubic feet/liter). Since storage is for six months, the volume of egg wash water per head is 0.05776 (256 × 0.000451238 ÷ 2).

Fixed One-Time Costs

Several lagoon cover manufacturers were contacted to identify costs of purchasing and installing lagoon covers. The results of the survey are shown in Table 5.15-1. Installed lagoon covers range from $1.20 to $4.81 per square foot, with lower costs per square foot expected at larger installations and depending upon whether insulation is required. Thus, to develop costs for installation of insulated lagoon covers, a cost of $4.00 per square foot was assumed. The capital cost of a flare is estimated to be $2,500, and the cost for a cover and flare is calculated using the following equation:

$$\text{Capital Cost} = \text{Area of Cover} \times \$4/\text{ft}^2 + \$2{,}500$$

Table 5.15-1

Manufacturer-Suggested Costs of Lagoon Covers for ½-Acre Lagoons

Dealer	Description	Cost
Lange Containment Systems, Inc.	30 mil PVC liner, 36 mil reinforced Hypalon cover system	$1.28/ft^2
	installation	$34,665
CW Neal	½-acre lagoon, 32-mil polypropylene, installed	$3-4/ft^2
Environmental Fabrics, Inc.	½-acre lagoon, 40 mil HDPE uninsulated cover, gas, and rain collection	$0.85/ft^2
	½-acre lagoon, 40 mil HPDE R-6 insulated cover, gas, and rain collection	$2.25/ft^2
Reef Industries	Permalon®, ply X-210 reinforced floating cover system (not including foam float logs)	$0.40/ft^2
Geomembrane Technologies, Inc.	½-acre cover system installed, 30 mil reinforced modified PVC layer (XR-5) and ½-inch sublayer	$105,000
Environmental Protection Inc.	36 mil reinforced cover	$0.45 - $0.50/ft^2

Annual Costs

Operation and maintenance costs for lagoon covers were estimated at 2 percent of capital costs. Appendix Table A-18 presents costs for lagoon covers at veal operations.

5.16 Feeding Strategies

Feeding strategies designed to reduce nitrogen (N) and phosphorus (P) losses include more precise diet formulation, enhancing the digestibility of feed ingredients, genetic enhancement of cereal grains and other ingredients resulting in increased feed digestibility and improved quality control. These strategies increase the efficiency with which the animals use the nutrients in their feed and decrease the amount of nutrients excreted in the waste. With a lower nutrient content, more manure can be applied to the land and less cost is incurred to transport excess manure from the farm. Strategies that focus on reducing P concentrations, thus reducing overapplication of P and associated runoff into surface waters, can turn manure into a more balanced fertilizer in terms of plant requirements.

5.16.1 Technology Description

Feeding strategies that reduce nutrient concentrations in waste have been developed for specific animal sectors, and those for the swine and poultry industries are described below. The application of these types of feeding strategies to the beef industry has lagged behind other livestock sectors and is not discussed here.

Swine

Lenis and Schutte (1990) showed that the protein content of a typical Dutch swine ration could be reduced by 30 grams per kilogram without negative effects on animal performance. They calculated that a 1-percent reduction in feed N could result in a 10-percent reduction in excreted N. Monge et al. (1998) confirmed these findings by concluding that a 1-percent reduction in feed N yielded an 11-percent reduction in excreted N. Experts believe that N losses through excretion can be reduced by 15 to 30 percent in part by minimizing excesses in diet with better quality control at the feed mill (NCSU, 1998).

Poultry

Precision nutrition entails formulating feed to meet more precisely the animals' nutritional requirements, causing more of the nutrients to be metabolized, thereby reducing the amount of nutrients excreted. For more precise feeding, it is imperative that both the nutritional requirements of the animal and the nutrient yield of the feed are fully understood. Greater understanding of poultry physiology has led to the development of computer growth models that take into account a variety of factors, including strain, sex, and age of bird, for use in implementing a nutritional program. By optimizing feeding regimes using simulation results, poultry operations can increase growth rates while reducing nutrient losses in manure.

Phytase can be used to feed all poultry. Phosphorus reductions of 30 to 50 percent have been achieved by adding phytase to the feed mix while simultaneously decreasing the amount of inorganic P normally added (NCSU, 1999). Addition of phytase to feed significantly reduces P levels in poultry manure. The high cost of phytase application equipment has discouraged more widespread use. Phytase is in use at many poultry operations.

5.16.2 Costs

The cost model applies feeding strategies to all Category 2 and 3 swine and poultry operations under all options. Hauling costs are compared for the cases with and without feeding strategies under a range of technology scenarios, including separators, retrofit scraper systems, sludge cleanout, highrise hog houses, hoop houses for hogs, and lagoon covers.

The basic approach to estimating the costs of feeding strategies involves six steps:

1. Determine P-based and N-based feeding strategy costs for animal type;
2. Determine the quantity of N and P in the applied manure;
3. Determine the acreage required to spread manure under N-based or P-based management;

4. Determine the quantity of nutrient in excess of on-farm needs;

5. Determine hauling costs; and

6. Add hauling costs to feeding strategy costs.

Feeding Strategy Costs

Feeding strategy costs for both swine and poultry are provided in Table 5.16.2-1 (Tetra Tech, 2000c). EPA estimates that it costs $10 per ton ($0.005 per pound) to reduce nitrogen in feed. It is assumed that layers consume the same quantity of feed per day as do broilers, which consume 11 pounds of feed, costing $0.055, to achieve market weight. Since broiler turnover is 5.5 flocks per year, versus 1 flock per year for layers, the quantity of feed for layers is estimated as 5.5 × 11, bringing the cost to $0.3025 per layer (5.5 × 0.055). Turkeys consume 46 pounds of feed, at a cost of 46 × 0.005, or $0.23 per turkey.

Phosphorus feeding strategy costs for broilers and layers are assumed to be zero since integrators supply the feed to the growers, and phytase is commonly used at these operations. The cost of phytase is estimated at $1 per ton, or $0.0005 per pound. For turkeys, the feeding cost is therefore 46 × 0.0005, or $0.023 per turkey.

Table 5.16.2-1

Feeding Strategy Costs for Swine and Poultry

Animal	Turns	Feeding Strategy Costs ($ Per Animal)	
		N Strategy	P Strategy
Broiler	5.5	0.055	0
Layer	1	0.3025	0
Turkey	2.5	0.23	0.023
Pig - FF	2.1	2.70	0.36
Pig - GF	2.8	2.70	0.36

Feeding costs are calculated using the following equations:

Swine - P-Based: $Cost_{FS} = Nohead \times UnitCost \times Turns \times 0.7$

Other: $Cost_{FS} = Nohead \times UnitCost \times Turns$

where:

$Cost_{FS}$	=	Cost of feeding strategies
UnitCost	=	Cost per animal for feeding strategy (Table 5.16.2-1)
Turns	=	Number of flocks or turnovers per year (Table 5.16.2-1).

Quantity of Nutrients Applied

Implementation of feeding strategies reduces the quantity of nutrients excreted. The cost model assumes a 40-percent reduction in phosphorus excretion and a 20-percent reduction in nitrogen excretion under P-based and N-based feeding strategies, respectively. The following equation is used to calculate nutrient production resulting from feeding strategy implementation:

$$Nutrient_{FS} = Nutrient \times (1\text{-}Reduction)$$

where:

$Nutrient_{FS}$	=	Total nutrient (N or P) in manure under feeding strategies
Nutrient	=	Total nutrient (N or P) in manure without feeding strategies
Reduction	=	Feeding strategy nutrient reduction (N or P).

Acreage Required for Spreading

The acreage required to spread manure is calculated based upon nutrient content of the manure, nutrient losses occurring during transport of the manure to the field, crop uptake of the nutrient, and the portion of manure given away by the operation. The cost model assumes that all nutrients are available to the crops, which is a conservative estimate with regard to

acreage requirements. The values for nutrient uptake by crops are given in Table 5.16.2-2 (Tetra Tech, 2000c). The following equation is used to determine the acreage required for spreading:

$$Acreage_{FS} = Nutrient_{FS} \times Efficiency \times (1\text{-}Given) \div Uptake$$

where:

$Acreage_{FS}$	=	Acreage required to spread manure under feeding strategies, acres
$Nutrient_{FS}$	=	Total nutrient (N or P) in manure under feeding strategies, pounds per year
Efficiency	=	Portion of nutrient (N or P) available to crop, decimal fraction = 1
Given	=	Portion of manure given away, decimal fraction
Uptake	=	Crop uptake of nutrient (N or P), pounds per acre per year (Section 4.9).

Table 5.16.2-2

Crop Nutrient Uptake

Animal Type	Region	N Uptake (pounds per acre per year)	P Uptake (pounds per acre per year)
Poultry	Mid-Atlantic	183	20
	Midwest	141	10
	South	141	10
Swine	Central	185	24
	Mid-Atlantic	138	14
	Midwest	198	19

Excess Nutrients

The cost model assumes that nitrogen feeding strategies are used under N-based management, while phosphorus feeding strategies are used under P-based management. Excess nutrients result when the acreage required to spread the manure at either N-based or P-based

agronomic rates exceeds the acreage available at the operation. The cost model requires hauling for cases where there are excess nutrients. The following equation is used to calculate the quantity of excess nitrogen and phosphorus under P-based management where phosphorus feeding strategies are employed:

$$Excess_N = N_{NoFS} \times (1 - Acreage_{Farm} \div Acreage_{FS\text{-}P}) \times (1\text{-Given})$$

$$Excess_P = (P_{FS} - P_{Farm}) \times (1\text{-Given})$$

where:

$Excess_N$	=	Excess nitrogen, lb/yr
$Excess_P$	=	Excess phosphorus, lb/yr
N_{NoFS}	=	Nitrogen in manure without feeding strategies, lb/yr
P_{FS}	=	Phosphorus in manure with feeding strategies, lb/yr
P_{Farm}	=	Phosphorus required on farm to meet crop nutrient requirements, lb/yr
$Acreage_{Farm}$	=	Acreage on farm available to spread manure, acres
$Acreage_{FS\text{-}P}$	=	Acreage required to spread manure under P feeding strategies, acres
Reduction	=	Feeding strategy nutrient reduction (N or P)
Given	=	Portion of manure given away, decimal fraction.

A similar set of equations is used to determine excess nitrogen and phosphorus amounts under N-based nutrient management. In simple terms, the amount of manure spread on the farm is based upon the quantity of the target nutrient (N or P) available in the manure after feedings strategies for that nutrient are implemented. The nutrients in the leftover manure are considered excess nutrients.

Hauling Costs

Hauling costs are determined using the basic approach described for contractor hauling costs in Section 5.9.2. The portion of manure to be hauled is determined from the following equation:

$$HaulPct = 1 - (Acreage_{Farm} \div Acreage_{FS})$$

where:

HaulPct	=	Portion of manure hauled away, decimal fraction
$Acreage_{Farm}$	=	Acreage on farm available to spread manure, acres
$Acreage_{FS}$	=	Acreage required to spread manure under (N or P) feeding strategies, acres.

The quantity of manure to be hauled is calculated from the following equations for liquid and solid manure:

Liquid: $Volume_{LiquidManure} = Volume_{Manure} \times HaulPct \times (1\text{-}Given) \times (1\text{-}Mangive)$

Solid: $Weight_{SolidManure} = Weight_{Manure} \times HaulPct \times (1\text{-}Given) \times (1\text{-}Mangive)$

where:

$Volume_{LiquidManure}$	=	Annual volume of liquid manure to haul, gallons/year
$Weight_{SolidManure}$	=	Annual weight of solid manure to haul, tons/year
$Volume_{Manure}$	=	Annual volume of manure produced, gallons/year
$Weight_{Manure}$	=	Annual weight of manure produced, tons/year
Given	=	Portion of manure given away, decimal fraction
HaulPct	=	Portion of manure hauled away, decimal fraction
Mangive	=	Frequency factor for giving manure away.

EPA assumes that Category 3 operations incur no cost to haul manure under N-based management since that is the baseline scenario. For all other Category 2 and 3 liquid-based swine and poultry operations, the cost of hauling the sludge is determined using the following equation:

$$Cost_{Liquid} = (Volume_{LiquidManur} \times LiquidFirst) + (LiquidAdd \times Volume_{LiquidManur}) \times (Transport\text{-}1))$$

where:

$Cost_{Liquid}$	=	Annual cost of hauling liquid manure
$Volume_{LiquidManur}$	=	Annual volume of liquid manure to haul, gallons/year
LiquidFirst	=	Liquid hauling cost for first mile
LiquidAdd	=	Liquid hauling cost beyond first mile
Transport	=	Transport distance for hauling manure.

Transport distances are given in Table 5.9.2-1. For the Mid-Atlantic region, the transport distances for liquid hauling are changed if feeding strategies are employed. If the hauling percentage (HaulPct) is less than 20 percent (0.20), the transport distance is set at 5.5 miles, the distance for N-based management at Category 2 facilities (see Table 5.9.2-1). Otherwise, the transport distance is set to 18 miles in the Mid-Atlantic region.

For all other Category 2 and 3 solid-based operations, the cost of hauling the manure is determined using the following equation:

$$Cost_{Solid} = Weight_{SolidManure} \times HaulRate \times Transport$$

where:

$Cost_{Solid}$	=	Annual cost of hauling solid manure
$Weight_{SolidManure}$	=	Annual weight of solid manure to haul, tons/year
HaulRate	=	Hauling rate based upon hauling distance (Table 5.17.3-3)
Transport	=	Transport distance for hauling manure.

Total Feeding Strategy Costs

The cost model assessed the relative cost of feeding strategies by summing the costs for feeding strategies and the associated hauling. This cost can be compared versus hauling without feeding strategies to determine which is less expensive. Similarly, hauling associated with other nutrient reduction technologies (e.g., scraper systems) is costed with and without feeding strategies. The total cost of feeding strategy implementation is estimated with the following equation:

$$Cost = Cost_{FS} + Cost_{Hauling}$$

where:

$Cost_{FS}$	=	Cost of feeding strategies
$Cost_{Hauling}$	=	Cost of hauling with feeding strategies.

5.17 Options to Retrofit Swine and Wet Layer Systems to Dry Systems

In addition to the use of lagoon covers to comply with the requirements of Option 5, EPA investigated retrofitting swine and wet layer systems to replace lagoons as the waste management practice. Retrofitting to a "scraper system" was assessed for swine and wet layer facilities. In addition, retrofitting to high-rise and hoop houses for swine operations was assessed. The scraper system and high-rise house retrofit options require the cleanout and closure of the existing lagoon.

5.17.1 Lagoon Cleanout and Closure Costs

Lagoon closures were used as part of the cost test for BAT option 5, and were also considered as part of a proposed permit requirement to have a closure plan or a bond to ensure closure. These options were not selected.

USDA NRCS developed an interim standard that has been use for closure of lagoons used in North Carolina. NCDENR (1999) prepared a list of 65 lagoon closures that have been cost-shared by the North Carolina Agriculture Cost Share Program. The smallest lagoon was 0.11 acres, and the largest was 2.5 acres. The range of closure costs on a per acre basis was generally in the \$15K/acre to \$60K/acre range. The average cost to clean out and close 65 dairy, beef, poultry, and swine lagoons was \$0.031 per gallon. This value is used to estimate the cost of lagoon cleanout and closure nationally using the following equation:

$$\text{Cleanout Cost} = \text{Volume}_{\text{Manure}} \times 0.031$$

where:

$\text{Volume}_{\text{Manure}}$ = Volume of manure for one year, gallons

Cleanout Cost = VolumeManure × 0.031

Where,

VolumeManure = Volume of manure for one year (gallons)

5.17.2 Retrofit to Scraper System

Mechanical scrapers are dedicated to a specific alley, propelled by electrical devices, and attached by cables or chains (USDA NRCS, 1996). Scrape alleys range from 3 to 8 feet wide for swine and poultry operations.

Scraper systems are applied to both swine and wet-layer facilities in the cost model . One retrofit unit is required for each 1,250 hogs or 25,000 layers, with a minimum of one unit per operation. Components of scraper systems costed in the model include a motor, blades, and a steel tank for storage of scraped material for one year. There is also a setup cost and a cost for cleanout of the existing lagoon (see Section 5.4). When facilities are retrofitted to a scraper system, the dilution factor is set to 1, no additional water is added, and scraped material is moved to a covered steel tank to limit dilution by precipitation.

It is assumed that each animal house has a single alley requiring one scraper system (Figure 5.17.2-1). Each scraper has two blades. Steel scraper blades last for 10 years (MDS, 2002). Since costs are amortized over 20 years, four steel blades are purchased at $177 each as capital costs. This cost is based upon $29.50 per foot for 6-foot blades (MDS, 2002). EPA assumes a setup cost of $36,000 per house, and $200 for a 1/4 HP motor. The volume of waste to be stored in the tank is calculated from the following equation:

$$Volume_{ManureUndiluted} = nohead \times weight \div 1{,}000 \times volume \times 365 \times 7.481$$

where:

$Volume_{ManureUndiluted}$	=	Annual volume of undiluted manure, gallons/year
nohead	=	Number of head
weight ÷ 1000	=	Animal weight divided by 1,000 = Number of animal units
volume	=	Cubic feet of manure produced per animal unit per day

365	=	Days per year
7.481	=	Gallons per cubic foot.

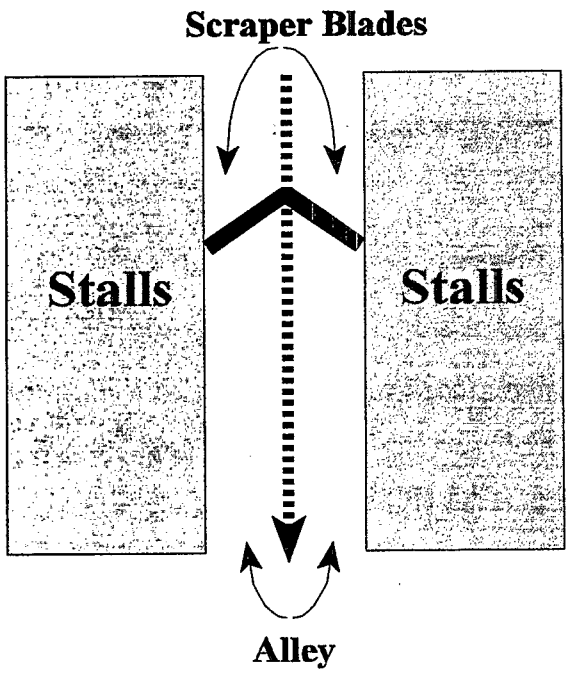


Figure 5.17.2-1. Scraper System

Capital Costs

Retrofit costs (minus lagoon cleanout costs) are calculated using the following equation:

$$\text{Capital Cost} = ((\text{Setup} + \text{Motor}) + (\text{Blades} \times 177)) \times \text{Number} + (\text{Volume}_{\text{ManureUndiluted}} \times \text{Tankcost})$$

where:

Setup	=	Setup cost of $36,000
Motor	=	Motor cost of $200
Blades	=	Number of steel scraper blades (4)
177	=	Cost of steel scraper blades

Number	=	Number of retrofit units
Tankcost	=	Cost of steel tank ($0.18 per gallon).

Annual Costs

Annual operation and maintenance include labor, electricity, replacement blades and standard maintenance. EPA estimates motor usage for each unit to be 897 kWh at $0.095 per kWh. Labor for each unit is estimated to be 52 hours per year at $10 per hour, and maintenance is estimated at 2 percent of initial costs, including cleanout of the lagoon ($724). Annual costs are calculated using the following equation:

$$\text{Annual Cost} = (\text{Electricity} \times \text{Rate} + \text{Hours} \times \text{Labor}) \times \text{Number} + \text{Capital Cost} \times 0.02$$

where:

Electricity	=	Annual electricity usage per unit
Rate	=	Cost of electricity
Hours	=	Labor per unit
Labor	=	Labor rate
Number	=	Number of retrofit units
CapitalCost	=	Capital Cost (including lagoon cleanout)
0.02	=	Standard maintenance rate.

5.17.3 Retrofit to High Rise Hog Houses

Menke, et al. (2000) evaluated the construction costs for a two-story confinement housing design. Material falls through open slots onto the first floor where it is composted with carbon-rich material. A high-rise house for 1,000 head of finishing pigs is 44 feet × 190 feet. On a per pig basis, a traditional deep pit house in Indiana/Ohio costs $155 to 160 per animal; a lagoon style flush house costs $145 per animal; and the high-rise building costs $185 per animal. The high-rise building costs include professional engineering design that meets NRCS design standards. Building a deep-pit house to these standards is estimated to increase the construction cost of a deep-pit house by $15,000 ($15 per animal).

Operation and maintenance costs for a high-rise hog facility are estimated at 2 percent of initial costs. Additional costs include energy costs and drying agents. Energy costs for a traditional confinement building are estimated at $2,500 to $2,800 per year. The high-rise building has average monthly costs of approximately $400 or $4,800 annually. Drying agents evaluated include wheat straw, corn stalks, and wood shavings. Around 50 to 60 tons of wood shavings are needed to cover the house at a depth of 2 feet at an annual cost of $4,000 to $5,000 per year. In contrast, 5 feet of straw or corn stalk material are needed to absorb similar amounts of moisture. Even at a lower cost of $9 to $10 per 1,200 pound bale of corn stalks, the higher volumes required offset the unit cost savings. Straw and corn materials also tend to degrade and compost more rapidly than wood, requiring more frequent addition of drying material to the house.

The cost of feed and manure handling are assumed to be no different from baseline. Therefore, the initial cost of high-rise buildings for hogs is calculated using the following equation:

$$\text{Capital Cost} = \text{Nohead} \times \text{Construction}$$

where:

Nohead	=	Number of head
Construction	=	Cost of construction ($185 per pig space).

Annual costs are estimated with the following equation:

$$\text{Annual Cost} = \text{Nohead} \times \text{Operation} + \text{Capital Cost} \times 0.02$$

where:

Nohead	=	Number of head
Operation	=	Cost of confinement fuel, repairs, and utilities ($3.22 per pig).

5.17.4 Retrofit to Hoop Houses

Hoop structures are low-cost, Quonset-shaped swine shelters with no form of artificial climate control. Wooden or concrete sidewalls 4 to 6 feet tall are covered with an ultraviolet and moisture-resistant, polyethylene fabric tarp supported by 12- to 16-gauge tubular steel hoops or steel truss arches placed 4 to 6 feet apart. Hoop structures with a diameter greater than 35 feet generally have trusses rather than the tubing used on narrower hoops. Some companies market hoops as wide as 75 feet. Tarps are affixed to the hoops using ropes or winches and nylon straps.

Generally, the majority of the floor area is earthen, with approximately one-third of the south end of the building concreted and used as a feeding area. Approximately 150 to 200 finisher hogs or up to 60 head of sows are grouped together in one large, deep-bedded pen. Plentiful amounts of high-quality bedding are applied to the earthen portion of the structure, creating a bed approximately 12 to 18 inches deep. The heavy bedding absorbs animal manure to produce a solid waste product. Additional bedding is added continuously throughout the production cycle. Fresh bedding keeps the bed surface clean and free of pathogens and sustains aerobic decomposition. Aerobic decomposition within the bedding pack generates heat and elevates the effective temperature in the unheated hoop structure, improving animal comfort in winter conditions.

The costing for hoop houses is similar to that for high-rise houses. Capital costs are estimated using the following equation:

$$\text{Capital Cost} = \text{Nohead} \times \text{Construction}$$

where:

Nohead	=	Number of head
Construction	=	Cost of construction ($55 per pig space).

Annual costs are estimated with the following equation:

$$\text{Annual Cost} = \text{Nohead} \times (\text{Operation} + \text{Bedding} + \text{Hours} \times \text{Labor}) + \text{Capital Cost} \times 0.02$$

where:

Nohead	=	Number of head
Operation	=	Cost of confinement fuel, repairs, and utilities ($1.40 per pig)
Bedding	=	Cost of bedding ($4.20 per pig)
Hours	=	Labor (1.12 hours per pig)
Labor	=	$10 per hour.

5.18 Recycling of Flush Water

In liquid-based systems, fresh water can be used for flushing or water from a secondary lagoon can be recycled as flush water. This technology is applied to Category 2, lagoon-based swine operations for all options except Option 5.

Costing for this technology includes piping, labor, and an extra lined lagoon designed to provide an additional 20 days of storage. The design of the extra lagoon is discussed in Section 5.4.5, and lagoon liners are described in Section 5.4.2. EPA assumes that 250 feet of pipe are required to connect the extra lagoon to the pump, at a cost of $2.13 per foot. It is estimated that 4 hours of labor is required to install the pipe and set up the pump, at a cost of $10/hour.

Capital Cost

The capital costs are estimated with the following equation:

$$\text{Capital Cost} = \text{Pipelength} \times \text{Pipecost} + \text{Hours} \times \text{Labor} + \text{ExtraLagoon} + \text{Liner}$$

where:

Pipelength	=	Length of pipe
Pipecost	=	Cost per foot of pipe
Hours	=	General labor hours to install pipe and pump
Labor	=	$10/hour

ExtraLagoon	=	Cost to build lagoon with storage for 20 days
Liner	=	Cost of liner for extra lagoon.

The cost to build the extra lagoon is estimated by multiplying the lagoon volume by the earth moving cost of $2.60 per cubic yard. The cost of the liner is determined by multiplying the surface area of the liner (bottom plus sides) by the liner cost of $1.84 per square foot (clay plus synthetic).

Annual Costs

The annual cost is calculated with the following equation:

$$\text{Annual Cost} = \text{Capital Cost} \times 0.02$$

5.19 Sludge Cleanout

Sludge must be removed from lagoons periodically to keep storage capacity available. The cost model accounts for sludge cleanout annually for beef feedlots, dairies, and heifer operations and once every five years for liquid-based swine operations for all considered options.

5.19.1 Technology Description

Nondegradable solids settle to the bottom of lagoons as sludge, which is periodically removed. The liquid is applied to on-site cropland as fertilizer or irrigation water, or it is transported off site. The sludge can also be land applied as a fertilizer and soil amendment.

Compared with lagoon liquids, lagoon sludges have higher concentrations of all pollutants that are not completely soluble. Some organic N associated with heavier and nondegradable organics also settles into the lagoon sludge and stays, resulting in a high-organic N fraction of total Kjeldahl N (TKN) in settled solids.

Beef and Dairy Model

For the beef, dairy, and sludge operations, sludge removal is assumed to occur annually because of the higher capacity requirements associated with liquid storage receiving runoff from open lots. Cost for removing the sludge is determined using a cost test against three options:

1) Lagoon or pond is pumped to a traveling gun. Sludge is applied to land on site using the traveling gun.

2) Lagoon or pond is pumped to a tanker truck owned and operated by the operation owner. The tanker truck ships the sludge to an off-site location.

3) A custom applicator brings equipment on site, removes the sludge, and ships the sludge off site.

Hauling costs incurred by the owner/operator are included in Section 5.9.

5.19.2 Beef and Dairy Costs

Capital Costs

The cost model assumes that facilities with less than 30 acres may choose to purchase a traveling gun or contract with a custom applicator to remove sludge from their lagoons. The model assumes that facilities with 30 or greater acres may choose to purchase a tanker truck to haul their own waste or will contract with a custom applicator to remove sludge from their lagoons. Costs for a traveling gun are outlined in Section 5.8 and costs to purchase a tanker truck are outlined in Section 5.9. Contracting with a custom applicator has no assumed capital costs.

Annual Costs

Annual costs for traveling guns and tanker truck hauling are estimated at 5 percent of the capital costs. Annual costs for contracting with a custom applicator are estimated at $0.05 per gallon of sludge. Appendix Table A-19 presents sludge removal costs for beef feedlots, dairies, and heifer operations.

5.19.3 Swine Costs

For the swine cost model, zero cost is assumed for sludge cleanout, but hauling costs are estimated. The volume of sludge to be hauled is determined using the following equation:

$$Volume_{Sludge} = Volume_{Manure} \times (1\text{-}Given) \times Solids \times 0.924 \times HaulPct \times (1\text{-}mangive)$$

where:

$Volume_{Sludge}$	=	Annual volume of sludge to haul, gallons/year
$Volume_{Manure}$	=	Annual volume of manure produced, gallons/year
Given	=	Portion of manure given away, decimal fraction
Solids	=	Solids content of manure, decimal fraction
0.924	=	Moisture content of sludge
HaulPct	=	Portion of manure hauled away, decimal fraction
Mangive	=	Frequency factor for giving manure away.

EPA assumes that Category 3 swine operations incur no cost to haul sludge under N-based management since that is the baseline scenario. For all other Category 2 and 3 liquid-based swine operations, the cost of hauling the sludge is determined using the following equation:

$$Cost_{Sludge} = (Volume_{Sludge} \times LiquidFirst) + (LiquidAdd \times Volume_{Sludge} \times (Transport - 1))$$

where:

$Cost_{Sludge}$	=	Annual cost of hauling sludge
$Volume_{Sludge}$	=	Annual volume of sludge to haul, gallons/year
LiquidFirst	=	Liquid hauling cost for first mile
LiquidAdd	=	Liquid hauling cost beyond first mile

Transport = Transport distance for hauling sludge.

The values of LiquidFirst ($0.008/gallon-mile) and LiquidAdd ($0.0013/gallon-mile) are taken from Table 5.9.2-3. In cases where feeding strategies are employed (see Section 5.21.9), sludge volume is reduced by the factor (1-FSRed) to account for the reduced quantity of solid waste produced under feeding strategies. The value of FSRed is 0.40. Further, for the Mid-Atlantic region, the transport distances are changed if feeding strategies are employed. If the hauling percentage (HaulPct) is less than 20 percent (0.20), the transport distance is set at 5.5 miles, the distance for N-based management at Category 2 facilities (see Table 5.9.2-1). Otherwise, the transport distance is set to 18 miles in the Mid-Atlantic region for swine facilities that use feeding strategies to reduce manure-P production.

5.20 Surface Water Monitoring

Option 4 requires animal feeding operations to monitor nearby water bodies for contaminants.

5.20.1 Practice Description

Surface water monitoring is used to evaluate the nutrient loading of waterways near animal feeding operations. The primary purpose of this monitoring is to determine the effectiveness of implemented technologies and practices at preventing contamination of surface water. Possible sources of excess loading include uncontained runoff and lagoon overflow during peak storm events.

The best time to monitor the effectiveness of runoff control systems is immediately following storm events; therefore, sampling events are not scheduled in advance. Animal feeding operations are costed for sampling water bodies going through or adjacent to feeding operations immediately following storm events, up to 12 times per year.

5.20.2 Prevalence of the Practice in the Industry

It is assumed that beef feedlots, dairies, and veal operations do not have surface water monitoring programs in place, therefore, the cost model assigns the cost of surface water monitoring to every operation evaluated under Option 4. Note that Option 4 is the only option in the cost model that includes surface water monitoring.

5.20.3 Design

The design for surface water monitoring is based on the sampling program and includes monitoring at the surface impoundment (pond or lagoon) and the stockpile. The requirements of the sampling program are:

- Twelve sampling events per year at surface water bodies;
- One sampling event per year at the lagoon or pond and at the stockpile;
- Four grab samples and one quality assurance (QA) sample per sampling event (Table 5.20-1 shows the total number of samples over a one-year period);
- Sampling will coincide with rain events in excess of 0.5 inches precipitation; and
- Analysis of each sample for nutrients (nitrite, nitrate, total Kjeldahl nitrogen, total phosphorus) and total suspended solids (TSS).

An alternative analysis considered ambient monitoring for metals (zinc, arsenic, copper), BOD_5, and biological organisms (fecal coliforms, enterococcus, salmonella, and escherichia coli). Due to high costs and limited holding times for BOD and pathogen samples, these parameters were not costed for Option 4. EPA believes the uncertainty of precipitation events prevents the CAFO owner from being prepared to rapidly sample; therefore, accurate sample collection and shipping would be very difficult for these additional constituents.

Table 5.20-1

Number of Samples

Number of sampling events per year	12
Number of samples per sampling event (4 grab + 1 QA)	5
Total annual samples	60

5.20.4 Costs

Initial cost estimates, shown in Table 5.20-2, include training, coolers, and reusable sampling equipment. Annual costs, shown in Table 5.20-3, include sterile containers and sampling supplies for each sampling event, labor costs associated with sampling, sample overnight shipment, and lab processing fees.

Table 5.20-2

Capital Costs for Surface Water Sampling

Description	Unit Cost	Capital Cost
Training (8 hr)	$10/hr	$80
Course fee	$40	$40
Misc. other costs (15% of labor)	--	$12
Coolers (2)	$30/cooler	$60
Sampling equipment (pipet, etc.)	$200	$200
	Total Capital Cost	**$392**

Table 5.20-3

Annual Costs for Surface Water Sampling

Description	Unit Cost	Annual Cost
250-mL bottles (2 per sample)	$2/bottle	$240
500-mL bottles (1 per sample)	$2.70/bottle	$162
Overnight shipping (30-lb cooler)	$60/sampling event	$720
Misc. supplies and transportation	$30	$30
Laboratory costs	$79/sample	$4,740
Sample collection (2 hrs/sampling event)	$10/hr	$240
QA & recordkeeping (1 hr/sampling event)	$10/hr	$120
	Total Annual Cost	**$6,252**

REFERENCE: Tetra Tech, 1999

5.20.5 Results

The cost model results for the surface water monitoring option do not vary between animal type, region, or size group. The capital cost for surface water monitoring is $392, and the annual cost is $6,252.

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6.0 FREQUENCY FACTORS

EPA recognizes that most individual farms are currently implementing certain waste management techniques or practices that are called for in the regulatory options considered. Only costs that are the direct result of the regulation are included in the cost model. Therefore, costs already incurred by operations are not attributed to the regulation.

Frequency factors are used in the cost model to simulate a cost allowance by reducing the expenditures necessary to bring a farm into compliance with the regulatory options considered. In other words, compliance costs are set to less than 100 percent of the cost of needed practices if farms are already implementing all or part of these practices or equivalent practices. The resulting cost could be viewed as an allowance. The degree to which costs are reduced is directly linked to the extent to which the required practices are already being implemented.

To reflect baseline industry conditions, EPA developed technology frequency factors to describe the percentage of the industry that already implements particular operations, techniques, or practices that may be used to meet the requirements of the final rule. In some cases, these frequency factors are based on an assumed performance category (i.e., high, medium, and low performance) as estimated by U.S. Department of Agriculture (USDA). EPA also developed ground water control frequency factors based on the location of the facility and current state requirements for permeabilities of waste management storage units. In addition, EPA developed nutrient basis frequency factors describing the distribution of farms that would apply manure to soils on a nitrogen or phosphorus basis, land availability frequency factors describing the distribution of farms with and without sufficient cropland to land apply the manure and wastewater generated at the farm, and transportation frequency factors describing the distribution of farms transporting excess manure and wastewater off site.

Some technologies included in the cost model, including composting and anaerobic digestion, were assumed not to be present under baseline industry conditions. Therefore, EPA

assumed all of the facilities incur the cost of implementing the technologies and did not develop frequency factors for these technologies.

This section presents the frequency factors and the methodologies used to develop them in the following subsections:

- Section 6.1 - Beef and Dairy Technology Frequency Factors;
- Section 6.2 - Beef and Dairy Nutrient Basis Frequency Factors;
- Section 6.3 - Beef and Dairy Land Availability Frequency Factors;
- Section 6.4 - Swine and Poultry Technology Frequency Factors;
- Section 6.5 - Swine and Poultry Nutrient Basis Frequency Factors;
- Section 6.6 - Swine and Poultry Land Availability Frequency Factors; and
- Section 6.7 - Ground Water Control Frequency Factors.

6.1 Beef and Dairy Technology Frequency Factors

Technology frequency factors reflect the percentage of operations that have a particular operation, technique, or practice (e.g., settling basin) in place at baseline (i.e., prior to implementation of the regulation). Frequency factors are based on geographic location, type and size of operation, existing regulatory requirements, and overall status of the industry. EPA developed technology frequency factors for practices or technologies included in the cost model, including:

- Solids separation using earthen settling basins;
- Runoff controls (i.e., berms);
- Liquid land application (e.g., center pivot irrigation);
- Nutrient management planning (i.e., setbacks, lagoon markers, soil sampling, manure sampling, recordkeeping, document preparation);
- Solids separation using concrete settling basins;
- Naturally lined ponds and lagoons; and
- Transportation.

Frequency factors were developed to represent the current implementation rate of various practices used on operations. Since current implementation can vary significantly across operations in a given sector, the frequency factors were developed to represent low, medium, and high implementation costs based on farm performance. For example, operations classified as "low implementation cost" generally tend to have already implemented the practice and thus "low" (or no) additional costs are expected for such operations. Conversely, "high implementation cost" operations are assumed to have little or low levels of implementation and are expected to have "high" additional costs to implement a given practice or meet a certain standard. EPA assumed that 50 percent of all facilities would incur "medium" costs, 25 percent of facilities would incur "low" costs, and 25 percent would incur "high" costs.

EPA developed technology frequency factors that vary by farm performance using the same methodology and source of USDA data. Section 6.1.1 discusses the development of these frequency factors for beef feedlots, dairies, heifer operations, and veal operations. Frequency factors for some technologies were not included in USDA's data. The development of factors that were not presented in the USDA data that were assumed to vary by level of performance is described in Section 6.1.2 for beef feedlots, dairies, heifer operations, and veal operations. The remaining technology frequency factors are not assumed to vary by farm performance. EPA developed these remaining technology frequency factors using several different data sources. Section 6.1.3 discusses these frequency factors for beef feedlots, dairies, heifer operations, and veal operations. Section 6.1.4 discusses the frequency factors developed for the swine and poultry cost model.

6.1.1 Performance-Based Frequency Factors Based on USDA Data

EPA received frequency factors from USDA as part of a document entitled *Estimation of Private and Public Costs Associated with Comprehensive Nutrient Management Plan Implementation: A Documentation* (April 23, 2001). This document includes frequency factors for three performance-based categories of facilities (low-performing, medium-performing, and high-performing) for a series of "representative" farms defined by USDA in eight USDA

defined regions. USDA defined high performers to be 25 percent of the facilities, medium performers to be 50 percent of the facilities, and low performers to be 25 percent of the facilities. EPA also used these percentages to calculate the number of facilities that are high, medium, and low performers.

To use USDA's frequency factors in the cost models, EPA "mapped" USDA's representative farms to its model farms and then weighted the frequency factors by the percent distribution of farms within each region. The general methodology used to perform this translation is provided below. See ERG's memorandum to the record *Methodology to Incorporate USDA Frequency Factors into Beef and Dairy Cost Model Methodology (ERG, 2001)* for a more detailed description of the methodology and USDA data used for beef feedlots, dairies, and heifer and veal operations.

Mapping USDA Representative Farms to EPA Model Farms

To use these performance-based frequency factors for beef feedlots, heifer operations, dairies, and veal operations, EPA correlated the USDA representative farms and regions to EPA's model farms and five geographic regions. To do this, EPA divided each USDA region into individual states and then weight-averaged the frequency factors from each state in that region to calculate the frequency factors for that region, according to the total number of operations in each state.

EPA's cost methodology for beef feedlots and heifer operations uses a single model farm to represent the costs of the majority of beef feedlots and heifer operations in the country with greater than 300 head. USDA's frequency factors for beef are based on two representative farms in eight geographic regions. The USDA factors are presented for the following size groups:

- >30;
- >100;
- 30 - 500;
- >500;

- 30 - 1,000; and
- >1,000 head.

EPA correlated these size groups to the Agency's size groups of 300 - 499 (Medium 1), 500 - 999 (Medium 2 and 3), and ≥1,000 (Large 1) head. EPA applied USDA's assumptions for beef feedlots to heifer operations since USDA's data did not include information for heifer operations.

EPA's cost methodology for dairies uses two model farms to represent the costs of the majority of dairies in the country with greater than 200 head. The USDA methodology uses five representative farms to reflect the current state of the industry. No dairies with greater than 200 head are represented by USDA's farm #1 and only a small portion are represented by USDA's farm #2. Therefore, EPA used frequency factors from only USDA farms #3, #4, and #5.

The Agency did not compare veal operations because EPA assumes that all veal operations currently have appropriate waste management practices in place and would require nutrient management planning.

Tables 6.1.1-1 and 6.1.1-2 present the correlation of EPA model farm components to the USDA representative farm components for beef feedlots and dairies, respectively.

Weighting USDA Frequency Factors

To use USDA's frequency factors at EPA model farms, EPA first weighted the frequency factors by the percent distribution of farms in a given USDA region. For example, if a USDA region was described using representative farm #1 and representative farm #2, and the USDA weighting factors indicate that 30 percent of operations in this region are represented by farm #1 and 70 percent of operations are represented by farm #2, then the weighted frequency factor for that region is:

$$\text{Weighted frequency factor} = \text{Frequency factor}_{\text{Farm\#1}} \times 0.3 + \text{Frequency factor}_{\text{Farm\#2}} \times 0.7$$

Next, EPA determined the states included in the USDA regions and estimated how many USDA facilities were in each state. EPA then calculated the percentage of the total number of EPA facilities in each USDA region using its estimates of the number of facilities in each state. These percentages provide the basis for weighting the USDA frequency factors to create the frequency factor for the EPA region. Table 6.1.1-3 presents the portion of beef feedlots and heifer operations and Table 6.1.1-4 presents the portion of dairies from the USDA region that fall within the corresponding EPA region, expressed as a percentage of the total EPA beef feedlots, heifer operations, and dairies in that region.

Table 6.1.1-1

Correlation of EPA Beef Model Farm Components and USDA Representative Farm Components

Animal Type	EPA Model Farm	USDA Representative Farm[a]	
		#1	#2
Beef	Partially paved drylot	Lot with smooth, hardened surface	Graded, curbed, fenced lots
	Concrete pad (Options 3 & 4)	Concrete slab for manure storage	Not listed
	Berms	Adequate clean water diversion system	Adequate clean water diversion system
	Stormwater pond	Adequate runoff storage pond	Adequate runoff storage pond
	Earthen settling basin	Not listed	Adequate settling basin
	Solids land application	Appropriate solids collection/ spreading/transfer equipment	Appropriate solids collection/ spreading/transfer equipment
	Liquid land application	Appropriate liquid collection/ spreading/transfer equipment	Appropriate liquid collection/ spreading/transfer equipment
	Nutrient management planning	Manure and soil testing	Manure and soil testing
		One-time documentation of facility	One-time documentation of facility
		Routine recordkeeping	Routine recordkeeping
	Off-site transportation	Off-farm export	Off-farm export

[a]This list includes all components included for that representative farm in all regions.

Table 6.1.1-2

Correlation of EPA Dairy Model Farm Components and USDA Representative Farm Components

Animal Type	EPA Model Farm	USDA Representative Farm[a]		
		#3	#4	#5
Dairy	Berms	Adequate clean water diversion system	Adequate clean water diversion system	Adequate clean water diversion system
	Concrete settling basin	Separator or settling basin[b]	Separator or settling basin[b]	Separator or settling basin[b]
	Anaerobic lagoon	Adequate liquid storage	Adequate liquid storage	Adequate liquid storage
	Liquid land application	Appropriate liquid spreading/transfer equipment	Appropriate liquid spreading/transfer equipment	Appropriate liquid spreading/transfer equipment
	Nutrient management planning	Manure and soil testing	Manure and soil testing	Manure and soil testing
		One-time documentation of facility	One-time documentation of facility	One-time documentation of facility
		Routine recordkeeping	Routine recordkeeping	Routine recordkeeping
	Off-site transportation	Off-farm export	Off-farm export	Off-farm export

[a]This list includes all components included for that representative farm in all regions.
[b]A footnote on the USDA tables indicates that 30 percent of operations have a separator or settling basins.

Using the percentages in Tables 6.1.1-3 and 6.1.1-4, EPA calculated the weighted frequency factors for each of the five EPA regions. For example, for beef feedlots in the EPA Central region, a frequency factor can be calculated using the following formulas:

USDA Region A Frequency Factor × 0.10 = USDA portion A
USDA Region B Frequency Factor × 0.19 = USDA portion B
USDA Region C Frequency Factor × 0.15 = USDA portion C
USDA Region D Frequency Factor × 0.56 = USDA portion D

Sum of USDA portions = EPA regional frequency factor

Table 6.1.1-3

Percentage of EPA Beef Feedlots and Heifer Operations in USDA Regions

Animal Type	EPA Region	USDA Regions[a]							
		A	B	C	D	E	F	G	H
Beef	Central	0.10	0.19	0.15	0.56	0	0	0	0
	Mid-Atlantic	0	0	0	0	0.05	0	0.45	0.50
	Midwest	0.13	0	0.16	0	0	0.70	0	0
	Pacific	0	1	0	0	0	0	0	0
	South	0	0	0	0	0	0	0	1
Heifer	Central	0.02	0.48	0.13	0.38	0	0	0	0
	Mid-Atlantic	0	0	0	0	0	0	0	0
	Midwest	0.27	0	0.15	0	0	0.54	0	0
	Pacific	0	1	0	0	0	0	0	0
	South	0	0	0	0	0	0	0	0

[a]Region A: MT, WY, ND, MN
Region B: CA, AZ, AK, HI, UT, NV, WA, OR, ID
Region C: CO, KS, NE, SD
Region D: TX, OK, NM
Region E: MA, RI, CN, VT, NH, ME
Region F: MO, IL, IN, OH, MI, WI, IA
Region G: PA, NY, NJ
Region H: VA, WV, MD, DE, NC, TN, KY, SC, GA, AL, MS, FL, AR, LA

Table 6.1.1-4

Percentage of EPA Dairies in USDA Regions

Animal Type	EPA Region	USDA Regions [a]		
		Dairy Belt	Southeast	West
Dairy	Central	0	0	1
	Mid-Atlantic	0.74	0.26	0
	Midwest	1	0	0
	Pacific	0	0	1
	South	0	1	0

[a]Dairy Belt Region - MN, IA, MO, WI, IL, MI, IN, OH, PA, NY, VT, ND, SD, NE, KS, NJ, MD, DE, MA, CT, RI, NH, ME
Southeast Region - KY, TN, FL, VA, WV, NC, SC, GA, AL, MS, AR, LA
West Region - CA, OR, WA, ID, NM, TX, HI, AK, AZ, UT, NV, MT, WY, CO, OK

Frequency Factors for Earthen Settling Basins

All regulatory options assume that beef feedlots and heifer operations require an earthen basin to collect runoff. The regulatory options also assumed that dairies and veal operations have concrete basins instead of earthen basins due to the higher flow of water from the barn and parlor cleaning operations that enter the settling basin. Table 6.1.1-5 lists the percentage of beef feedlots and heifer operations that would incur costs for earthen basins by size class, region, and requirements.

Frequency Factors for Runoff Controls

Under all regulatory options, CAFOs are required to contain any runoff collecting in potentially contaminated areas. For the purpose of estimating compliance costs, EPA assumes that facilities will use berms to control runoff. Table 6.1.1-6 presents estimates of beef feedlots, heifer operations, and dairies that will incur costs to install berms based on size class, requirements, and regional location. EPA assumes that veal, swine, and poultry operations do not require berms.

Table 6.1.1-5

Percentage of Beef Feedlots and Heifer Operations Incurring Earthen Basin Costs for All Regulatory Options

Animal Type	Size Class	Performance	Region				
			Central	Mid-Atlantic	Midwest	Pacific	South
Beef and Heifers	Medium 1 Medium 2 Medium 3	High	100%	100%	100%	100%	100%
		Medium	80%	80%	80%	80%	80%
		Low	40%	40%	40%	40%	40%
	Large 1 Large 2[a]	High	100%	100%	100%	100%	100%
		Medium	80%	80%	80%	80%	80%
		Low	40%	40%	40%	40%	40%

[a]Large 2 size class represents only beef feedlots.

Frequency Factors for Liquid Land Application

Under all regulatory options, beef feedlots, heifer operations, and dairies are assumed to land apply their liquid manure and process wastewaters. Table 6.1.1-7 presents estimates of beef feedlot, heifer operations, and dairies that will incur costs (i.e, purchase liquid land application equipment) to apply liquid manure and wastewaters to their cropland based on size class, requirements, and regional location. EPA assumes that all veal operations have appropriate equipment for liquid land application and, therefore, do not incur any additional costs.

Frequency Factors for Nutrient Management Planning

Under all regulatory options, beef feedlots, heifer operations, and dairies are assumed to incur costs associated with nutrient management planning. Nutrient management planning includes setbacks, lagoon depth markers, soil sampling, manure sampling, recordkeeping, and document preparation. Table 6.1.1-8 presents estimates of beef feedlots, heifer operations, and dairies that will incur costs to comply with the nutrient management planning requirements based on size class, requirements, and regional location. All veal operations (100 percent) are assumed to incur costs for nutrient management planning.

Table 6.1.1-6

Beef Feedlots, Heifer Operations, and Dairies Incurring Costs to Install and Maintain Berms for All Regulatory Options

Animal Type	Size Class	Performance	Region				
			Central	Mid-Atlantic	Midwest	Pacific	South
Beef and Heifers	Medium 1	High	74%	92%	59%	50%	85%
		Medium	56%	32%	46%	40%	65%
		Low	32%	21%	12%	0%	43%
	Medium 2	High	71%	92%	55%	50%	84%
		Medium	54%	32%	43%	40%	65%
		Low	29%	21%	6%	0%	43%
	Medium 3	High	74%	92%	59%	50%	85%
		Medium	56%	32%	46%	40%	65%
		Low	32%	21%	12%	0%	43%
	Large 1	High	67%	92%	50%	50%	85%
		Medium	51%	32%	40%	40%	65%
		Low	23%	21%	0%	0%	43%
	Large 2[a]	High	50%	92%	50%	50%	85%
		Medium	40%	32%	40%	40%	65%
		Low	0%	21%	0%	0%	43%
Dairy	Medium 1	High	30%	34%	59%	30%	40%
		Medium	10%	21%	36%	10%	20%
		Low	0%	7%	14%	0%	0%
	Medium 2	High	30%	34%	59%	30%	40%
		Medium	10%	21%	36%	10%	20%
		Low	0%	7%	14%	0%	0%
	Medium 3	High	30%	34%	59%	30%	40%
		Medium	10%	21%	36%	10%	20%
		Low	0%	7%	14%	0%	0%
	Large 1	High	30%	33%	58%	30%	40%
		Medium	10%	20%	38%	10%	20%
		Low	0%	8%	18%	0%	0%

[a]Large 2 size class represents only beef feedlots.

Table 6.1.1-7

Beef Feedlots, Heifer Operations, and Dairies Incurring Costs for Liquid Land Application for All Regulatory Options

Animal Type	Size Class	Requirements	Region				
			Central	Mid-Atlantic	Midwest	Pacific	South
Beef and Heifers	Medium 1	High	100%	80%	100%	100%	97%
		Medium	70%	56%	70%	70%	67%
		Low	32%	26%	37%	40%	24%
	Medium 2	High	100%	80%	100%	100%	97%
		Medium	70%	56%	70%	70%	67%
		Low	33%	26%	38%	40%	24%
	Medium 3	High	100%	80%	100%	100%	97%
		Medium	70%	56%	70%	70%	67%
		Low	32%	26%	37%	40%	24%
	Large 1	High	100%	80%	100%	100%	97%
		Medium	70%	56%	70%	70%	67%
		Low	34%	26%	40%	40%	24%
	Large 2[a]	High	100%	80%	100%	100%	97%
		Medium	70%	56%	70%	70%	67%
		Low	40%	26%	40%	40%	24%
Dairy - Flush	Medium 1 Medium 2 Medium 3 Large 1	High	50%	55%	92%	50%	65%
		Medium	30%	40%	57%	30%	51%
		Low	10%	21%	14%	10%	37%
Dairy - Hose	Medium 1 Medium 2 Medium 3	High	50%	57%	91%	50%	65%
		Medium	30%	39%	55%	30%	51%
		Low	10%	19%	13%	10%	37%
	Large 1	High	50%	55%	92%	50%	65%
		Medium	30%	40%	57%	30%	51%
		Low	10%	21%	14%	10%	37%

[a]Large 2 size class represents only beef feedlots.

Table 6.1.1-8

Beef Feedlots, Heifer Operations, and Dairies Incurring Costs for Nutrient Management Planning for All Regulatory Options

Animal Type	Size Class	Requirements	Region				
			Central	Mid-Atlantic	Midwest	Pacific	South
Beef and Heifers	Medium 1 Medium 2 Medium 3	High	100%	100%	100%	100%	100%
		Medium	90%	95%	90%	90%	93%
		Low	80%	79%	80%	80%	80%
	Large 1 Large 2[a]	High	100%	100%	100%	100%	100%
		Medium	90%	95%	90%	90%	93%
		Low	80%	79%	80%	80%	80%
Dairy - Flush	Medium 1 Medium 2 Medium 3 Large 1	High	100%	63%	100%	100%	100%
		Medium	90%	57%	90%	90%	90%
		Low	80%	50%	80%	80%	80%
Dairy - Scrape	Medium 1 Medium 2 Medium 3	High	100%	64%	100%	100%	100%
		Medium	90%	58%	90%	90%	90%
		Low	80%	51%	80%	80%	80%
	Large 1	High	100%	63%	100%	100%	100%
		Medium	90%	57%	90%	90%	90%
		Low	80%	50%	80%	80%	80%

[a]Large 2 size class represents only beef feedlots.

6.1.2 Other Performance-Based Frequency Factors

For some technologies, USDA did not provide data based on farm performance. Therefore, EPA used implementation rates identified in literature, which are provided as single values rather than a range of values. Because EPA believes that the implementation of these technologies varies according to farm performance, EPA used the single values to calculate the range of frequency factors for these technologies using the following methodology:

1) Identify the overall frequency of implementation of the technology or practice.

Let X = the overall implementation, or frequency factor.

2) If X 25%, then

Low Frequency factor	=	0%
Medium Frequency Factor	=	0%
Highest Frequency Factor	=	X ÷ 25%

If 25% < X < 75%, then

Low Frequency factor	=	0%
Medium Frequency Factor	=	(X - 25%) ÷ 50%
Highest Frequency Factor	=	100%

If X ≥75%, then

Low Frequency factor	=	(X - 75%) ÷ 25%
Medium Frequency Factor	=	100%
Highest Frequency Factor	=	100%

Thus, it was assumed that low implementation cost operations had a frequency factor of 100 percent (100 percent of facilities had implemented the practice) and high implementation cost operations had a frequency factor of 0 percent. "Medium implementation cost" was then calculated by assuming that 25 percent of the operations incurred low implementation cost, 25 percent incurred high implementation cost, and the remaining 50 percent incurred medium implementation cost. For example, if literature reported the actual implementation rate to be 65 percent, the low and high implementation cost frequency factors were assumed to be 100 and 0 percent, respectively. The medium implementation cost frequency factor would be computed as 80 percent.

The frequency factors for concrete settling basins in the beef and dairy cost model was calculated in this way, as shown in Table 6.1.2-1.

Table 6.1.2-1

Frequency Factors Identified from Literature and Used to Calculate Low, Medium, and High Frequency Factors for Beef and Dairy Cost Model

Technology or Practice	Size Class	Overall Frequency Factor	Implementation Cost Frequency Factor		
			Low	Medium	High
Concrete Settling Basin	Medium	20%	0%	0%	80%
	Large	33%	0%	16%	100%

6.1.3 Other Technology Frequency Factors

Some of the technology components of EPA's cost models are not based on USDA's performance-based data. Frequency factors for naturally lined ponds, lagoons, and transportation costs are based on several different data sources and are described below.

Naturally Lined Pond and Lagoon Frequency Factors

The cost models for beef feedlots, heifer operation, dairies, veal operations, swine operations, and wet layer operations include naturally lined ponds and lagoons. This subsection presents the frequency factors for beef feedlot, dairies, heifer and veal operations.

Using information from site visits and state and federal regulations, EPA assumed that all large-sized beef feedlots and all large dairies have adequate storage for process wastewater consistent with the 1974 regulation. EPA developed frequency factors for medium-sized beef feedlots with naturally lined ponds using site visit information and best professional judgment. Based on discussions with the Professional Dairy Heifer Growers Association, EPA

assumed that heifer operations operate like beef feedlots; therefore, the Agency used the same frequency factors for naturally lined ponds for both types of operations.

Frequency factors for medium-sized dairies with naturally lined ponds are based on site visit information, NAHMS data, and current state and federal regulations. According to NAHMS, 13.5 percent of dairies in the 500-to-699-head group and 4.3 percent in the greater than 700 head group do not have any kind of waste storage facility. Of the sites visited by EPA, only one dairy had neither a lagoon nor large storage tank. Therefore, EPA assumes that the larger the dairy, the more likely it is to have a lagoon or other waste storage facility. According to NAHMS, dairies of 200 head and above in the East and Midwest (31.4 and 16.9 percent, respectively) are less likely to have lagoons or storage than dairies in the West (7.9 percent). EPA assumes that the smaller dairies (less than 700 mature dairy cows) comprise the largest percentage of dairies without waste storage in each region.

Based on site visits and discussions with the American Veal Association, EPA assumes that all veal operations have sufficient lagoon capacity to manage all of the manure and wastewater generated. Table 6.1.3-1 presents the percentage of beef feedlots, heifer operations, dairies, and veal operations that would incur costs to install a naturally lined pond or lagoon under Options 1, 2, 4, 5A, and 6. The percentages do not vary by region. EPA also used these frequency factors to determine the percentage of facilities requiring additional storage capacity under Option 7.

Transportation Frequency Factors

EPA developed frequency factors for facilities requiring the off-site transportation of excess manure and waste for all animal types using information from existing state regulations (ERG, 2000; EPA, 1999). Frequency factors were developed only for Category 2 facilities because the percentage of Category 1 and 3 facilities transporting excess manure and waste remains the same under all regulatory options. EPA assumes that facilities required by their states to land apply at agronomic rates are using nitrogen-based application rates and already incur the cost of transporting excess manure and waste off site. EPA assumes that no facilities are

currently meeting phosphorus-based agronomic application of manure and, therefore, assumes that all operations costed for phosphorus-based application will incur costs to transport excess manure.

Table 6.1.3-1

Percentage of Beef Feedlots, Heifer Operations, Dairies, and Veal Operations Incurring Costs to Install a Naturally Lined Pond or Lagoon

Animal Type	Size Class	Percentage of Facilities
Beef and Heifers	Medium 1	50%
	Medium 2	50%
	Medium 3	50%
	Large 1	0%
	Large 2[a]	0%
Dairy	Medium 1	10%
	Medium 2	10%
	Medium 3	10%
	Large 1	0%
Veal	All	0%

[a]Large 2 size class represents only beef feedlots.

To calculate the frequency factors for Category 2 beef feedlots and dairies, EPA determined the threshold requirements for nitrogen-based agronomic application of manure for 22 major dairy and beef-producing states based on state regulations. The Agency then used industry profile and Census of Agriculture data to determine the number of facilities in each state above both the state threshold and EPA's proposed threshold. EPA recorded the number of facilities above both thresholds by region; these facilities are assumed to already incur transportation costs for excess manure. EPA compared the number of facilities assumed to incur transportation costs with the number of facilities above the proposed threshold to arrive at regional frequency factors representing transportation costs. States other than the 22 included in the analysis were assumed not to require nitrogen-based agronomic application of animal wastes. EPA assumes that heifer

operations operate the same as beef feedlots and, therefore, heifer operations use the same frequency factors as beef feedlots. EPA assumes that all veal operations are Category 1 operations and therefore, did not develop transportation frequency factors for these operations. Table 6.1.3-2 presents the percentage of Category 2 beef feedlots, heifer operations, and dairies incurring costs for transporting excess manure and waste off site.

Table 6.1.3-2

Percentage of Category 2 Beef Feedlots, Heifer Operations, and Dairies Incurring Costs for Transporting Excess Manure and Waste Off Site

Animal Type	Size Class	Region				
		Central	Mid-Atlantic	Midwest	Pacific	South
Beef	Medium 1 Medium 2 Medium 3	100%	100%	78%	100%	100%
	Large 1 Large 2	13%	6%	33%	100%	100%
Heifer	Medium 1 Medium 2 Medium 3	100%	100%	82%	100%	100%
	Large 1	13%	6%	33%	100%	100%
Dairy	Medium 1 Medium 2 Medium 3	100%	100%	82%	100%	100%
	Large 1	46%	34%	77%	100%	54%

6.2 Beef and Dairy Nutrient Basis Frequency Factors

Several cost modules compute component costs separately for both nitrogen- and phosphorus-based application and are adjusted based on frequency factors that indicate the use of the component in the industry. For Options 1 and 1A, the cost model estimates costs for all operations for nitrogen-based application, and for Option 2A, estimates costs for all operations for phosphorus-based application. However, under the remaining options, EPA used the soil test map from USDA's *Agricultural Phosphorus and Eutrophication* book (USDA ARS, 1999) to

determine the percentage of facilities in each state that would require nitrogen-based versus phosphorus-based application rates. The soil map identified the percentage of soil samples in each state that had soil test P (phosphorus) levels in the "high or above" categories. States colored red on the map reported high or above soil test P levels in more than 50 percent of the samples. Phosphorus levels of greater than 50 parts per million are generally considered "high." States colored pink/orange reported high or above soil test P levels in 25 to 50 percent of the samples, and states colored green reported high or above soil test P levels in less than 25 percent of the samples.

Using these results for soil test P levels, EPA made the following assumptions:

- Facilities located in "green" states would require only nitrogen-based applications;
- Facilities located in "pink/orange" states would require 40 percent phosphorus-based and 60 percent nitrogen-based applications; and
- Facilities located in "red" states would require 60 percent phosphorus-based and 40 percent nitrogen-based applications.

EPA adopted this 40/60 and 60/40 split of applications to account for areas within a given state that would have soils with low phosphorus levels.

Using these determinations, EPA calculated the percentage of operations that would require phosphorus-based applications under Options 2 through 7 for each region. These percentages were calculated by animal type, size class, and regions using the following equation:

$$\text{P Facs\%} = \left(\frac{\text{State FacR}}{\text{Total Fac}} \times 60\% \text{ PBased}\right) + \left(\frac{\text{State FacO}}{\text{Total Fac}} \times 40\% \text{ PBased}\right) \quad [6\text{-}2]$$

where:

P Facs%	=	Percentage of facilities, by region, that would require phosphorus-based application
State FacR	=	Number of facilities in a red state
State FacO	=	Number of facilities in an orange/pink state
Total Fac	=	Total number of facilities in that size class and region

%Pbased = Percentage of facilities that would require phosphorus-based application for that given state.

EPA calculated the percentage of nitrogen-based application facilities in each region and size class using the following equation:

$$N\ Facs = 100\% - P\ Facs \quad [6\text{-}3]$$

where:

N Facs = Percentage of facilities that would require nitrogen-based application

P Facs = Percentage of facilities that would require phosphorus-based application.

Table 6.2-1 presents the percentages of nitrogen-based and phosphorus-based facilities by animal type, by size class, and by region for Options 2 through 7.

6.3 Beef and Dairy Land Availability Frequency Factors

All operations fall into one of three land availability categories depending on the amount of on-site cropland available for manure application:

- Category 1 operations have sufficient land to land apply all of their generated manure and wastewater at appropriate agronomic rates. No manure is transported off site.
- Category 2 operations do not have sufficient land to land apply all of their generated manure and wastewater at appropriate agronomic rates. The excess manure after agronomic application is transported off site.
- Category 3 operations do not have any available land for manure application. All generated manure and wastewater is transported off site.

Facility counts for swine and broiler operations were provided by USDA NRCS including land availability category; therefore, these model farms did not require disaggregation using the land availability frequency factors. However, facility counts for layers, pullets, turkeys,

and cattle operations were not provided by land availability category. Therefore, EPA applied the land availability categories to the facility counts for these operations.

Table 6.2-1

Percentage of Nitrogen-Based and Phosphorus-Based Application Facilities

Animal Type	Size Class	Application Percentage Basis	Region				
			Central	Mid-Atlantic	Midwest	Pacific	South
Beef and Heifers	Medium 1	Nitrogen	53%	51%	60%	40%	49%
		Phosphorus	47%	49%	40%	60%	51%
	Medium 2	Nitrogen	54%	51%	60%	40%	55%
		Phosphorus	46%	49%	40%	60%	45%
	Medium 3	Nitrogen	48%	49%	60%	40%	50%
		Phosphorus	52%	51%	40%	60%	50%
	Large 1	Nitrogen	45%	49%	61%	40%	0%
		Phosphorus	55%	51%	39%	60%	0%
	Large 2	Nitrogen	46%	60%	61%	40%	0%
		Phosphorus	54%	40%	39%	60%	0%
Dairy	Medium 1	Nitrogen	46%	47%	47%	40%	56%
		Phosphorus	54%	53%	53%	60%	44%
	Medium 2	Nitrogen	47%	46%	47%	40%	57%
		Phosphorus	53%	54%	53%	60%	43%
	Medium 3	Nitrogen	49%	44%	49%	40%	48%
		Phosphorus	51%	56%	51%	60%	52%
	Large 1	Nitrogen	56%	44%	50%	40%	47%
		Phosphorus	44%	56%	50%	60%	53%
Veal	Medium 1	Nitrogen	40%	60%	44%	0%	0%
		Phosphorus	60%	40%	56%	0%	0%
	Medium 2	Nitrogen	40%	0%	44%	0%	0%
		Phosphorus	60%	0%	56%	0%	0%
	Medium 3	Nitrogen	40%	0%	44%	0%	0%
		Phosphorus	60%	0%	56%	0%	0%

EPA calculated the percentage of facilities in each of these categories using USDA data. USDA conducted a national analysis of the 1997 Census of Agriculture data to estimate the manure production at livestock facilities (Kellogg, R. et al, 2000). As part of this analysis, USDA estimated the number of confined livestock facilities that produce more manure than they can land-apply on their available cropland and pasturelands at agronomic rates for nitrogen and phosphorus and the number of confined livestock operations that do not have any available cropland or pastureland. This analysis also identified the amount of excess manure at the facilities with insufficient land.

EPA used USDA's facility counts to develop the percentage of facilities that are classified as Category 2 and 3 under a 100-percent nitrogen-based application scenario and a 100-percent phosphorus-based application scenario. EPA estimated the percentage of facilities classified as Category 2 and 3 using the following equations:

$$\text{Percent Category 2 Facs} = \frac{\text{No. Farms with Excess Manure (N or P) and Cropland}}{\text{Total No. Confined Livestock Farms}} \quad [6\text{-}4]$$

$$\text{Percent Category 3 Facs} = \frac{\text{No. Farms with Excess Manure (N or P) and No Cropland}}{\text{Total No. of Confined Livestock Farms}} \quad [6\text{-}5]$$

where:

Percent Category 2 Facs	=	Percentage of facilities classified as Category 2
Percent Category 3 Facs	=	Percentage of facilities classified as Category 3
No. Farms with Excess Manure (N or P) and Cropland	=	Number of facilities with excess manure on a nitrogen or phosphorus basis and some cropland for land application
No. Farms with Excess Manure (N or P) and No Cropland	=	Number of facilities with excess manure on a nitrogen or phosphorus basis and no cropland for land application
Total No. of Confined Livestock Farms	=	Total number of confined livestock farms

EPA estimated the percentage of facilities classified as Category 1 using the following equation:

Percent Category 1 Facs = 100% - Percent Category 2 - Percent Category 3 [6-5]

where:

Percent Category 1 Facs	=	Percentage of facilities classified as Category 1
Percent Category 2	=	Percentage of facilities classified as Category 2
Percent Category 3	=	Percentage of facilities classified as Category 3

Option 1 uses only nitrogen-based application factors, while Options 2 through 7 use a combination of both nitrogen- and phosphorus-based factors. Table 6.3-1 presents EPA's estimated percentage of Category 1, 2, and 3 facilities using nitrogen- and phosphorus-based applications.

Table 6.3-1

Percentage of Category 1, 2, and 3 Facilities Using Nitrogen- and Phosphorus-Based Applications

Animal Type	Size Class	Nitrogen-Based Application			Phosphorus-Based Application		
		Category 1	Category 2	Category 3	Category 1	Category 2	Category 3
Beef	Medium 1 Medium 2 Medium 3	84%	9%	7%	62%	31%	7%
	Large 1	68%	21%	11%	22%	67%	11%
	Large 2	8%	53%	39%	1%	60%	39%
Dairy	Medium 1 Medium 2 Medium 3	50%	36%	14%	25%	61%	14%
	Large 1	27%	51%	22%	10%	68%	22%
Heifer	Medium 1 Medium 2 Medium 3	84%	9%	7%	62%	31%	7%
	Large 1	68%	21%	11%	22%	67%	11%
Veal	Medium 1 Medium 2 Medium 3	100%	0%	0%	100%	0%	0%

6.4 Poultry and Swine Technology Frequency Factors

Frequency factors were developed to represent the current implementation rate of various practices used on operations. Since current implementation can vary significantly across operations in a given sector, the frequency factors were developed to represent low, medium, and high implementation costs. For example, operations classified as "low implementation cost" generally tend to have already implemented the practice and thus "low" (or no) additional costs are expected for such operations. Conversely, "high implementation cost" operations are assumed to have little or low levels of implementation and are expected to have "high" additional costs to implement a given practice or meet a certain standard. Data received from USDA were presented in this manner for some technologies and practices, including manure testing, soil testing, record keeping, mortality composting, and adequate mortality storage (Kellogg, 2002).

In some cases, implementation rates in the literature are provided as single values rather than a range of values. Thus, it was assumed that low implementation cost operations had a frequency factor of 100 percent (100 percent of facilities had implemented the practice) and high implementation cost operations had a frequency factor of 0 percent. "Medium implementation cost" was then calculated by assuming that 25 percent of the operations incurred low implementation cost, 25 percent incurred high implementation cost, and the remaining 50 percent incurred medium implementation cost. For example, if literature reported the actual implementation rate to be 65 percent, the low and high implementation cost frequency factors were assumed to be 100 and 0 percent, respectively. The medium implementation cost frequency factor would be computed as 80 percent. In those cases where the medium implementation factor calculation produced results that were not possible, the low or high frequency factor would be adjusted down or up, as appropriate, until a realistic medium frequency factor resulted. For example, if the literature-reported implementation rate was 80 percent, the low and medium frequency factors would be 100 percent and the high frequency factor would be adjusted up to 20 percent (rather than 0 percent).

Where data from USDA were not available, EPA used frequency factors obtained from other sources, which varied by sector, component, or practice. Industry and USDA data were used as the basis for most of the frequency factors for layers and swine; analysis of state and federal regulations was used primarily for broilers and turkeys. EPA's report on state regulatory programs (USEPA, 1999) was also used for all animal sectors. Costs were not attributed to CAFO model farms when state regulations specify standards or require practices equal to or more stringent than the proposed technology options.

Because the literature and industry provided data for the broiler and turkey sectors were generally not detailed enough to generate frequency factors, EPA reviewed the specific regulatory language and summaries of regulations for 12 major poultry-producing states regarding requirements for nutrient management plans (NMPs) at broiler and turkey farms (Tetra Tech, 2000). Requirements were considered for farms in two size groups: 300 to 1,000 animal units (AU) and greater than 1,000 AU. All broiler and turkey farms were assumed to use dry waste management systems.

From the analysis of state and federal regulations, EPA determined that a few states already require broiler and turkey farms to implement some of the components of an NMP. Except as specified for groundwater and surface water requirements, and in cases where select frequency factors could be based on available industry data, the analysis from these 12 states was used to calculate regional frequency factors. These regional frequency factors approximate the number of farms that are currently required to implement NMP components and therefore already incur costs for these components.

Weighted averages were used to estimate frequency factors for each NMP component (for 300 to 1,000 AU and >1,000 AU), as illustrated in the example in Table 6.4-1. The weight reflects the percentage of operations in the entire region already incurring the costs of that component.

Table 6.4-1

Illustration of Method to Calculate Frequency Factors from Weighted Averages

State	Number of Farms[a]	Component Required?[b]	Weight
A	10	Yes	10
B	40	No	0
C	20	Yes	20
D	20	No	0
Regional Total	100		(30/100) = 0.30

[a] The number of farms for broilers and turkeys differs within each state, so the overall regional frequency factors may be different for broilers versus turkeys. 1997 Census of Agriculture data (USDOC, 1999) were used to determine the number of farms in each state within the two size ranges, 300 to 1,000 AU and >1,000 AU.
[b] Components were assumed *not* to be required for states other than the 12 reviewed.

Technology Frequency Factors for Poultry and Swine

Data used to determine frequency factors for poultry and swine varied upon the sector and component or practice. Industry and USDA data were used as the basis for most of the frequency factors for layers (United Egg Producers/United Egg Association and Capitolink, 1999) and swine (USDA APHIS, 1995 and NPPC, 1998), whereas analysis of state and federal regulations was used primarily for broilers and turkeys. In addition, frequency factors were also derived from data provided by USDA NRCS (2002) provided to EPA electronically on February 6, 2002. USDA NRCS data included frequency factors for three performance-based categories of facilities (low performing, medium performing, and high performing) for a series of "representative" farms defined by USDA. Frequency factors are presented in Tables 6.4-2 through 6.4-8 for the various combinations of sector, region, size class, and performance level.

Literature and industry data for the broiler and turkey sectors was generally not detailed enough to generate frequency factors. Instead, EPA reviewed the specific regulatory language and summaries of regulations for 12 major poultry-producing states regarding requirements for nutrient management plans (NMPs) at broiler and turkey facilities (Tetra Tech, 2000). Requirements were considered for both medium and large facilities. All broiler and turkey

facilities were assumed to use dry waste management systems. From the analysis of state and federal regulations, EPA determined that a few states already require broiler and turkey facilities to implement some of the components of a NMP. Except as specified for ground water and surface water requirements, and in cases where select frequency factors could be based on available industry data, the analysis from these 12 states were used to calculate regional frequency factors. These state regulation based frequency factors approximate the number of facilities that are currently required to implement NMP components and, therefore, must already incur costs for these components. Weighted averages were used to estimate frequency factors for each component.

Assessment of Ground Water Link to Surface Water. The frequency factors for these assessments at layer (United Egg Producers/United Egg Association and Capitolink, 1999) facilities was based upon industry data, while the frequency factors for broiler and turkey facilities were conservatively assumed to be zero. The frequency factors for swine facilities was based upon a review of state regulations that already require lagoons to be lined.

Surface Water Monitoring and O&M. The frequency factors for surface water monitoring at layer facilities were assumed to be zero based on site visits, those for swine were based upon industry data (USDA APHIS, 1995), and those for broiler and turkey facilities were derived from an analysis of state regulations (Tetra Tech, 2000).

Soil Augers. The frequency factors for soil augers at layer (United Egg Producers/United Egg Association and Capitolink, 1999) and swine (NPPC, 1998) facilities were based upon industry data, while the frequency factors for broiler and turkey facilities were derived from an analysis of state regulations (Tetra Tech, 2000). In cases where states require soil testing at broiler and turkey facilities, it was assumed that soil augers (or an equivalent technology) are also required or otherwise available to the facility, and thus not costed.

Table 6.4-2

Broiler Frequency Factors: Percent of High (H), Medium (M), Low (L) Performance Facilities By Region That Already Incur Costs

Description	Region	Mid-Atlantic								South								Source
	Size Class	Large				Medium				Large				Medium				
	Performance	H	M	L	A[a]	H	M	L	A[a]	H	M	L	A[a]	H	M	L	A[a]	
Already assess GW link to SW		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Conserv. Assump.
SW monitoring; O&M		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	State Regulations
Soil auger		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	State Regulations
Manure sampler		45	1.7	0	12.1	65	0.7	0	16.6	90	1.2	0	23.1	85	1.5	0	22	State Regulations
Scales (2) for spreader calibration		45	1.7	0	12.1	65	0.7	0	16.6	0	0	0	0	0	0	0	0	State Regulations
Initial NMP development and NMP on-farm recurring		45	1.7	0	12.1	65	0.7	0	16.6	90	1.2	0	23.1	85	1.5	0	22	State Regulations
Calibration of manure spreader		45	1.7	0	12.1	65	0.7	0	16.6	0	0	0	0	0	0	0	0	State Regulations
Storm water diversions		0	0	0	0	0	0	0	0	90	1.2	0	23.1	85	1.5	0	22	State Regulations
Storm water—O&M		0	0	0	0	0	0	0	0	90	1.2	0	23.1	85	1.5	0	22	State Regulations
Stream buffer and O&M		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	State Regulations
Visual inspection		0	0	0	0	0	0	0	0	90	1.2	0	23.1	85	1.5	0	22	State Regulations
Feeding strategies		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	Site visits and industry consult.
Operations that sell or trade		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	UEP, 2002
Adequate storage		90	60	0	52.5	90	60	0	52.5	90	60	30	60	90	60	30	60	USDA NRCS
Soil testing		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Manure testing		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Record keeping		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Mortality—composting		95	85	75	85	95	55	20	56.3	95	85	75	85	95	55	20	56.3	USDA NRCS
Mortality—O&M		95	85	75	85	95	55	20	56.3	95	85	75	85	95	55	20	56.3	USDA NRCS

Note: GW = ground water, SW = surface water, NMP = nutrient management planning, O&M operation and maintenance

[a] Weighted average computed as 0.25 × High (H) + 0.50 × Medium (M) + 0.25 × Low (L)

Table 6.4-3

Turkey Frequency Factors: Percent of High (H), Medium (M), Low (L) Performance Facilities That Already Incur Costs

Description	Region	Midwest								Mid-Atlantic								Source
	Size Class	Large				Medium				Large				Medium				
	Performance	H	M	L	A[a]	H	M	L	A[a]	H	M	L	A[a]	H	M	L	A[a]	
Already assess GW link to SW		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Conserv. Assump.
SW monitoring; O&M		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	State Regulations
Soil auger		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	State Regulations
Manure sampler		40	0.2	0	10.1	100	26.6	0	38.3	5	0.1	0	1.3	1	0.3	0	0.4	State Regulations
Scales (2) for spreader calibration		40	0.2	0	10.1	100	26.6	0	38.3	5	0.1	0	1.3	1	0.3	0	0.4	State Regulations
Initial NMP development and NMP on-farm recurring		0	0	0	0	0	0	0	0	5	0.1	0	1.3	1	0.3	0	0.4	State Regulations
Calibration of manure spreader		40	0.2	0	10.1	100	26.6	0	38.3	5	0.1	0	1.3	1	0.3	0	0.4	State Regulations
Storm water diversions		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	State Regulations
Storm water—O&M		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	State Regulations
Stream buffer and O&M		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	State Regulations
Visual inspection		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	State Regulations
Feeding strategies		10	5	0	5	20	0	0	5	10	5	0	5	20	0	0	5	Site visits and industry consult.
Operations that sell or trade		100	56	0	53	100	56	0	53	100	56	0	53	100	56	0	53	UEP, 2002
Adequate storage		90	50	0	47.5	90	50	0	47.5	90	50	0	47.5	90	50	0	47.5	USDA NRCS
Soil testing		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Manure testing		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Record keeping		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Mortality—composting		70	40	10	40	70	40	10	40	70	40	10	40	70	40	10	40	USDA NRCS
Mortality—O&M		70	40	10	40	70	40	10	40	70	40	10	40	70	40	10	40	USDA NRCS

Note: GW = ground water, SW = surface water, NMP = nutrient management planning, O&M operation and maintenance

[a] Weighted average computed as 0.25 × High (H) + 0.50 × Medium (M) + 0.25 × Low (L)

Table 6.4-4

Layer Frequency Factors: Percent of High (H), Medium (M), Low (L) Performance Facilities That Already Incur Costs

Description	Region	Midwest								South								Source
	Size Class	Large				Medium				Large				Medium				
	Performance	H	M	L	A[a]	H	M	L	A[a]	H	M	L	A[a]	H	M	L	A[a]	
Already assess GW link to SW		40	1.8	0	10.9	40	1.8	0	10.9	100	30	0	40	100	30	0	40	UEP/UEA
SW monitoring; O&M		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	EPA site visits
Soil auger		100	18.6	0	34.3	100	18.6	0	34.3	100	50	0	50	100	50	0	50	UEP/UEA
Manure sampler		100	91.2	0	70.6	100	91.2	0	70.6	100	100	0	75	100	100	0	75	UEP/UEA
Scales (2) for spreader calibration		100	73.6	0	61.8	100	73.6	0	61.8	100	50	0	50	100	50	0	50	UEP/UEA
Initial NMP development and NMP on-farm recurring		100	88.8	0	69.4	100	88.8	0	69.4	100	100	0	75	100	100	0	75	UEP/UEA
Calibration of manure spreader		100	73.6	0	61.8	100	73.6	0	61.8	100	50	0	50	100	50	0	50	UEP/UEA
Storm water diversions		100	99.3	25	80.9	100	99.3	25	80.9	100	90	0	70	100	90	0	70	UEP/UEA
Storm water—O&M		100	99.3	25	80.9	100	99.3	25	80.9	100	90	0	70	100	90	0	70	UEP/UEA
Stream buffer and O&M		100	99.3	25	80.9	100	99.3	25	80.9	100	90	0	70	100	90	0	70	UEP/UEA
Visual inspection		100	0	0	25	100	0	0	25	100	0	0	25	100	0	0	25	AFO strategy
Feeding strategies		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Conserv. Assump.
Operations that sell or trade		100	29.4	0	39.7	100	29.4	0	39.7	100	29.4	0	39.7	100	29.4	0	39.7	UEP, 2002
Lagoon depth marker (wet manure handling system)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0	0	0	0	0	0	0	0	Conserv. Assump.
Adequate storage (dry manure handling system)		95	80	70	81.3	90	60	40	62.5	90	70	60	72.5	80	40	20	45	USDA NRCS
Adequate storage (wet manure handling system)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	80	60	40	60	80	60	40	60	USDA NRCS
Soil testing		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Manure testing		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Record keeping		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Mortality—composting		95	85	75	85	90	55	20	55	95	85	75	85	90	55	20	55	USDA NRCS
Mortality—O&M		95	85	75	85	90	55	20	55	95	85	75	85	90	55	20	55	USDA NRCS

Note: GW = ground water, SW = surface water, NMP = nutrient management planning, O&M operation and maintenance

[a] Weighted average computed as 0.25 × High (H) + 0.50 × Medium (M) + 0.25 × Low (L)

Table 6.4-5

Swine Farrow-to-Finish Operations (Lagoon and Evaporative Lagoon) Frequency Factors: Percent of High (H), Medium (M), Low (L) Performance Facilities That Already Incur Costs

Description	Region	Midwest/Central								Mid-Atlantic								Source
	Size Class	Large				Medium				Large				Medium				
	Performance	H	M	L	A[a]	H	M	L	A[a]	H	M	L	A[a]	H	M	L	A[a]	
Already in compliance with lagoon liner requirements		90	1.2	0	23.1	4	0.2	0	1.1	45	2.1	0	12.3	25	2.3	0	7.4	State Regulations
SW monitoring; O&M		100	5.8	0	27.9	18.4	0	0	4.6	70	0.8	0	17.9	20	1.4	0	5.7	USDA APHIS
Soil auger		100	98	80	94	0	0	0	0	100	98	80	94	0	0	0	0	NPPC, 1998
Manure sampler		100	93.8	0	71.9	0	0	0	0	100	93.8	0	71.9	0	0	0	0	NPPC, 1998
Scales (2) for spreader calibration		100	93.8	0	71.9	0	0	0	0	100	93.8	0	71.9	0	0	0	0	NPPC, 1998
Initial NMP development and NMP on-farm recurring		100	43.8	0	46.9	40	1.4	0	10.7	100	88.8	0	69.4	95	2.3	0	24.9	USDA APHIS
Calibration of manure spreader		100	100	96	99	0	0	0	0	100	100	96	99	0	0	0	0	AFO strategy
Storm water diversions		100	50	0	50	0	0	0	0	100	50	0	50	0	0	0	0	Site visits
Storm water diversions—O&M		100	5.8	0	27.9	15	1.7	0	4.6	70	0.8	0	17.9	20	1.4	0	5.7	Site visits
Stream buffer and O&M		100	100	96	99	0	0	0	0	100	100	96	99	0	0	0	0	Site visits and State Regulations
Visual inspection		100	0	0	25	0	0	0	0	100	0	0	25	0	0	0	0	AFO strategy
Feeding strategies		100	85.4	0	67.7	55	2.3	0	14.9	100	95.4	0	72.7	70	0.6	0	17.8	USDA APHIS
Transportation (N-based)		0	0	0	0	0	0	0	0	100	100	98.4	99.6	100	99.9	15	78.7	State Regulations
Lagoon depth marker		100	100	96	99	0	0	0	0	100	100	96	99	0	0	0	0	AFO strategy
Soil testing		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Manure testing		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Record keeping		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Mortality—composting		100	95.1	0	72.5	100	95.1	0	72.5	100	99.7	5	76.1	100	99.7	5	76.1	Sobecki and
Mortality—O&M		100	95.1	0	72.5	100	95.1	0	72.5	100	99.7	5	76.1	100	99.7	5	76.1	Clipper, 1999

Note: GW = ground water, SW = surface water, NMP = nutrient management planning, O&M operation and maintenance

[a] Weighted average computed as 0.25 × High (H) + 0.50 × Medium (M) + 0.25 × Low (L)

Table 6.4-6

Swine Farrow-to-Finish Operations (Deep Pits) Frequency Factors: Percent of High (H), Medium (M), Low (L) Performance Facilities That Already Incur Costs

Description	Region	Midwest								Mid-Atlantic								Source
	Size Class	Large				Medium				Large				Medium				
	Performance	H	M	L	A[a]	H	M	L	A[a]	H	M	L	A[a]	H	M	L	A[a]	
Already in compliance with lagoon liner requirements		90	1.2	0	23.1	4	0.2	0	1.1	45	2.1	0	12.3	25	2.3	0	7.4	State Regulations
SW monitoring; O&M		100	5.8	0	27.9	18.4	0	0	4.6	70	0.8	0	17.9	20	1.4	0	5.7	USDA APHIS
Soil auger		100	98	80	94	0	0	0	0	100	98	80	94	0	0	0	0	NPPC, 1998
Manure sampler		100	93.8	0	71.9	0	0	0	0	100	93.8	0	71.9	0	0	0	0	NPPC, 1998
Scales (2) for spreader calibration		100	93.8	0	71.9	0	0	0	0	100	93.8	0	71.9	0	0	0	0	NPPC, 1998
Initial NMP development and NMP on-farm recurring		100	43.8	0	46.9	40	1.4	0	10.7	100	88.8	0	69.4	95	2.3	0	24.9	USDA APHIS
Calibration of manure spreader		100	100	96	99	0	0	0	0	100	100	96	99	0	0	0	0	AFO strategy
Storm water diversions		100	50	0	50	0	0	0	0	100	50	0	50	0	0	0	0	Site visits
Storm water diversions—O&M		100	5.8	0	27.9	15	1.7	0	4.6	70	0.8	0	17.9	20	1.4	0	5.7	Site visits
Stream buffer and O&M		100	100	96	99	0	0	0	0	100	100	96	99	0	0	0	0	Site visits and State Regulations
Visual inspection		100	0	0	25	0	0	0	0	100	0	0	25	0	0	0	0	AFO strategy
Feeding strategies		100	85.4	0	67.7	55	2.3	0	14.9	100	95.4	0	72.7	70	0.6	0	17.8	USDA APHIS
Transportation (N-based)		0	0	0	0	0	0	0	0	100	100	98.4	99.6	100	99.9	15	78.7	State Regulations
Lagoon depth marker		100	100	96	99	0	0	0	0	100	100	96	99	0	0	0	0	AFO strategy
Soil testing		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Manure testing		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Record keeping		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Mortality—composting		100	95.1	0	72.5	100	95.1	0	72.5	100	99.7	5	76.1	100	99.7	5	76.1	Sobecki and Clipper, 1999
Mortality—O&M		100	95.1	0	72.5	100	95.1	0	72.5	100	99.7	5	76.1	100	99.7	5	76.1	

Note: GW = ground water, SW = surface water, NMP = nutrient management planning, O&M operation and maintenance

[a] Weighted average computed as 0.25 × High (H) + 0.50 × Medium (M) + 0.25 × Low (L)

Table 6.4-7

Swine Grow/Finish Operations (Lagoon and Evaporative Lagoon) Frequency Factors: Percent of High (H), Medium (M), Low (L) Performance Facilities That Already Incur Costs

Description	Region	Midwest/Central								Mid-Atlantic								Source
	Size Class	Large				Medium				Large				Medium				
	Performance	H	M	L	A[a]	H	M	L	A[a]	H	M	L	A[a]	H	M	L	A[a]	
Already in compliance with lagoon liner requirements		90	1.2	0	23.1	4	0.2	0	1.1	45	2.1	0	12.3	25	2.3	0	7.4	State Regulations
SW monitoring; O&M		100	5.8	0	27.9	18.4	0	0	4.6	70	0.8	0	17.9	20	1.4	0	5.7	USDA APHIS
Soil auger		100	98	80	94	0	0	0	0	100	98	80	94	0	0	0	0	NPPC, 1998
Manure sampler		100	93.8	0	71.9	0	0	0	0	100	93.8	0	71.9	0	0	0	0	NPPC, 1998
Scales (2) for spreader calibration		100	93.8	0	71.9	0	0	0	0	100	93.8	0	71.9	0	0	0	0	NPPC, 1998
Initial NMP development and NMP on-farm recurring		100	43.8	0	46.9	40	1.4	0	10.7	100	88.8	0	69.4	95	2.3	0	24.9	USDA APHIS
Calibration of manure spreader		100	100	96	99	0	0	0	0	100	100	96	99	0	0	0	0	AFO strategy
Storm water diversions		100	50	0	50	0	0	0	0	100	50	0	50	0	0	0	0	Site visits
Storm water diversions—O&M		100	5.8	0	27.9	15	1.7	0	4.6	70	0.8	0	17.9	20	1.4	0	5.7	Site visits
Stream buffer and O&M		100	100	96	99	0	0	0	0	100	100	96	99	0	0	0	0	Site visits and State Regulations
Visual inspection		100	0	0	25	0	0	0	0	100	0	0	25	0	0	0	0	AFO strategy
Feeding strategies		100	85.4	0	67.7	55	2.3	0	14.9	100	95.4	0	72.7	70	0.6	0	17.8	USDA APHIS
Transportation (N-based)		0	0	0	0	0	0	0	0	100	100	98.4	99.6	100	100	18	79.5	State Regulations
Lagoon depth marker		100	100	96	99	0	0	0	0	100	100	96	99	0	0	0	0	AFO strategy
Soil testing		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Manure testing		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Record keeping		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Mortality—composting		100	95.1	0	72.5	100	95.1	0	72.5	100	99.7	5	76.1	100	99.7	5	76.1	Sobecki and
Mortality—O&M		100	95.1	0	72.5	100	95.1	0	72.5	100	99.7	5	76.1	100	99.7	5	76.1	Clipper, 1999

Note: GW = ground water, SW = surface water, NMP = nutrient management planning, O&M operation and maintenance

[a] Weighted average computed as 0.25 × High (H) + 0.50 × Medium (M) + 0.25 × Low (L)

Table 6.4-8

Swine Grow/Finish Operations (Deep Pits) Frequency Factors: Percent of High (H), Medium (M), Low (L) Performance Facilities That Already Incur Costs

Description	Region	Midwest/Central								Mid-Atlantic								Source
	Size Class	Large				Medium				Large				Medium				
	Performance	H	M	L	A[a]	H	M	L	A[a]	H	M	L	A[a]	H	M	L	A[a]	
Already in compliance with lagoon liner requirements		90	1.2	0	23.1	4	0.2	0	1.1	45	2.1	0	12.3	25	2.3	0	7.4	State Regulations
SW monitoring; O&M		100	5.8	0	27.9	18.4	0	0	4.6	70	0.8	0	17.9	20	1.4	0	5.7	USDA APHIS
Soil auger		100	98	80	94	0	0	0	0	100	98	80	94	0	0	0	0	NPPC, 1998
Manure sampler		100	93.8	0	71.9	0	0	0	0	100	93.8	0	71.9	0	0	0	0	NPPC, 1998
Scales (2) for spreader calibration		100	93.8	0	71.9	0	0	0	0	100	93.8	0	71.9	0	0	0	0	NPPC, 1998
Initial NMP development and NMP on-farm recurring		100	43.8	0	46.9	40	1.4	0	10.7	100	88.8	0	69.4	95	2.3	0	24.9	USDA APHIS
Calibration of manure spreader		100	100	96	99	0	0	0	0	100	100	96	99	0	0	0	0	AFO strategy
Storm water diversions		100	50	0	50	0	0	0	0	100	50	0	50	0	0	0	0	Site visits
Storm water diversions—O&M		100	5.8	0	27.9	15	1.7	0	4.6	70	0.8	0	17.9	20	1.4	0	5.7	Site visits
Stream buffer and O&M		100	100	96	99	0	0	0	0	100	100	96	99	0	0	0	0	Site visits and State Regulations
Visual inspection		100	0	0	25	0	0	0	0	100	0	0	25	0	0	0	0	AFO strategy
Feeding strategies		100	85.4	0	67.7	55	2.3	0	14.9	100	95.4	0	72.7	70	0.6	0	17.8	USDA APHIS
Transportation (N-based)		0	0	0	0	0	0	0	0	100	100	98.4	99.6	100	100	18	79.5	State Regulations
Lagoon depth marker		100	100	96	99	0	0	0	0	100	100	96	99	0	0	0	0	AFO strategy
Soil testing		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Manure testing		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Record keeping		20	10	0	10	20	10	0	10	20	10	0	10	20	10	0	10	USDA NRCS
Mortality—composting		100	95.1	0	72.5	100	95.1	0	72.5	100	99.7	5	76.1	100	99.7	5	76.1	Sobecki and Clipper, 1999
Mortality—O&M		100	95.1	0	72.5	100	95.1	0	72.5	100	99.7	5	76.1	100	99.7	5	76.1	

Note: GW = ground water, SW = surface water, NMP = nutrient management planning, O&M operation and maintenance

[a] Weighted average computed as 0.25 × High (H) + 0.50 × Medium (M) + 0.25 × Low (L)

Manure Sampler. The frequency factors for manure samplers at layer (United Egg Producers/United Egg Association and Capitolink, 1999) and swine (NPPC, 1998) facilities were based upon industry data, while the frequency factors for broiler and turkey facilities were derived from an analysis of state regulations (Tetra Tech, 2000). In cases where states require manure testing at broiler and turkey facilities, it was assumed that manure samplers (or an equivalent technology) are also required or otherwise available to the facility, and thus not costed.

Scales for Spreader Calibration. The frequency factors for calibration scales at layer (United Egg Producers/United Egg Association and Capitolink, 1999) and swine (NPPC, 1998) facilities were based upon industry data, while the frequency factors for broiler and turkey facilities were derived from an analysis of state regulations (Tetra Tech, 2000). In cases where states require calibration of manure spreaders at broiler and turkey facilities, it was assumed that calibration scales (or an equivalent calibration technology or method) are also required or otherwise available to the facility, and thus not costed. Calibration of solid manure spreaders can be performed in a number of ways, some of which are based on volume instead of weight, and liquid-based systems can also be calibrated in terms of volume.

Initial NMP Development and NMP Recurring. The frequency factors for development of an on-farm NMP at layer (United Egg Producers/United Egg Association and Capitolink, 1999) and swine (USDA APHIS, 1995) facilities were based upon industry data, while the frequency factors for broiler and turkey facilities were derived from an analysis of state regulations (Tetra Tech, 2000). Revision of plans at broiler and turkey facilities was considered to occur only if explicitly mentioned in the state regulations.

Calibration of Manure Spreader. The frequency factors for spreader calibration at layer facilities were based upon industry data (United Egg Producers/United Egg Association and Capitolink, 1999), those for swine facilities were based upon data from the AFO Strategy (USEPA, 1999), and those for broiler and turkey facilities were derived from an analysis of state regulations (Tetra Tech, 2000).

Storm Water Diversions and Storm Water O&M. The frequency factors for storm water diversions at layer facilities (United Egg Producers/United Egg Association and Capitolink, 1999) were based upon industry data, those for swine facilities were based upon site visits, and those for broiler and turkey facilities were derived from an analysis of state regulations (Tetra Tech, 2000). The frequency factors for operation and maintenance of field runoff controls were assumed to be equal to those for initial implementation of the controls.

Stream Buffer and O&M. The frequency factors for stream buffers at layer facilities were based upon industry data (United Egg Producers/United Egg Association and Capitolink, 1999), those for swine facilities were based upon site visits and state regulations, and those for broiler and turkey facilities were derived from an analysis of state regulations (Tetra Tech, 2000). .

Visual Inspection. The frequency factors for visual inspection at layer and swine facilities were based upon the AFO Strategy (USEPA, 1999), while the frequency factors for broiler and turkey facilities were derived from an analysis of state regulations (Tetra Tech, 2000).

Feeding Strategies. The frequency factors for feeding strategies at swine facilities were based upon USDA data (USDA APHIS, 1995), while the frequency factors for broiler and turkey facilities were provided by site visits and conversations with industry. Most broiler facilities have phase diets, and an increasing number of broiler operations utilize feed additives such as phytase. All broiler operations were all assumed to have phytase additions to their diet, thus no benefit is observed. Phytase use is less common in turkey production where debates exist that the skeletal structure of poults is affected by phytase interactions with calcium. EPA assumed few if any layer facilities incorporated phased diets or feeding strategies beyond nutritional requirements of the birds and molting (if any), and assumed the frequency factor was zero.

Operations that Sell or Trade Manure. The frequency factors for the percentage of swine operations that already sell, trade, or otherwise transport manure off-site for swine is conservatively set to zero based on the small fraction of operations that report

transporting manure off site (USDA APHIS, 1995). The frequency factors for poultry are based on recent data submitted to the EPA (United Egg Producers, 2002).

Lagoon Marker. The frequency factors for lagoon depth markers at swine facilities were based upon the AFO Strategy (USEPA, 1999). It was assumed that no layer facilities had lagoon depth markers, and dry manure facilities do not need depth markers.

Adequate Storage, Soil Testing, Manure Testing, Record Keeping, Mortality (Composting and O&M). The frequency factor for these components were primarily based on data provided by USDA NRCS (2002). These frequency factors are from USDA's input files entitled *Summary of CNMP needs and total cost per component for Manure and Wastewater Storage and Handling* provided to EPA electronically on February 6, 2002. The input file includes frequency factors for three performance-based categories of facilities (low performing, medium performing, and high performing) for a series of "representative" farms defined by USDA. Data describing the exact methods for handling swine mortality were not available, however, EPA believes all Large CAFOs already have technologies/BMPs in place to handle routine mortalities. Since additional controls of mortalities were only considered for Option 3, EPA only calculated incremental costs for those operations with a direct hydrologic link to surface waters from the ground water beneath the production area. The portion of facilities required to implement additional swine mortality controls was based on an assessment of ground water risk (USEPA, 2000). Thus, the frequency factors for swine mortality represent the percent of operations that would not have to implement additional mortality practices because they do not have a hydrologic link from the ground water to the surface water rather than the actual percentage of swine operations that have adequate mortality handling facilities.

6.5 Poultry and Swine Nutrient Basis Frequency Factors

EPA estimated the number of facilities that will have to land-apply their manure on a phosphorus basis by using state soil test data (Sharpley, A.N., T. Daniel, T. Sims, J. Lemunyon, R. Stevens, R. Parry, 1999). Consistent with EPA acknowledgment of site-specific differences, these data clearly show that high soil phosphorus levels are a regional problem. Distinct areas of

general phosphorus deficit and surplus exist within states and regions and can be correlated to areas of intensive animal production. To develop the percentage of agricultural soils testing high in phosphorus on a regional basis, the percentage of soils testing high or above in phosphorus was weighted with the number of facilities in each state. Table 6.5-1 shows the results of the facility-weighted soil test values by region and animal type. The label "P" indicates that more than half of the facility-weighted soils tested high or above for phosphorus. An "N" indicates that less than half of the facility-weighted soil tests in the region were high in phosphorus. If the facility weighted soil test values indicated that more than half of the soils in the region tested high for phosphorus, it was assumed that 60 percent of the facilities will require a phosphorus-based manure application rate and 40 percent can use a nitrogen-based rate. If the facility-weighted soil test values indicated that less than half of the soils in the region tested high for phosphorus, it was assumed that 40 percent of the facilities will require a phosphorus-based manure application rate and 60 percent can use a nitrogen-based rate. This approach reflects the potential fluctuations in phosphorus soil tests in a given state.

Table 6.5-1

AFO Nutrient Management Planning Basis by Animal Sector and Region Based on Percentage of Agricultural Soils Analyzed by Soil Test Laboratories in 1997 That Tested High or Above for Phosphorus

Sector Industry	Farm Size	Regions				
		Central	Mid-Atlantic	Midwest	Pacific	South
Broilers	Medium	P	P	P	P	N
Layers (dry)	Medium	P	P	P	P	N
Layer (wet)	Medium	N	P	P	P	N
Swine	Medium	N	P	P	P	P
Turkey	Medium	N	P	P	P	P
Broilers	Large	P	P	P	P	N
Layers (dry)	Large	P	P	P	P	N
Layers (wet)	Large	P	P	P	P	N
Swine	Large	N	P	P	P	P
Turkey	Large	N	P	P	P	P

Key: N = less than half of the facility-weighted soil tests in the region were high in phosphorus.
P = more than half of the facility-weighted soils tested high or above for phosphorus.

6.6 Poultry and Swine Land Availability Frequency Factors

All operations fall into one of three land availability categories depending on the amount of on-site cropland available for manure application.

- Category 1 operations have sufficient land to land-apply all of their generated manure and wastewater at appropriate agronomic rates. No manure is transported off site.

- Category 2 operations do not have sufficient land to land-apply all of their generated manure and wastewater at appropriate agronomic rates. The excess manure after agronomic application is transported off site.

- Category 3 operations do not have any available land for manure application. All generated manure and wastewater is transported off site.

For broilers and swine, the number of operations by land availability category was provided by the USDA NRCS (2002) at the state or group-of-state level. Section 4.3 provides details on how these data were processed for broilers and swine. For layers and turkeys, the number of operations by land availability category was provided by USDA NRCS (2002) at the national level by size class. Percentages were computed using the number of operations by land availability category with the results provided in Table 6.6.1. Due to data disclosure issues the number of Category 1 operations using a phosphorus based application rate was not made available. Lacking this data, EPA heuristically assumed that 20 percent of the Category 1 operations using nitrogen based application rates would be Category 1 using phosphorus based application rates.

Table 6.6-1

Percentage of Category 1, 2, and 3 Operations for Layers and Turkeys

Sector	Size Class	Nitrogen Based Applications			Phosphorus Based Applications		
		Category 1	Category 2	Category 3	Category 1	Category 2	Category 3
Layers	Medium 1	25.64%	44.97%	29.38%	4.25%	66.37%	29.38%
Layers	Medium 2	19.28%	40.36%	40.36%	3.86%	55.78%	40.36%
Layers	Medium 3	14.71%	40.34%	44.96%	2.94%	52.10%	44.96%
Layers	Large 1	10.88%	41.43%	47.69%	2.18%	50.13%	47.69%
Layers	Large 2	10.88%	41.43%	47.69%	2.18%	50.13%	47.69%
Turkeys	Medium 1	16.11%	53.03%	30.86%	3.22%	65.92%	30.86%
Turkeys	Medium 2	7.32%	60.46%	32.22%	1.46%	66.32%	32.22%
Turkeys	Medium 3	10.69%	53.05%	36.26%	2.14%	61.60%	36.26%
Turkeys	Large 1	7.47%	53.87%	38.66%	0.00%	61.34%	38.66%

6.7 Ground Water Control Frequency Factors

EPA developed two sets of frequency factors for all animal types for ground water control costs. The first set of frequency factors corresponds to Options 3A/3B and includes ground water monitoring, ponds and lagoons with engineered liners, concrete pads for solid waste storage areas, and a hydrological assessment. The second set of frequency factors corresponds to Options 3C/3D and includes permeability standards for waste storage units.

EPA developed the frequency factors for Option 3A/3B using an analysis of soil types and ground water depths across the country (USEPA, 2000). Based on this analysis, EPA determined that, under Option 3A/3B, facilities located in areas with sandy soils, shallow depths to ground water, and karst or karst-like terrains would require ground water controls and all other facilities would incur only the costs for the ground water assessment. Table 6.2-1 presents the frequency factors for facilities located in areas requiring controls and facilities requiring only a ground water assessment under Options 3A/3B.

Table 6.2-1

Percentage of Facilities Incurring Ground Water Costs Under Option 3A/3B

Animal Type	Size Class	Region	Facilities Requiring All Ground Water Controls	Facilities Requiring Only a Hydrologic Assessment
All	All	Central	13%	87%
		Mid-Atlantic	24%	76%
		Midwest	27%	73%
		Pacific	12%	88%
		South	22%	78%

EPA developed the frequency factors for Option 3C/3D using an analysis of state regulations. Facilities located in states with permeability standards for waste storage units and in locations identified under Option 3A/3B as high-risk areas were assumed to already be in compliance with Option 3C/3D and therefore would not incur costs. EPA determined that

existing permeability standards applied only to large facilities and, therefore, assumed that all medium facilities located in areas with a high risk of ground water contamination would incur costs. To develop regional frequency factors for facilities that would incur costs under Option 3C/3D, EPA used the following equation:

$$FacPermeability = (1 - \%FacState) \times \%FacGW \quad [6\text{-}1]$$

where:

FacPermeability	=	Percentage of facilities located in the region that incur ground water costs under Option 3C/3D
%FacState	=	Percentage of facilities in the region that are located in states with existing permeability standards
%FacGW	=	Percentage of facilities in the region that are located in areas with a high risk of ground water contamination.

Table 6.2-2 presents the percentage of facilities requiring ground water costs under Option 3C/3D.

Table 6.2-2

Percentage of Beef Feedlots, Dairies, and Heifer Operations Incurring Ground Water Costs Under Option 3C/3D

Animal Type	Size Class	Region				
		Central	Mid-Atlantic	Midwest	Pacific	South
Option 3C						
Beef and Heifer	Medium 1 Medium 2 Medium 3	13%	24%	27%	12%	22%
	Large 1 Large 2	6%	20%	26%	10%	22%
Dairy	Medium 1 Medium 2 Medium 3	13%	24%	27%	12%	22%
	Large 1	7%	22%	13%	12%	22%
Veal	Medium 1 Medium 2 Medium 3	13%	24%	27%	12%	22%
Option 3D						
Beef and Heifer	Medium 1 Medium 2 Medium 3	87%	76%	73%	88%	78%
	Large 1 Large 2	94%	80%	74%	90%	78%
Dairy	Medium 1 Medium 2 Medium 3	87%	76%	73%	88%	78%
	Large 1	93%	78%	87%	88%	78%
Veal	Medium 1 Medium 2 Medium 3	13%	24%	27%	12%	22%

6.8 References

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7.0 EXAMPLE MODEL CALCULATIONS

This section includes an example calculation of model farm costs for the beef and dairy cost model.

7.1 Beef and Dairy Model Farm Example Calculation

This subsection uses the information presented previously in this report to provide an example calculation of model farm costs. The beef and dairy cost model calculates the total model farm costs using the waste management system component costs with the frequency factors. This subsection presents an example of this calculation for the following model farm for Option 2:

- Animal type = Dairy;
- Size class = Large 1 (i.e., >700 head);
- Regional location = Central;
- Farm type = Flush; and
- Performance level = Medium.

Under Option 2, the cost model estimates costs for a Large dairy operation in the Central region for the following waste management system components:

- Runoff control berms;
- Concrete settling basin;
- Lagoon;
- Accumulated sludge removal;
- Composting;
- Liquid land application equipment;
- Commercial fertilizer application;
- Nutrient management planning; and
- Off-site waste transportation.

This example does not show how each of these component costs is calculated. Instead, this example uses these component costs (Appendix A) and frequency factors to calculate the final weighted model farm cost.

The costs presented in this example represent the expected costs for this model farm for the final rule. Appendix C presents the model farm costs (in 1997 dollars) for Options 1, 2 and 5.

7.1.1 Unit Component Costs

The first step in the cost calculation is the generation of costs for each component included in the regulatory option. As noted in Section 7.1, EPA is not showing how these costs are calculated here; instead, these component costs are provided as the starting point for this example. The methodology for calculating these costs is presented in corresponding sections of this report.

Component costs are classified based on whether they vary by nutrient application basis and land availability category. Nutrients may be applied on site according to either the nitrogen needs of the crops or the phosphorus needs of the crops. Additionally, all model farms are classified into three land availability categories:

- Category 1 facilities have enough cropland to apply all of their waste on site;
- Category 2 facilities have some cropland, and apply some of their waste on site and haul the other portion of waste off site; and
- Category 3 facilities have no cropland and haul all of their waste off site.

The cost model calculates costs for seven possibilities for each farm type, region, size group, and performance level:

1) Component cost does not vary by nutrient basis or category;
2) Component cost varies by category and nutrient: Nitrogen basis, Category 1 facility;
3) Component cost varies by category and nutrient: Phosphorus basis, Category 1 facility;

4) Component cost varies by category and nutrient: Nitrogen basis, Category 2 facility;

5) Component cost varies by category and nutrient: Phosphorus basis, Category 2 facility;

6) Component cost varies by category and nutrient: Nitrogen basis, Category 3 facility; and

7) Component cost varies by category and nutrient: Phosphorus basis, Category 3 facility.

The cost model calculates a weighted model summary cost for each category by summing the component costs that do not vary with the category costs, weighted according to the nutrient basis and category.

Table 7.1.1-1 presents component costs that do not vary by nutrient application basis (i.e., nitrogen- versus phosphorus-based application). Table 7.1.1-2 presents component costs that do vary by nutrient application basis. Finally, Table 7.1.1-3 presents the component costs for the four transportation scenarios considered for both Category 2 and Category 3 flush dairies.

Table 7.1.1-1

Component Costs for Option 2 That Do Not Vary by Nutrient Application Basis Flush Dairy, Large 1, Central

Component	Flush Dairy	
	Capital	Annual
Runoff control berms	$3,069	$61
Concrete settling basin	$130,713	$2,614
Lagoon	$201,552	$10,078
Accumulated sludge removal	$122,426	$6,121
Composting	$9,157	$7,995

Table 7.1.1-2

Component Costs for Option 2 That Vary by Nutrient Application Basis
Flush Dairy, Large 1, Central

	Nitrogen-Based Application			Phosphorus-Based Application		
	Capital	Fixed	Annual	Capital	Fixed	Annual
Category 1						
Nutrient Management Planning	$0	$3,648	$2,453	$0	$9,316	$5,750
Commercial Nitrogen Fertilizer	$0	$0	$0	$0	$0	$25,361
Liquid Land Application	$70,454	$0	$7,510	$125,115	$0	$11,541
Category 2						
Nutrient Management Planning	$0	$2,151	$1,581	$0	$3,194	$2,188
Commercial Nitrogen Fertilizer	$0	$0	$0	$0	$0	$7,300
Liquid Land Application	$64,925	$0	$6,212	$104,562	$0	$10,669
Category 3						
Nutrient Management Planning	$0	$1,035	$1,089	$0	$1,035	$1,089
Commercial Nitrogen Fertilizer	$0	$0	$0	$0	$0	$0
Liquid Land Application	$0	$0	$0	$0	$0	$0

NOTE: Nutrient Management Planning includes the following costs: nutrient plan development, soil and manure sampling, land application equipment calibration, recordkeeping and reporting, lagoon depth markers, and identification of setback areas.

Table 7.1.1-3

Transportation Costs for Option 2 Flush Dairy, Large 1, Central

Category[a]	Transportation Scenario	Nitrogen-Based Application		Phosphorus-Based Application	
		Capital	Annual	Capital	Annual
2	Purchase truck	$171,724	$21,932	$373,312	$46,494
	Contract haul	$0	$68,850	$0	$30,400
	Purchase truck (composted manure)	$171,724	$21,909	$373,312	$46,426
	Contract haul (composted manure)	$0	$68,831	$0	$30,363
3	Purchase truck	NA	NA	$373,312	$106,031
	Contract haul	NA	NA	$0	$130,758
	Purchase truck (composted manure)	NA	NA	$373,312	$105,997
	Contract haul (composted manure)	NA	NA	$0	$130,751

[a]Category 1 operations do not incur transportation costs because they have sufficient land to apply all waste on site.
NA - Not applicable; Category 3 operations do not incur transportation costs under N-based scenarios because they are already assumed to transfer all waste off site under N-based scenarios.

7.1.2 Calculation of Weighted Component Costs

The cost model then weights the component costs to reflect the percentage of operations that already have some components in place. The following equation is used to weight the component costs:

$$Cost_{weighted} = Cost_{component} \times (1 - \text{Frequency Factor}) \quad [7\text{-}1]$$

where:

$Cost_{weighted}$ = Weighted component cost
$Cost_{component}$ = Component cost (from Table 7.1.1-1)
Frequency Factor = Percentage of operations that have component in place.

Table 7.1.2-1 presents the frequency factors used for large flush dairy operations in the Central region.

Table 7.1.2-1

Percentage of Operations Assumed to Have Equivalent Technology In Place Flush Dairy, Large 1, Central

Component	Performance Category of Operation		
	High	Medium	Low
Runoff control berms	100%	90%	70%
Concrete settling basin	33%	33%	33%
Lagoon	100%	100%	100%
Accumulated sludge removal	100%	100%	100%
Composting	0%	0%	0%
Nutrient management planning	20%	10%	0%
Commercial nitrogen fertilizer	0%	0%	0%
Liquid land application	90%	70%	50%
Transportation (N-Based)	54%	54%	54%

Equation 7-1 is used to calculate the weighted component costs for the model farm for all land availability categories (Categories 1, 2, and 3) and performance categories (high, medium, and low). For example, capital weighted costs for liquid land application in Category 2 at a medium performing facility are calculated as follows:

$$\begin{aligned} Cost_{weighted} &= Cost_{component} \times (1 - \text{Frequency Factor}) \\ &= \$64{,}925 \times (1 - 0.70) \\ &= \$19{,}477 \end{aligned}$$

where:

$64,924	=	Category 2 liquid land application cost, Table 7.1.1-2
0.70	=	Frequency factor for liquid land application from Table 7.1.2-1.

Table 7.1.2-2 presents the weighted component costs for components that do not vary by nutrient application basis and land availability category. Costs are shown for all performance categories. Table 7.1.3-1 presents the weighted costs for components that vary by nutrient application basis and land availability category.

Table 7.1.2-2

Weighted Component Costs for Option 2 That Do Not Vary by Nutrient Application Basis and Land Availability Category Medium Performance, Flush Dairy, Large 1, Central

Component	Capital	Annual
Runoff control berms	$307	$6
Concrete settling basin	$87,578	$1,752
Lagoon	$0	$0
Accumulated sludge removal	$0	$0
Composting	$9,157	$7,995

7.1.3 Calculation of Weighted Farm Costs

Some weighted component costs vary depending on the nutrient application basis and land availability category, as shown in Table 7.1.3-1. To calculate weighted farm costs, the cost model applies farm-type frequency factors to the weighted component costs to represent the portion of operations that can be characterized within each nutrient management basis and land availability category.

Table 7.1.3-1

Weighted Component Costs for Option 2 That Vary by Nutrient Application Basis and Land Availability Category Medium Performance, Flush Dairy, Large 1, Central

Component	Nitrogen-Based Application		Phosphorus-Based Application	
	Capital Costs	Annual Costs	Capital Costs	Annual Costs
Category 1				
Nutrient management planning	$3,283	$2,207	$8,384	$5,175
Commercial nitrogen fertilizer	$0	$0	$0	$25,361
Liquid land application	$35,227	$3,755	$62,557	$5,771
Transportation - Purchase truck option	$0	$0	$0	$0
Transportation - Contract-hauling option	$0	$0	$0	$0
Transportation - Purchase truck option with composting	$0	$0	$0	$0
Transportation - Contract-hauling option with composting	$0	0$0	$0	$0
Category 2				
Nutrient management planning	$1,935	$1,423	$2,875	$1,969
Commercial nitrogen fertilizer	$0	$0	$0	$7,300
Liquid land application	$32,462	$3,106	$52,281	$5,335
Transportation - Purchase truck option	$171,724	$21,932	$373,312	$46,494
Transportation - Contract-hauling option	$0	$68,850	$0	$30,400
Transportation - Purchase truck option with composting	$171,724	$21,909	$373,312	$46,426
Transportation - Contract-hauling option with composting	$0	$68,831	$0	$30,363
Category 3				
Nutrient management planning	$1,035	$1,089	$1,035	$1,089
Commercial nitrogen fertilizer	$0	$0	$0	$0
Liquid land application	$0	$0	$0	$0
Transportation - Purchase truck option	$0	$0	$373,312	$106,031
Transportation - Contract-hauling option	$0	$0	$0	$130,758
Transportation - Purchase truck option with composting	$0	$0	$373,312	$105,997
Transportation - Contract-hauling option with composting	$0	$0	$0	$130,751

The first farm-type weighting factor applied adjusts the weighted component costs for the land availability category (Category 1, Category 2, or Category 3). Section 6.0 presents the calculation of the land availability category frequencies, and Table 7.1.3-2 provides these frequency factors for dairies under the nitrogen-based and phosphorus-based application scenarios.

Table 7.1.3-2

Land Availability Category Frequency Factors
Dairies, Large 1

	Nitrogen Basis	Phosphorus Basis
Category 1	27%	10%
Category 2	51%	68%
Category 3	22%	22%

The second farm-type weighting factor applied adjusts the weighted component costs for the type of nutrient-based application used. Because all operations are required to land apply using a nitrogen-based application rate under Option 1, the weighted farm costs are equal to the nitrogen-based weighted component costs. Likewise, because all operations are required to land-apply using a phosphorus-based application rate under Option 2A, the weighted farm costs are equal to the phosphorus-based weighted component costs. For the remaining options, EPA assumed that each model farm would apply waste based on both a nitrogen and phosphorus basis. Section 6.0 presents the percentage of costs that are attributed to an N-based application basis versus a P-based application basis for each model farm. For this example, the nutrient-based frequency factors for large dairies in the Central region are 56 percent of operations require nitrogen-based application and 44 percent of operations require phosphorus-based application.

The cost model uses these two farm-type factors to calculate the weighted farm costs using the following equation:

$$\text{Category } X_{\text{weightedcost}} = \frac{[(\%N \times \%N\text{-Cat } X \times \text{Cat1(N)Cost}) + (\%P \times \%P\text{-Cat } X \times \text{Cat1(P)Cost})]}{[(\%N \times \%N\text{-Cat } X) + (\%P \times \%P\text{-Cat } X)]} \quad [7\text{-}3]$$

where:

%N	=	Percentage of land that requires N-based application
%N-Cat X	=	Category X frequency factor under an N-based application scenario
%P	=	Percentage of land that requires P-based application
%P-Cat X	=	Category X frequency factor under an P-based application scenario.

For example, capital weighted costs for liquid land application in Category 2 at a medium-performing facility are calculated as:

$$\text{Land Application}_{\text{cat2}} = \frac{[(56\% \times 54\% \times \$19{,}477) + (44\% \times 68\% \times \$31{,}369)]}{[56\% \times 54\% + 44\% \times 68\%]} \quad [7\text{-}4]$$

The cost model uses each of the weighted model farm components to calculate the weighted model farm costs using Equation 7-3 for each possible category and transportation option. The transportation cost test is then used to determine which transportation option is the least costly, as described in Section 5.17 of this report. The selected transportation option for this example is contract hauling without composting for both Category 2 and 3 operations.

Table 7.1.3-3 presents the weighted farm costs for the example model, including the selected least-cost transportation scenario.

Table 7.1.3-3

Weighted Farm Costs for Option 2
Medium Performance, Flush Dairy, Large 1, Central

Component	Category 1		Category 2		Category 3	
	Capital	Annual	Capital	Annual	Capital	Annual
Concrete basin	$87,578	$1,752	$87,578	$1,752	$87,578	$1,752
Berms	$307	$6	$307	$6	$307	$6
Composting[b]	$0	$0	$0	$0	$0	$0
Lagoon	$0	$0	$0	$0	$0	$0
Nutrient management planning[c]	$4,433	$2,877	$2,416	$1,702	$1,035	$1,089
Liquid land application	$24,833	$2,526	$25,561	$2,548	$0	$0
Commercial fertilizer application	$0	$5,717	$0	$3,735	$0	$0
Selected Transportation Scenario						
Purchase truck	$0	$0	$0	$49,178	$0	$57,533

[a]Costs are weighted by farm type (hose versus flush) and by application basis (nitrogen versus phosphorus).
[b]Composting costs were not selected as part of the model farm costs.
[c]Nutrient management planning capital costs are fixed costs; 3-year recurring costs are also incurred, but are not shown in this table.

7.1.4 Final Model Farm Costs

The weighted farm costs are summed and annualized for each of the transportation scenarios, and the least costly scenario is selected. The cost model sums these costs to generate the final model farm capital, annual, fixed, and 3-year recurring costs by category. Table 7.1.4-1 presents the weighted farm costs selected for the model farm. Commercial fertilizer costs are listed as a separate cost item in the model farm result tables presented in Appendix C.

Table 7.1.4-1

Model Farm Costs by Category
Medium Performance, Flush Dairy, Large 1, Central

Component	Capital	Annual	Fixed
Category 1			
Total Model Farm Costs	$112,718	$56,658	$4,926
Commercial Fertilizer Application	$0	$5,717	$0
Category 2			
Total Model Farm Costs	$113,446	$63,731	$2,685
Commercial Fertilizer Application	$0	$3,735	$0
Category 3			
Total Model Farm Costs	$87,885	$2,968	$1,150
Commercial Fertilizer Application	$0	$0	$0

7.2 Swine and Poultry Model Farm Cost Example

This section uses the information presented previously in this report to provide an example calculation of model farm costs. The total model farm costs are calculated using the waste management system component costs with the frequency factors. This section presents an example of this calculation for the following model farm for Option 2 (manure land-applied on a P-basis):

- Animal type = Swine;
- Size class = Large 1 (i.e., 2,500 to 4,999 head);
- Regional location = Mid-Atlantic;
- Farm type = Grow-Finish;
- Waste storage system = lagoon; and
- Performance level = Medium.

Under Option 2, the following components are costed for the above model farm:

- Nutrient management planning (NMP) one time costs (soil auger, manure sampler, scales for manure spreader calibration, initial NMP development).

- NMP reoccurring costs (on-farm NMP development every 5 years, soil testing every 3 years).
- NMP annual costs (record keeping, manure spreader calibration, manure testing twice per year).
- Facility upgrades (lagoon depth marker, berms to divert storm water from entering lagoon, field runoff controls).
- Facility annual costs (visual inspection, operation and maintenance of berms, operation and maintenance of field runoff controls, and land rental value).
- Practices to remove excess manure nutrients from the operation site (secondary lagoon to decrease dilution and the least expensive scenario of the following: feeding strategies; hauling, with or without feeding strategies; solid liquid separation and hauling, with or without feeding strategies; retrofit to scraper system and hauling, with or without feeding strategies; retrofit to high rise and hauling, with or without feeding strategies; retrofit to hoop house and hauling, with or without feeding strategies; sludge cleanout every 5 years, with or without feeding strategies).
- Commercial fertilizer costs that replace manure nutrients in some situations.

The methodologies used to calculate the costs for each of these waste management system components are presented in Chapter 5. This example demonstrates how these methodologies are used to calculate the costs for one model farm. This example also demonstrates how the frequency factors are used to calculate the final, weighted, model farm cost.

7.2.1 Unit Component Costs

As in the previous dairy example, the first step in the cost calculation is the generation of costs for each component included in the regulatory option. This example does not include calculating the component level costs; instead, these component costs are provided as the starting point for this example. The methodology for calculating each of these costs is presented in corresponding chapters of this report.

Component costs are classified based on whether they vary by nutrient application basis and land availability category. Nutrients may be applied on site according to either the nitrogen needs of the crops or the phosphorus needs of the crops (the examples below assume

that manure nutrients are applied to meet the phosphorus needs of the crops). Additionally, all model farms are classified into three land availability categories:

- Category 1 facilities have enough cropland to apply all of their manure nutrients on site;
- Category 2 facilities have some cropland, and apply some of their manure nutrients on site and can use a variety of practices to remove the remaining manure nutrients; and
- Category 3 facilities have no cropland and must remove excess manure nutrients from the operation site.

Costs are calculated for six possibilities for each farm type, region, size group, and performance level:

1) Component cost that do not vary by nutrient basis and category;
2) Component costs that do not vary for facilities that apply manure on site;
3) Component costs that vary in direct proportion to the number of animals at the facility;
4) Component costs that vary by the acreage at the facility (Category 1 and 2 facilities);
5) Component costs for Category 2 facilities that vary by regulatory option; and
6) Category 3 facility costs for moving manure nutrients an additional distance under option 2.

A weighted model summary cost is calculated for each category by summing the component costs that do not vary with the category costs, weighted according to the nutrient basis and category.

Table 7.2-1 presents component costs that do not vary by option, facility category, or nutrient application basis (i.e., nitrogen- versus phosphorus-based application). Table 7.2-2 presents component costs that do vary for facilities that apply manure on-site. Table 7.2-3 presents the component costs that vary only based upon the number of head at the facility. Table

7.2-4 presents component costs that vary by the acreage at the facility (Category 1 and 2 facilities). Table 7.2-5 presents component costs for Category 2 facilities that vary by regulatory option.

Table 7.2-1

Component Costs for That Do Not Vary by Option, Facility Category, or Manure Nutrient Application Basis Swine Grow-Finish with Lagoons, Large 1, Mid-Atlantic

Component	Capital	Annual
Manure sampler	$30	None
Record keeping	None	$1,020
Lagoon depth marker	$30	None
Manure testing	None	$100
Visual inspection	None	$130

Table 7.2-2

Component Costs That Do Not Vary for Facilities That Land Apply Manure On-site Swine Grow-Finish with Lagoons, Large 1, Mid-Atlantic

Component	Capital	Annual
Soil auger	$25	None
Two scales for spreader calibration	$500	None
Calibrate manure spreader	None	$40

Table 7.2-3

Component Costs That Vary by Facility Based on Head Count Swine Grow-Finish with Lagoons, Large 1, Mid-Atlantic

Model Farm Description	Number of Head	Storm Water Diversions (berms)	
		Capital	Annual
Category 1			
Option 1 (N-based application)	2,664	$816	$16
Option 2 (P-based application)	2,500	$795	$16
Category 2			
N-based application	4,581	$863	$17
P-based application	4,581	$863	$17
Category 3			
All options	4,424	$1,008	$20

Table 7.2-4

Component Costs for Options 1 and 2 That Vary by Facility Based on Acreage (Category 1 and 2 only) Swine Grow-Finish with Lagoons, Large 1, Mid-Atlantic

Cat	Component	Nitrogen-Based Application						Phosphorus-Based Application					
		Acres	Capital	Fixed	Annual	3-year	5-year	Acres	Capital	Fixed	Annual	3-year	5-year
1	Cost to develop initial NMP	76	NA	$1,343	NA	NA	NA	702	NA	$4,475	NA	NA	NA
	NMP development every 5 years	76	NA	NA	NA	NA	$383	702	NA	NA	NA	NA	$3,515
	Soil testing every 3 years	76	NA	NA	NA	$26	NA	702	NA	NA	NA	$234	NA
	Field runoff controls	76	$285	NA	NA	NA	NA	702	$2,616	NA	NA	NA	NA
	Runoff controls – O&M, rental	76	NA	NA	$177	NA	NA	702	NA	NA	$1,623	NA	NA
2	Cost to develop initial NMP	76	NA	$1,341	NA	NA	NA	175	NA	$1,807	NA	NA	NA
	NMP development every 5 years	76	NA	NA	NA	NA	$381	175	NA	NA	NA	NA	$847
	Soil testing every 3 years	76	NA	NA	NA	$25	NA	175	NA	NA	NA	$56	NA
	Field runoff controls	76	$284	NA	NA	NA	NA	175	$630	NA	NA	NA	NA
	Runoff controls – O&M, rental	76	NA	NA	$176	NA	NA	175	NA	NA	$162	NA	NA

O&M = operation and maintenance
NA = Not Applicable.

Unique Category 2 Facility Costs

Practices that reduce or remove excess manure nutrients are only used for Category 2 facilities. The least expensive scenario of the following is selected:

- Feeding strategies;
- Install secondary lagoon to reduce manure dilution and hauling with or without feeding strategies;
- Solid liquid separation and hauling with or without feeding strategies;
- Retrofit to scraper system and hauling with or without feeding strategies;
- Retrofit to high rise and hauling with or without feeding strategies;
- Retrofit to hoop house and hauling with and without feeding strategies; or
- Install secondary lagoon to reduce manure dilution and sludge cleanout and hauling every five years with and without feeding strategies.

Under option 2, Category 2 facilities that are required to apply their manure on site using P-based application rates incur costs to apply commercial fertilizer. Table 7.2-5 presents the unique component costs for Category 2 facilities by manure nutrient application basis.

Table 7.2-5

Component Costs That are Unique to Category 2 Facilities
Options 1 and 2, Swine Grow-Finish with Lagoons, Large 1, Mid-Atlantic

Option	Selected BMPs	Nitrogen-Based Application					Phosphorus-Based Application				
		Capital	Fixed	Annual	3-year	5-year	Capital	Fixed	Annual	3-year	5-year
1	Secondary lagoon with pipe and pump	$8,633	NA	NA	NA	NA	NA	NA	NA	NA	NA
	O&M for secondary lagoon, pipe, pump	NA	NA	$173	NA	NA	NA	NA	NA	NA	NA
	Sludge removal and hauling every 5 years	NA	NA	NA	NA	$129	NA	NA	NA	NA	NA
2	Secondary lagoon with pipe and pump	$8,633	NA	NA	NA	NA	$6,461	NA	NA	NA	NA
	O&M for secondary lagoon, pipe, pump	NA	NA	$173	NA	NA	NA	NA	$129	NA	NA
	Sludge removal and hauling every 5 years	NA	NA	NA	NA	$129	NA	NA	NA	NA	$6,787
	Commercial N fertilizer applied on site to replace manure N	NA	NA	NA	NA	NA	NA	NA	$2,580	NA	NA

NA = Not Applicable.

Category 3 Facility Costs for Option 2 P-based Manure Application

Under option 2 (P-based land application) Category 3 facilities are assumed to haul their manure farther than they do under option 1 (N-based application) because more land is required. As stated previously, facilities are assumed to apply their manure off site on a N-basis. Thus it is assumed that costs are only applicable to the regulation for moving manure from Category 3 facilities under option 2. The costs are calculated by multiplying the additional mileage by the commercial hauling rate and the mass of the manure to be hauled. The model selects the least expensive practice for moving the manure nutrients the additional distance from the facility. The least expensive practice for Category 3 grow-finish facilities under option 2 in the Mid-Atlantic region is hauling lagoon sludge every 5 years at a cost of $8,496.

7.2.2 Calculation of Adjusted Component Costs

As stated in section 7.1, the component costs are then adjusted to reflect the percentage of operations that already have some components in place. The following equation is used to adjust the component costs:

$$Cost_{adjusted} = Cost_{component} \times (1 - \text{Frequency Factor})$$

where:

$Cost_{adjusted}$	=	Adjusted component cost
$Cost_{component}$	=	Component cost
Frequency Factor	=	Percentage of operations that have component in place.

Table 7.2-6 presents the frequency factors used for Large 1 grow-finish operations in the Mid-Atlantic Region.

Table 7.2-6

Percent Operations Assumed to Have Equivalent Technology In Place Swine Grow-Finish Operations with Lagoons, Large 1, Mid-Atlantic Region

Component	Performance Category of Operation*		
	High	Medium	Low
Soil auger	100%	98%	80%
Manure sampler	100%	94%	0%
Scales for manure spreader calibration	100%	94%	0%
Development NMP initial and recurring	100%	89%	0%
Calibration of manure spreader	100%	100%	96%
Visual inspections	100%	0%	0%
Soil testing	20%	10%	0%
Manure testing	20%	10%	0%
Recordkeeping	20%	10%	0%
Lagoon depth marker	100%	100%	96%
Stream buffers and O&M	100%	100%	96%
Feeding strategies	100%	95%	0%
Runoff control berms	100%	50%	0%
Runoff control berm O&M	70%	1%	0%
Transportation (N-Based)	100%	100%	98%

* H = the high performing facilities (top 25%), M = the medium performing facilities (middle 50%, and L = the low performing facilities (bottom 25%).

Equation 7-2 is used to calculate the adjusted component costs for each model farm. For example, the annual costs for recordkeeping at a Category 2 medium performing facility are calculated as follows:

$$\begin{aligned} Cost_{adjusted} &= Cost_{component} \times (1 - \text{Frequency Factor}) \\ &= \$1{,}020 \times (1 - 0.10) \\ &= \$918 \end{aligned}$$

where:

$1,020	=	Annual recordkeeping costs from Table 7.2-1.
0.10	=	Frequency factor for medium performer from Table 7.2-6.

Table 7.2-7 presents the adjusted component costs for components that do not vary by nutrient application basis and land availability category. Costs are shown for all performance categories. Table 7.2-8 presents the adjusted component costs for components that do not vary for facilities that apply manure on site. Table 7.2-9 presents the adjusted component costs that vary only based upon the number of head at the facility. Table 7.2-10 presents adjusted component costs that vary by the acreage at the facility (Category 1 and 2 facilities). Table 7.2-11 presents adjusted component costs for Category 2 facilities that vary by regulatory option. Note that the frequency factors for Category 2 facilities that already reduce or remove excess manure nutrients is zero for high, medium, and low performance facilities. It is also assumed that no facilities use commercial N on site (zero frequency factor). Thus the costs do not vary by performance level.

Table 7.2-7

Adjusted Component Costs That Do Not Vary by Option, Facility Category, or Manure Nutrient Application Basis
Swine Grow-Finish with Lagoons, Large 1, Mid-Atlantic

Component	Capital			Annual		
	H	M	L	H	M	L
Manure sampler	$0	$1	$6	$0	$0	$0
Record keeping	$0	$0	$0	$816	$918	$1,020
Lagoon depth marker	$0	$0	$1	$0	$0	$0
Manure testing	$0	$0	$0	$80	$90	$100
Visual inspection	$0	$0	$0	$0	$130	$130

Table 7.2-8

Adjusted Component Costs for Option 2 That Do Not Vary for Facilities That Land Apply Manure On Site
Swine Grow-Finish with Lagoons, Large 1, Mid-Atlantic

Component	Capital			Annual		
	H	M	L	H	M	L
Soil auger	$0	$1	$5	$0	$0	$0
Two scales for manure spreader calibration	$0	$31	$500	$0	$0	$0
Calibrate manure spreader	$0	$0	$0	$0	$0	$2

Table 7.2-9

Adjusted Component Costs That Vary by Facility Based on Head Count Swine Grow-Finish with Lagoons, Large 1, Mid-Atlantic

Model Farm Description	Number of Head	Storm Water Diversions (berms)					
		Capital			Annual		
Category 1		**H**	**M**	**L**	**H**	**M**	**L**
Option 1 (N-based application)	2,664	$0	$408	$816	$5	$16	$16
Option 2 (P-based application)	2,500	$0	$398	$795	$5	$16	$16
Category 2		**H**	**M**	**L**	**H**	**M**	**L**
N-based application	4,581	$0	$432	$863	$5	$17	$17
P-based application	4,581	$0	$432	$863	$5	$17	$17
Category 3		**H**	**M**	**L**	**H**	**M**	**L**
All options	4,424	$0	$504	$1,008	$6	$20	$20

Table 7.2-10

Adjusted Component Costs by Performance Level for Options 1 and 2 That Vary by Facility Based on Acreage (Category 1 and 2 only) Swine Grow-Finish with Lagoons, Large 1, Mid-Atlantic

Cat	Component	Nitrogen-Based Application					Phosphorus-Based Application				
		Acres	Cost type	H	M	L	Acres	Cost type	H	M	L
1	Cost to develop initial NMP	76	Fixed	$0	$148	$1,343	702	Fixed	$0	$492	$4,475
	NMP development every 5 years	76	5-year	$0	$43	$383	702	5-year	$0	$387	$3,515
	Soil testing every 3 years	76	3-year	$20	$23	$26	702	3-year	$187	$211	$234
	Field runoff controls	76	Capital	$0	$0	$11	702	Capital	$0	$0	$105
	Runoff controls – O&M, rental	76	Annual	$0	$0	$7	702	Annual	$0	$0	$65
2	Cost to develop initial NMP	76	Fixed	$0	$150	$1,341	175	Fixed	$0	$202	$1,807
	NMP development every 5 years	76	5-year	$0	$43	$381	175	5-year	$0	$95	$847
	Soil testing every 3 years	76	3-year	$20	$23	$25	175	3-year	$45	$51	$56
	Field runoff controls	76	Capital	$0	$0	$11	175	Capital	$0	$0	$25
	Runoff controls – O&M, rental	76	Annual	$0	$0	$7	175	Annual	$0	$0	$6

NA = Not Applicable.

Table 7.2-11

Adjusted Component Costs That are Unique to Category 2 Facilities
Options 1 and 2, Swine Grow-Finish with Lagoons, Large 1, Mid-Atlantic

Option	Selected BMPs	Nitrogen-Based Application				Phosphorus-Based Application			
		Cost type	H	M	L	Cost type	H	M	L
1	Secondary lagoon with pipe and pump	Capital	$8,633	$8,633	$8,633	Capital	NA	NA	NA
	O&M for secondary lagoon, pipe, pump	Annual	$173	$173	$173	Annual	NA	NA	NA
	Sludge removal and hauling every 5 years	5-year	$129	$129	$129	5-year	NA	NA	NA
2	Secondary lagoon with pipe and pump	Capital	$8,633	$8,633	$8,633	Capital	$6,461	$6,461	$6,461
	O&M for secondary lagoon, pipe, pump	Annual	$173	$173	$173	Annual	$129	$129	$129
	Sludge removal and hauling every 5 years	5-year	$129	$129	$129	5-year	$6,787	$6,787	$6,787
	Commercial N fertilizer applied on site to replace manure N	Annual	NA	NA	NA	Annual	$2,580	$2,580	$2,580

NA = Not Applicable.

7.2.3 Calculation of Weighted Farm Costs by Nutrient Application Basis for Option 2

The final step in calculating farm costs is to weight the adjusted component costs depending on the nutrient application basis. To calculate weighted farm costs, frequency factors are applied to the adjusted component costs to represent the portion of operations that use each nutrient management basis as shown in Table 7.2-12. Because all operations can land-apply using a nitrogen-based application rate under Option 1, the weighted farm costs are equal to the nitrogen-based weighted component costs. Likewise, because all operations are required to land-apply using a phosphorus-based application rate under Option 2A, the weighted farm costs are equal to the phosphorus-based weighted component costs. For the remaining options, it is assumed that model farms would apply waste based on a weighted nitrogen and phosphorus basis. For this example, the nutrient-based frequency factor for a large 1, swine, grow-finish operation in the Mid-Atlantic Region is 60 percent of operations use phosphorus-based application and 40 percent of the operations use nitrogen-based application. This frequency factor is applied such that the total number of category 1, 2, and 3 facilities that apply manure on a P-basis is equal to 60 percent of the total facilities.

Table 7.2-12

Assumed Nutrient Land Application Frequency For Total Facilities For Key Swine Regions Under Option 2

Key Regions	Nitrogen Basis	Phosphorus Basis
Mid-Atlantic	40%	60%
Midwest	40%	60%

The weighted farm costs using the following equation:

$$Cost_{weighted} = (Cost_{N} \times \%N) + (Cost_{P} \times \%P)$$

where:

%N	=	Percent of total facilities by performance level and facility category that are required to use N-based application
$Costs_N$	=	Adjusted component costs of N-based practice
%P	=	Percent of total facilities by performance level and facility category that are required to use P-based application
$Costs_P$	=	Adjusted component costs P-based practice.

For example, the weighted costs for initial NMP development at a Category 2 facility, medium performing facility are calculated as:

$$\begin{aligned} Cost_{weighted} &= (\$150 \times (26/77)) + (\$202 \times (51/77)) \\ &= \$50.65 + \$133.79 \\ &= \$184.44 \end{aligned}$$

7.2.4 Final Model Farm Costs

The weighted farm costs are summed for each option, facility type, size, land availability category, and performance level. The final model farm costs are summed separately for capital, fixed, annual, 3-year recurring, and 5-year recurring costs. Table 7.2-13 presents the weighted farm costs for the model farms presented in this example. A complete lists of the costs of the swine and poultry model farms is presented in Appendix C.

Table 7.2-13
Final Weighted Costs for Large 1 Grow-Finish Swine Operations With Lagoons in the Mid-Atlantic Region Under Options 1 and 2

Perform Level	Option	Category	Capital	Fixed	Annual	3-year recurring	5-year recurring	BMPs selected
H	1	1	$0	$0	$896	$20	$0	None
H	1	2	$8,720	$0	$1,069	$20	$0	Already haul at N
H	1	3	$0	$0	$896	$0	$0	Already haul at N
M	1	1	$422	$150	$1,146	$23	$43	None
M	1	2	$7,670	$150	$1,289	$23	$43	Already haul at N
M	1	3	$487	$0	$1,148	$0	$0	Already haul at N
L	1	1	$1,320	$1,343	$1,274	$26	$383	None
L	1	2	$8,592	$1,341	$1,418	$25	$510	Sludge Removal
L	1	3	$1,002	$0	$1,269	$0	$0	Already haul at N
H	2	1	$0	$0	$896	$58	$0	None
H	2	2	$8,353	$0	$1,062	$37	$4,507	Sludge Removal
H	2	3	$0	$0	$896	$0	$5,098	Sludge Removal
M	2	1	$420	$229	$1,146	$66	$122	None
M	2	2	$7,339	$185	$1,282	$42	$4,584	Sludge Removal
M	2	3	$487	$0	$1,148	$0	$5,098	Sludge Removal
L	2	1	$1,337	$2,052	$1,287	$73	$1,092	None
L	2	2	$8,259	$1,650	$1,417	$46	$5,240	Sludge Removal
L	2	3	$1,002	$0	$1,269	$0	$5,098	Sludge Removal

8.0 SENSITIVITY ANALYSES

The model-farm approach that EPA used to estimate costs for this regulation provides an average cost that a facility is projected to incur under the regulatory options. As discussed in Section 6.0, EPA used frequency factors to reflect baseline industry conditions for high-, medium-, and low-performing farm operations. For example, some facilities may already meet the proposed regulatory requirements; therefore, those facility costs will be zero. Alternatively, some facilities may currently meet very few of the proposed regulatory requirements, and these operations will incur costs that are much higher than the average model facility cost. By estimating compliance costs for each type of operation, EPA has effectively calculated the range of costs that would be incurred by facilities within each model farm.

Following the calculation of costs for each option, EPA performed sensitivity analyses on the cost model to identify major drivers for the model farm costs under various scenarios. EPA performed several sensitivity runs. These sensitivity analyses included the following modifications of the regulatory options:

- For Option 1A, EPA evaluated the costs associated with including capacity for a chronic storm event for all animal operations with liquid storage;
- EPA conducted a cost driver analysis on Options 2 and 5 to determine which waste management components were the major contributors to costs for beef feedlots, dairies, and heifer and veal operations;
- For Option 2A, EPA evaluated the costs associated with requiring all facilities to apply manure on an agronomic phosphorus basis for beef, dairy, heifer, and veal operations; and
- For Option 2B, EPA evaluated the costs associated with requiring the development of nutrient management planning for off-site manure recipients for beef feedlots, dairies, and heifer and veal operations.

8.1 Option 1A

The cost basis for all of the regulatory options evaluated for this rulemaking includes liquid storage capacity for a 25-year, 24-hour rainfall event. In addition to this rainfall event, the cost basis for Option 1A includes liquid storage capacity for a chronic storm event, classified as a 10-year, 10-day storm. Because there is a higher chance of a 10-year, 10-day storm event occurring in any given year, they have a higher amount of precipitation associated with them than 25-year, 24-hour rainfall events. The 10-year, 10-day storm event can make a difference of two inches or more per rainfall. If a lagoon or pond is only sized to contain process wastewater plus the runoff from a 25-year, 24-hour rainfall event, there is a greater chance of wastewater overflows due to a chronic storm event.

EPA assumes that facilities that require liquid storage as well as facilities that already have liquid storage incur costs to construct and maintain additional capacity to contain precipitation and runoff from the 10-day,10-year chronic storm event.

Facilities with no existing liquid storage: Under Option 1A, lagoon and ponds are sized for facilities that require new liquid storage to account for 6 months of average precipitation, the peak storm event (25-year, 24-hour rainfall event), and the chronic storm event (10-year, 10-day). Both direct precipitation and runoff resulting from the precipitation are included in the capacity of the lagoon or pond.

Facilities with existing liquid storage: Under Option 1A, additional lagoon or pond storage is sized for facilities that are assumed to already have liquid storage to account for the 10-year,10-day storm event. Both direct precipitation and runoff resulting from precipitation are included in the additional capacity of the pond or lagoon.

The increase in wastewater volume also affects the calculation of costs for liquid land application and transportation. These are waste management components downstream of the lagoon or pond that are dependent on liquid volume.

The model facility costs are significantly higher for Option 1A as a result of including capacity for the chronic rainfall event, ranging from 10 percent to multiple times the cost of Option 1.

8.2 Cost Driver Analysis

EPA performed an analysis on Options 2 and 5, as well as Option 3, to determine the primary cost drivers under each regulatory scenario for the beef, dairy, heifer, and veal animal groups. EPA used the weighted model farm output from the cost model to compare the weighted cost of each component that comprised the model farm costs. Table 8.2-1 summarizes the results of this analysis.

Additionally, EPA performed two sensitivity runs to identify the cost drivers for the swine and poultry cost model: the first compared the effects of nitrogen-based nutrient management verses phosphorus-based nutrient management on the costs, and the second compared the effects of ground water monitoring requirements on the costs. By running the model both with and without frequency factors, EPA was able to identify the costs of the technologies and practices that are most sensitive to the Agency's modeling assumptions. EPA was then able to identify the model elements and cost components that were cost drivers and would thus merit further analysis: the availability of cropland for manure utilization, the incremental costs of phosphorus-based application over nitrogen-based application, the costs of ground water controls, and the costs of incremental storage for timing constraints.

EPA had already developed an approach to reflect nitrogen- and phosphorus-based requirements and had developed three categories of land availability to capture the wide range of land application and hauling costs. EPA's sensitivity analysis concluded that the costs generated by the refined cost models were stable over a wide range of modeling. To further examine the cost impacts under different financial assumptions, such as varying revenue, farm performance, and net returns, EPA conducted sensitivity analyses.

Table 8.2-1

Results of Cost Driver Analysis

Animal	Size	Option	Primary Driver(s)[a]
Beef	Large	2	Nutrient management planning/transportation
		Ground water	Clay-lined pond/ Transportation/concrete pad
	Medium	2	Nutrient management planning/land application
		Ground water	Nutrient management planning/land application/clay-lined pond
Dairy	Large	2	Concrete settling basin/transportation
		Ground water	Clay-lined lagoon/transportation
	Medium	2	Nutrient management planning/transportation
		Ground water	Clay-lined lagoon/nutrient management planning
Heifers	Large	2	Nutrient management planning/transportation
		Ground water	Nutrient management planning/land application/clay-lined pond
	Medium	2	Nutrient management planning/land application
		Ground water	Nutrient management planning/land application
Veal	Medium	5	Covered lagoon

a All drivers are listed that make up the top 50% of costs.

8.3 Option 2A

Under the regulatory options, facilities will be required to follow either nitrogen-based nutrient management or phosphorus-based nutrient management. More cropland is required to land apply manure waste at agronomic phosphorus-based rates than nitrogen-based rates; therefore, phosphorus-based nutrient management incurs more costs for land application, irrigation, nutrient management planning, and off-site transportation of manure waste than nitrogen-based nutrient management.

To evaluate the significance of the nutrient application basis on the costs, EPA performed a sensitivity analysis named Option 2A, based on Option 2. Option 2 costs are based

on a combination of nitrogen-based and phosphorus-based nutrient management. Option 2A represents a modification of this option by assuming 100 percent of facilities would be located in a phosphorus-based nutrient management area.

Because more cropland is required for phosphorus-based application, operations that are Category 1 operations under nitrogen-based nutrient management may be reclassified as Category 2 operations under phosphorus-based nutrient management. That is, a facility with enough land to apply all of the manure waste on site under nitrogen-based application may not have enough land to apply all of their manure waste on site under phosphorus-based nutrient management. Because of this, the most dramatic comparison of the effects of changing the agronomic basis from nitrogen to phosphorus is seen by comparing the results of Option 1 (N-based application), Category 1 facilities to the sensitivity run for Option 2A (P-based application), Category 2 facilities.

Comparing these results shows an increase of between 200 to 500 percent in the costs from Option 1, Category 1 to Option 2A, Category 2 for most model farms. This increase is due to the following factors:

- Shift in the number of facilities from Category 1 to Category 2 (thereby incurring transportation costs);
- A portion of Category 2 facilities under N-based application are assumed to not incur transportation costs because they already apply manure at N-based rates, while they do incur these transportation costs under P-based application; and
- Larger acreage for phosphorus-based facilities, requiring more irrigation, soil sampling, and nutrient management planning costs.

8.4 Option 2B

Under the regulatory options, facilities will be required to design and implement a nutrient management plan for the use of manure waste on site. EPA performed a sensitivity

analysis to assess the estimated cost of developing a nutrient management plan for the use of manure off site as well as on site. The cost model assumed that off-site recipients of manure waste would apply the waste on a nitrogen-based agronomic basis.

The cost of a nutrient management plan is based on the number of acres on which manure waste would be applied. Therefore, the cost model calculated the cost of the off-site nutrient management plan by first estimating the amount of manure waste that would be transported off site, then the nutrient content of that waste, and finally, estimating the agronomic rate of application on a nitrogen basis. The cost model used these data to calculate the number of acres required to land apply all of the waste transported off site on a nitrogen basis. This acreage was the basis for the off-site nutrient management plan development costs.

The resulting cost to develop a nutrient management plan for recipients of waste transported off site was insignificant compared to the total weighted model farm cost, typically less than 5 percent of the weighted model farm cost.

8.5 Applications to Frozen Ground

Winter is the least desirable time for land application of manure. Although there are some benefits to winter applications of manure, the negative impacts outweigh the advantages. Winter applications might be advantageous because of greater labor availability and improved driving capabilities on frozen soils. In addition, although there may be significant losses of available nitrogen, the organic fraction will still be available for plant uptake. However, applying manure in winter creates a potential for nutrient runoff because the manure cannot be incorporated into frozen soil. Winter manure applications should include working the manure into the soil either by tillage or by subsurface injection to reduce the runoff potential. Another disadvantage of winter manure application is low nutrient utilization during the winter months.

In northern areas where frozen soil and snow cover are common conditions, winter manure application should be avoided. In fact, winter manure application is prohibited in a

number of northern states and in most Canadian provinces. There may be some justification for winter manure application, such as reduced ammonia volatilization and odor problems (Steenhuis, T.S., G.D. Bubenzer, and J.S. Converse, 1979), reduced runoff due to a mulching effect of solid manure (Young, R.A. and R.F. Holt, 1977; Clausen, J.C., 1990), enhanced die-off of some microorganisms in freeze-thaw cycles (Kibby, H.J., C. Hagedorn, and E.L. McCoy, 1978; Stoddard et al. 1998), avoidance of soil compaction, and simplified farm management schedules. However, considerable research has demonstrated that runoff from manure application on frozen or snow-covered ground has a high risk of negative water quality impact.

Extremely high runoff N and P concentrations have been reported from plot studies of winter-applied manure. Runoff concentrations as high as 23.5-1086.0 mg TKN /L and 1.6-15.4 mg TP/L have been observed (Thompson, D.B., T.L. Loudon, and J.B. Gerrish, 1979; Melvin, S. and J. Lorimor, 1996). In two Vermont field studies, Clausen (Clausen, J.C., 1990; Clausen, J.C., 1991) reported the following nutrient increases in runoff resulting from winter application of dairy manure:

- 165%-224% in total P concentrations;
- 246%-1480% in soluble P concentrations;
- 114% in TKN concentrations; and
- Up to 576% in NH3-N.

Runoff mass losses of up to 22 percent of applied N and up to 27 percent of applied P from winter-applied manure have been reported (Midgeley, A.R. and D.E. Dunklee, 1945; Hensler, R.F., R.J. Olsen, S.A. Witzel, O.J. Attoe, W.H. Paulson, and R.F. Johannes, 1970; Phillips, P.A., A.J. MacLean, F.R. Hore, F.J. Sowden, A.D. Tenant, and N.K. Patni, 1975; Converse, J.C., G.D. Bubenzer, and W.H. Paulson, 1976; Klausner, S.D., P.J. Zwerman, and D.F. Ellis, 1976, Young, R.A. and C.K. Mutchler, 1976, Clausen, J.C., 1990; Clausen, J.C., 1991; Melvin, S. and J. Lorimor, 1996). Much of this loss can occur in a single storm event (Klausner, S.D., P.J. Zwerman, and D.F. Ellis, 1976). Such losses may represent a significant portion of annual crop nutrient needs.

Runoff from winter-applied manure can be a major source of annual nutrient loading to water bodies. In a Wisconsin lake, 25 percent of the annual P load from animal waste sources was estimated to be from manure applied in winter (Moore, I.C. and F.W. Madison, 1985). In New York, snowmelt runoff from winter spreading on cropland contributed more P to a local reservoir than did runoff from poorly managed barnyards (Brown, M.P., P. Longabucco, M.R. Rafferty, P.D. Robillard, M.F. Walter, and D.A. Haith, 1989). Clausen and Meals (1989) estimated that 40 percent of Vermont streams and lakes would experience significant water quality impairments from the addition of just two winter-spread fields in their watersheds.

Winter application of manure results in increased microorganism losses in runoff from agricultural land (Reddy, K.R., R. Khaleel, and M.R. Overcash, 1981). Studies have shown that cool temperatures enhance survival of fecal bacteria (Reddy, K.R., R. Khaleel, and M.R. Overcash, 1981, Kibby, H.J., C. Hagedorn, and E.L. McCoy, 1978). However, research results are conflicting; some researchers have reported that freezing conditions are lethal to fecal bacteria (Kibby, H.J., C. Hagedorn, and E.L. McCoy, 1978, Stoddard et al. 1998). Kudva et al. (1998) found that E. coli can survive longer than 100 days in frozen manure at –20 degrees C. Vansteelant (2000) observed that freezing and thawing of a soil/slurry mix reduced E. coli levels by about 90 percent. Research has found that winter application of manure does not guarantee die-off of Cryptosporidium oocysts (Carrington, E.G. and M.E. Ransome, 1994; Fayer, R. and T. Nerad, 1996).

Furthermore, microorganism losses in winter application are increased due to the lack of incorporation or injection of applied manure into the soil. Therefore, filtration and adsorption of manure through soil contact is prevented. Both mechanisms are important for attenuating microorganism losses (Gerba, D., C. Wallis, and J. Mellnick, 1975; Patni, N.K., H.R. Toxopeus, and P.Y. Jui, 1985).

There are several additional disadvantages to winter manure application. Runoff from winter-spread fields during winter thaws or spring snowmelt occurs before the growing season. Riparian buffers or vegetated filter strips are relatively inactive at this time and therefore

ineffective in removing pollutants from runoff before delivery to surface waters. Also, winter application may occur due to lack of adequate manure storage. Since the manure must be applied frequently, a loss of management flexibility occurs which makes good nutrient management difficult.

Although several studies have reported little water quality impact from winter-spread manure (Klausner, S.D., P.J. Zwerman, and D.F. Ellis, 1976; Young, R.A. and R.F. Holt, 1977; Young, R.A. and C.K. Mutchler, 1976), such findings typically result from fortuitous circumstances of weather, soil properties, and timing/position of manure in the snowpack. The spatial and temporal variability and unpredictability of such factors makes the possibility of ideal conditions both unlikely and impossible to predict.

8.6 References

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Appendix A

Table A-1

Costs for Earthen Settling Basins at Beef Feedlots and Heifer Operations

Animal	Farm Type	Region	Size Class	Capital	Annual
Beef	Beef	Central	Large 1	$1,084	$54
Beef	Beef	Central	Large 2	$12,155	$608
Beef	Beef	Central	Medium 1	$413	$21
Beef	Beef	Central	Medium 2	$496	$25
Beef	Beef	Central	Medium 3	$591	$30
Beef	Beef	Mid-Atlantic	Large 1	$2,947	$147
Beef	Beef	Mid-Atlantic	Large 2	$38,378	$1,919
Beef	Beef	Mid-Atlantic	Medium 1	$785	$39
Beef	Beef	Mid-Atlantic	Medium 2	$1,054	$53
Beef	Beef	Mid-Atlantic	Medium 3	$1,369	$68
Beef	Beef	Midwest	Large 1	$2,780	$139
Beef	Beef	Midwest	Large 2	$35,992	$1,800
Beef	Beef	Midwest	Medium 1	$751	$38
Beef	Beef	Midwest	Medium 2	$1,001	$50
Beef	Beef	Midwest	Medium 3	$1,297	$65
Beef	Beef	Pacific	Large 1	$2,101	$105
Beef	Beef	Pacific	Large 2	$26,457	$1,323
Beef	Beef	Pacific	Medium 1	$614	$31
Beef	Beef	Pacific	Medium 2	$800	$40
Beef	Beef	Pacific	Medium 3	$1,016	$51
Beef	Beef	South	Large 1	$4,471	$224
Beef	Beef	South	Large 2	$59,829	$2,991
Beef	Beef	South	Medium 1	$1,092	$55
Beef	Beef	South	Medium 2	$1,509	$75
Beef	Beef	South	Medium 3	$2,002	$100
Heifers	Heifers	Central	Large 1	$887	$44
Heifers	Heifers	Central	Medium 1	$413	$21
Heifers	Heifers	Central	Medium 2	$512	$26
Heifers	Heifers	Central	Medium 3	$618	$31
Heifers	Heifers	Mid-Atlantic	Large 1	$2,309	$115
Heifers	Heifers	Mid-Atlantic	Medium 1	$792	$40
Heifers	Heifers	Mid-Atlantic	Medium 2	$1,103	$55

Table A-1 (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Heifers	Heifers	Mid-Atlantic	Medium 3	$1,449	$72
Heifers	Heifers	Midwest	Large 1	$2,181	$109
Heifers	Heifers	Midwest	Medium 1	$758	$38
Heifers	Heifers	Midwest	Medium 2	$1,046	$52
Heifers	Heifers	Midwest	Medium 3	$1,373	$69
Heifers	Heifers	Pacific	Large 1	$1,665	$83
Heifers	Heifers	Pacific	Medium 1	$622	$31
Heifers	Heifers	Pacific	Medium 2	$834	$42
Heifers	Heifers	Pacific	Medium 3	$1,069	$53
Heifers	Heifers	South	Large 1	$3,474	$174
Heifers	Heifers	South	Medium 1	$1,103	$55
Heifers	Heifers	South	Medium 2	$1,589	$79
Heifers	Heifers	South	Medium 3	$2,127	$106

Table A-2

Costs for Concrete Separators for Dairies and Veal Operations

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Flush	Central	Large 1	$130,713	$2,614
Dairy	Flush	Central	Medium 1	$28,880	$578
Dairy	Flush	Central	Medium 2	$44,963	$899
Dairy	Flush	Central	Medium 3	$60,458	$1,209
Dairy	Flush	Mid-Atlantic	Large 1	$130,713	$2,614
Dairy	Flush	Mid-Atlantic	Medium 1	$28,880	$578
Dairy	Flush	Mid-Atlantic	Medium 2	$44,963	$899
Dairy	Flush	Mid-Atlantic	Medium 3	$60,458	$1,209
Dairy	Flush	Midwest	Large 1	$130,713	$2,614
Dairy	Flush	Midwest	Medium 1	$28,880	$578
Dairy	Flush	Midwest	Medium 2	$44,963	$899
Dairy	Flush	Midwest	Medium 3	$60,458	$1,209
Dairy	Flush	Pacific	Large 1	$130,713	$2,614
Dairy	Flush	Pacific	Medium 1	$28,880	$578
Dairy	Flush	Pacific	Medium 2	$44,963	$899
Dairy	Flush	Pacific	Medium 3	$60,458	$1,209
Dairy	Flush	South	Large 1	$130,713	$2,614
Dairy	Flush	South	Medium 1	$28,880	$578
Dairy	Flush	South	Medium 2	$44,963	$899
Dairy	Flush	South	Medium 3	$60,458	$1,209
Dairy	Hose	Central	Large 1	$5,582	$112
Dairy	Hose	Central	Medium 1	$3,605	$72
Dairy	Hose	Central	Medium 2	$4,115	$82
Dairy	Hose	Central	Medium 3	$4,601	$92
Dairy	Hose	Mid-Atlantic	Large 1	$5,582	$112
Dairy	Hose	Mid-Atlantic	Medium 1	$3,605	$72
Dairy	Hose	Mid-Atlantic	Medium 2	$4,115	$82
Dairy	Hose	Mid-Atlantic	Medium 3	$4,601	$92
Dairy	Hose	Midwest	Large 1	$5,582	$112
Dairy	Hose	Midwest	Medium 1	$3,605	$72
Dairy	Hose	Midwest	Medium 2	$4,115	$82
Dairy	Hose	Midwest	Medium 3	$4,601	$92

Table A-2 (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Hose	Pacific	Large 1	$5,582	$112
Dairy	Hose	Pacific	Medium 1	$3,605	$72
Dairy	Hose	Pacific	Medium 2	$4,115	$82
Dairy	Hose	Pacific	Medium 3	$4,601	$92
Dairy	Hose	South	Large 1	$5,582	$112
Dairy	Hose	South	Medium 1	$3,605	$72
Dairy	Hose	South	Medium 2	$4,115	$82
Dairy	Hose	South	Medium 3	$4,601	$92
Veal	Flush	Central	Medium 1	$42,711	$854
Veal	Flush	Central	Medium 2	$55,192	$1,104
Veal	Flush	Central	Medium 3	$101,511	$2,030
Veal	Flush	Mid-Atlantic	Medium 1	$42,711	$854
Veal	Flush	Mid-Atlantic	Medium 2	$55,192	$1,104
Veal	Flush	Mid-Atlantic	Medium 3	$101,511	$2,030
Veal	Flush	Midwest	Medium 1	$42,711	$854
Veal	Flush	Midwest	Medium 2	$55,192	$1,104
Veal	Flush	Midwest	Medium 3	$101,511	$2,030
Veal	Flush	Pacific	Medium 1	$42,711	$854
Veal	Flush	Pacific	Medium 2	$55,192	$1,104
Veal	Flush	Pacific	Medium 3	$101,511	$2,030
Veal	Flush	South	Medium 1	$42,711	$854
Veal	Flush	South	Medium 2	$55,192	$1,104
Veal	Flush	South	Medium 3	$101,511	$2,030

Table A-3a

Costs for Berms at Dairies, Beef Feedlots, Heifer and Veal Operations

Animal	Farm Type	Region	Size Class	Capital	Annual
Beef	Beef	Central	Large 1	$5,187	$104
Beef	Beef	Central	Large 2	$19,466	$389
Beef	Beef	Central	Medium 1	$2,327	$47
Beef	Beef	Central	Medium 2	$2,842	$57
Beef	Beef	Central	Medium 3	$3,348	$67
Beef	Beef	Mid-Atlantic	Large 1	$5,187	$104
Beef	Beef	Mid-Atlantic	Large 2	$19,466	$389
Beef	Beef	Mid-Atlantic	Medium 1	$2,327	$47
Beef	Beef	Mid-Atlantic	Medium 2	$2,842	$57
Beef	Beef	Mid-Atlantic	Medium 3	$3,348	$67
Beef	Beef	Midwest	Large 1	$5,187	$104
Beef	Beef	Midwest	Large 2	$19,466	$389
Beef	Beef	Midwest	Medium 1	$2,327	$47
Beef	Beef	Midwest	Medium 2	$2,842	$57
Beef	Beef	Midwest	Medium 3	$3,348	$67
Beef	Beef	Pacific	Large 1	$5,187	$104
Beef	Beef	Pacific	Large 2	$19,466	$389
Beef	Beef	Pacific	Medium 1	$2,327	$47
Beef	Beef	Pacific	Medium 2	$2,842	$57
Beef	Beef	Pacific	Medium 3	$3,348	$67
Beef	Beef	South	Large 1	$5,187	$104
Beef	Beef	South	Large 2	$19,466	$389
Beef	Beef	South	Medium 1	$2,327	$47
Beef	Beef	South	Medium 2	$2,842	$57
Beef	Beef	South	Medium 3	$3,348	$67
Dairy	Flush	Central	Large 1	$3,069	$61
Dairy	Flush	Central	Medium 1	$1,283	$26
Dairy	Flush	Central	Medium 2	$1,673	$33
Dairy	Flush	Central	Medium 3	$1,988	$40
Dairy	Flush	Mid-Atlantic	Large 1	$3,069	$61
Dairy	Flush	Mid-Atlantic	Medium 1	$1,283	$26
Dairy	Flush	Mid-Atlantic	Medium 2	$1,673	$33

Table A-3a (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Flush	Mid-Atlantic	Medium 3	$1,988	$40
Dairy	Flush	Midwest	Large 1	$3,069	$61
Dairy	Flush	Midwest	Medium 1	$1,283	$26
Dairy	Flush	Midwest	Medium 2	$1,673	$33
Dairy	Flush	Midwest	Medium 3	$1,988	$40
Dairy	Flush	Pacific	Large 1	$3,069	$61
Dairy	Flush	Pacific	Medium 1	$1,283	$26
Dairy	Flush	Pacific	Medium 2	$1,673	$33
Dairy	Flush	Pacific	Medium 3	$1,988	$40
Dairy	Flush	South	Large 1	$3,069	$61
Dairy	Flush	South	Medium 1	$1,283	$26
Dairy	Flush	South	Medium 2	$1,673	$33
Dairy	Flush	South	Medium 3	$1,988	$40
Dairy	Hose	Central	Large 1	$3,069	$61
Dairy	Hose	Central	Medium 1	$1,283	$26
Dairy	Hose	Central	Medium 2	$1,673	$33
Dairy	Hose	Central	Medium 3	$1,988	$40
Dairy	Hose	Mid-Atlantic	Large 1	$3,069	$61
Dairy	Hose	Mid-Atlantic	Medium 1	$1,283	$26
Dairy	Hose	Mid-Atlantic	Medium 2	$1,673	$33
Dairy	Hose	Mid-Atlantic	Medium 3	$1,988	$40
Dairy	Hose	Midwest	Large 1	$3,069	$61
Dairy	Hose	Midwest	Medium 1	$1,283	$26
Dairy	Hose	Midwest	Medium 2	$1,673	$33
Dairy	Hose	Midwest	Medium 3	$1,988	$40
Dairy	Hose	Pacific	Large 1	$3,069	$61
Dairy	Hose	Pacific	Medium 1	$1,283	$26
Dairy	Hose	Pacific	Medium 2	$1,673	$33
Dairy	Hose	Pacific	Medium 3	$1,988	$40
Dairy	Hose	South	Large 1	$3,069	$61
Dairy	Hose	South	Medium 1	$1,283	$26
Dairy	Hose	South	Medium 2	$1,673	$33
Dairy	Hose	South	Medium 3	$1,988	$40
Heifers	Heifers	Central	Large 1	$4,536	$91

Table A-3a (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Heifers	Heifers	Central	Medium 1	$2,342	$47
Heifers	Heifers	Central	Medium 2	$2,928	$59
Heifers	Heifers	Central	Medium 3	$3,465	$69
Heifers	Heifers	Mid-Atlantic	Large 1	$4,536	$91
Heifers	Heifers	Mid-Atlantic	Medium 1	$2,342	$47
Heifers	Heifers	Mid-Atlantic	Medium 2	$2,928	$59
Heifers	Heifers	Mid-Atlantic	Medium 3	$3,465	$69
Heifers	Heifers	Midwest	Large 1	$4,536	$91
Heifers	Heifers	Midwest	Medium 1	$2,342	$47
Heifers	Heifers	Midwest	Medium 2	$2,928	$59
Heifers	Heifers	Midwest	Medium 3	$3,465	$69
Heifers	Heifers	Pacific	Large 1	$4,536	$91
Heifers	Heifers	Pacific	Medium 1	$2,342	$47
Heifers	Heifers	Pacific	Medium 2	$2,928	$59
Heifers	Heifers	Pacific	Medium 3	$3,465	$69
Heifers	Heifers	South	Large 1	$4,536	$91
Heifers	Heifers	South	Medium 1	$2,342	$47
Heifers	Heifers	South	Medium 2	$2,928	$59
Heifers	Heifers	South	Medium 3	$3,465	$69

Table A-3b

Costs for Berms for Poultry and Swine Operations Under Option 1

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Chicken	Broiler	Mid-Atlantic	Solid	Large 1	$505	$10	$526	$11	$569	$11
Chicken	Broiler	Mid-Atlantic	Solid	Large 2	$871	$17	$1,007	$20	$1,136	$23
Chicken	Broiler	Mid-Atlantic	Solid	Medium 1	$296	$6	$296	$6	$295	$6
Chicken	Broiler	Mid-Atlantic	Solid	Medium 2	$336	$7	$341	$7	$336	$7
Chicken	Broiler	Mid-Atlantic	Solid	Medium 3	$409	$8	$418	$8	$410	$8
Chicken	Broiler	South	Solid	Large 1	$505	$10	$529	$11	$522	$10
Chicken	Broiler	South	Solid	Large 2	$815	$16	$969	$19	$998	$20
Chicken	Broiler	South	Solid	Medium 1	$294	$6	$295	$6	$295	$6
Chicken	Broiler	South	Solid	Medium 2	$333	$7	$340	$7	$339	$7
Chicken	Broiler	South	Solid	Medium 3	$405	$8	$416	$8	$415	$8
Chicken	Layer: Dry	Midwest	Solid	Large 1	$766	$15	$766	$15	$766	$15
Chicken	Layer: Dry	Midwest	Solid	Large 2	$1,867	$37	$1,867	$37	$1,867	$37
Chicken	Layer: Dry	Midwest	Solid	Medium 1	$268	$5	$268	$5	$268	$5
Chicken	Layer: Dry	Midwest	Solid	Medium 2	$319	$6	$319	$6	$319	$6
Chicken	Layer: Dry	Midwest	Solid	Medium 3	$351	$7	$351	$7	$351	$7
Chicken	Layer: Dry	South	Solid	Large 1	$766	$15	$766	$15	$766	$15
Chicken	Layer: Dry	South	Solid	Large 2	$1,867	$37	$1,867	$37	$1,867	$37
Chicken	Layer: Dry	South	Solid	Medium 1	$268	$5	$268	$5	$268	$5
Chicken	Layer: Dry	South	Solid	Medium 2	$319	$6	$319	$6	$319	$6
Chicken	Layer: Dry	South	Solid	Medium 3	$351	$7	$351	$7	$351	$7
Chicken	Layer: Wet	South	Liquid	Large 1	$531	$11	$475	$10	$554	$11

Table A-3b (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Chicken	Layer: Wet	South	Liquid	Medium 3	$531	$11	$475	$10	$554	$11
Swine	Farrow to Finish	Central	Evapor	Large 1	$850	$17	$1,014	$20	$1,164	$23
Swine	Farrow to Finish	Central	Evapor	Large 2	$1,320	$26	$1,687	$34	$2,927	$59
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Large 1	$816	$16	$863	$17	$1,008	$20
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Large 2	$1,290	$26	$1,381	$28	$1,722	$34
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Medium 1	$535	$11	$488	$10	$554	$11
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Medium 2	$628	$13	$566	$11	$646	$13
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Medium 3	$713	$14	$640	$13	$735	$15
Swine	Farrow to Finish	Mid-Atlantic	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Midwest	Liquid	Large 1	$796	$16	$770	$15	$1,021	$20
Swine	Farrow to Finish	Midwest	Liquid	Large 2	$1,142	$23	$1,308	$26	$1,826	$37
Swine	Farrow to Finish	Midwest	Liquid	Medium 1	$531	$11	$475	$10	$554	$11
Swine	Farrow to Finish	Midwest	Liquid	Medium 2	$622	$12	$554	$11	$654	$13
Swine	Farrow to Finish	Midwest	Liquid	Medium 3	$713	$14	$626	$13	$744	$15
Swine	Farrow to Finish	Midwest	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Midwest	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Midwest	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Midwest	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Midwest	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Central	Evapor	Large 1	$850	$17	$1,014	$20	$1,164	$23
Swine	Grow Finish	Central	Evapor	Large 2	$1,320	$26	$1,687	$34	$2,927	$59

Table A-3b (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Swine	Grow Finish	Mid-Atlantic	Liquid	Large 1	$816	$16	$863	$17	$1,008	$20
Swine	Grow Finish	Mid-Atlantic	Liquid	Large 2	$1,290	$26	$1,381	$28	$1,722	$34
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 1	$535	$11	$488	$10	$554	$11
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 2	$628	$13	$566	$11	$646	$13
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 3	$713	$14	$640	$13	$735	$15
Swine	Grow Finish	Mid-Atlantic	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Large 1	$796	$16	$770	$15	$1,021	$20
Swine	Grow Finish	Midwest	Liquid	Large 2	$1,142	$23	$1,308	$26	$1,826	$37
Swine	Grow Finish	Midwest	Liquid	Medium 1	$531	$11	$475	$10	$554	$11
Swine	Grow Finish	Midwest	Liquid	Medium 2	$622	$12	$554	$11	$654	$13
Swine	Grow Finish	Midwest	Liquid	Medium 3	$713	$14	$626	$13	$744	$15
Swine	Grow Finish	Midwest	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Turkey	Slaughter	Mid-Atlantic	Solid	Large 1	$704	$14	$704	$14	$704	$14
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 1	$287	$6	$287	$6	$287	$6
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 2	$336	$7	$336	$7	$336	$7
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 3	$387	$8	$387	$8	$387	$8
Turkey	Slaughter	Midwest	Solid	Large 1	$704	$14	$704	$14	$704	$14

Table A-3b (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Turkey	Slaughter	Midwest	Solid	Medium 1	$287	$6	$287	$6	$287	$6
Turkey	Slaughter	Midwest	Solid	Medium 2	$336	$7	$336	$7	$336	$7
Turkey	Slaughter	Midwest	Solid	Medium 3	$387	$8	$387	$8	$387	$8

Table A-3c

Costs for Berms for Poultry and Swine Operations Under Option 2, P-based Scenario

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Chicken	Broiler	Mid-Atlantic	Solid	Large 1	$505	$10	$524	$10	$565	$11
Chicken	Broiler	Mid-Atlantic	Solid	Large 2	$736	$15	$999	$20	$1,144	$23
Chicken	Broiler	Mid-Atlantic	Solid	Medium 1	$295	$6	$296	$6	$295	$6
Chicken	Broiler	Mid-Atlantic	Solid	Medium 2	$335	$7	$341	$7	$336	$7
Chicken	Broiler	Mid-Atlantic	Solid	Medium 3	$408	$8	$417	$8	$410	$8
Chicken	Broiler	South	Solid	Large 1	$505	$10	$531	$11	$526	$11
Chicken	Broiler	South	Solid	Large 2	$736	$15	$974	$19	$1,028	$21
Chicken	Broiler	South	Solid	Medium 1	$293	$6	$295	$6	$295	$6
Chicken	Broiler	South	Solid	Medium 2	$331	$7	$340	$7	$340	$7
Chicken	Broiler	South	Solid	Medium 3	$402	$8	$416	$8	$416	$8
Chicken	Layer: Dry	Midwest	Solid	Large 1	$766	$15	$766	$15	$766	$15
Chicken	Layer: Dry	Midwest	Solid	Large 2	$1,867	$37	$1,867	$37	$1,867	$37
Chicken	Layer: Dry	Midwest	Solid	Medium 1	$268	$5	$268	$5	$268	$5
Chicken	Layer: Dry	Midwest	Solid	Medium 2	$319	$6	$319	$6	$319	$6
Chicken	Layer: Dry	Midwest	Solid	Medium 3	$351	$7	$351	$7	$351	$7
Chicken	Layer: Dry	South	Solid	Large 1	$766	$15	$766	$15	$766	$15
Chicken	Layer: Dry	South	Solid	Large 2	$1,867	$37	$1,867	$37	$1,867	$37
Chicken	Layer: Dry	South	Solid	Medium 1	$268	$5	$268	$5	$268	$5
Chicken	Layer: Dry	South	Solid	Medium 2	$319	$6	$319	$6	$319	$6
Chicken	Layer: Dry	South	Solid	Medium 3	$351	$7	$351	$7	$351	$7
Chicken	Layer: Wet	South	Liquid	Large 1	$529	$11	$471	$9	$554	$11

Table A-3c (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Chicken	Layer: Wet	South	Liquid	Medium 3	$529	$11	$471	$9	$554	$11
Swine	Farrow to	Central	Evapor	Large 1	$850	$17	$964	$19	$1,164	$23
Swine	Farrow to	Central	Evapor	Large 2	$1,270	$25	$1,600	$32	$2,925	$59
Swine	Farrow to	Mid-Atlantic	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Mid-Atlantic	Liquid	Large 1	$795	$16	$828	$17	$1,008	$20
Swine	Farrow to	Mid-Atlantic	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Mid-Atlantic	Liquid	Large 2	$1,180	$24	$1,320	$26	$1,722	$34
Swine	Farrow to	Mid-Atlantic	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Mid-Atlantic	Liquid	Medium 1	$534	$11	$477	$10	$554	$11
Swine	Farrow to	Mid-Atlantic	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Mid-Atlantic	Liquid	Medium 2	$624	$12	$558	$11	$646	$13
Swine	Farrow to	Mid-Atlantic	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Mid-Atlantic	Liquid	Medium 3	$711	$14	$631	$13	$735	$15
Swine	Farrow to	Midwest	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Midwest	Liquid	Large 1	$795	$16	$716	$14	$1,011	$20
Swine	Farrow to	Midwest	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Midwest	Liquid	Large 2	$1,070	$21	$1,158	$23	$1,809	$36
Swine	Farrow to	Midwest	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Midwest	Liquid	Medium 1	$529	$11	$471	$9	$554	$11
Swine	Farrow to	Midwest	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Midwest	Liquid	Medium 2	$618	$12	$547	$11	$654	$13
Swine	Farrow to	Midwest	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Midwest	Liquid	Medium 3	$711	$14	$618	$12	$744	$15
Swine	Grow Finish	Central	Evapor	Large 1	$850	$17	$964	$19	$1,164	$23

Table A-3c (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Swine	Grow Finish	Central	Evapor	Large 2	$1,270	$25	$1,600	$32	$2,925	$59
Swine	Grow Finish	Mid-Atlantic	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Large 1	$795	$16	$828	$17	$1,008	$20
Swine	Grow Finish	Mid-Atlantic	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Large 2	$1,180	$24	$1,320	$26	$1,722	$34
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 1	$534	$11	$477	$10	$554	$11
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 2	$624	$12	$558	$11	$646	$13
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 3	$711	$14	$631	$13	$735	$15
Swine	Grow Finish	Midwest	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Large 1	$795	$16	$716	$14	$1,011	$20
Swine	Grow Finish	Midwest	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Large 2	$1,070	$21	$1,158	$23	$1,809	$36
Swine	Grow Finish	Midwest	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Medium 1	$529	$11	$471	$9	$554	$11
Swine	Grow Finish	Midwest	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Medium 2	$618	$12	$547	$11	$654	$13
Swine	Grow Finish	Midwest	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Medium 3	$711	$14	$618	$12	$744	$15
Turkey	Slaughter	Mid-Atlantic	Solid	Large 1	$704	$14	$704	$14	$704	$14
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 1	$287	$6	$287	$6	$287	$6
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 2	$336	$7	$336	$7	$336	$7

Table A-3c (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 3	$387	$8	$387	$8	$387	$8
Turkey	Slaughter	Midwest	Solid	Large 1	$704	$14	$704	$14	$704	$14
Turkey	Slaughter	Midwest	Solid	Medium 1	$287	$6	$287	$6	$287	$6
Turkey	Slaughter	Midwest	Solid	Medium 2	$336	$7	$336	$7	$336	$7
Turkey	Slaughter	Midwest	Solid	Medium 3	$387	$8	$387	$8	$387	$8

Table A-3d

Costs for Berms for Poultry and Swine Operations Under Option 2, N-based Scenario

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Chicken	Broiler	Mid-Atlantic	Solid	Large 1	$505	$10	$526	$11	$569	$11
Chicken	Broiler	Mid-Atlantic	Solid	Large 2	$871	$17	$1,007	$20	$1,136	$23
Chicken	Broiler	Mid-Atlantic	Solid	Medium 1	$296	$6	$296	$6	$295	$6
Chicken	Broiler	Mid-Atlantic	Solid	Medium 2	$336	$7	$341	$7	$336	$7
Chicken	Broiler	Mid-Atlantic	Solid	Medium 3	$409	$8	$418	$8	$410	$8
Chicken	Broiler	South	Solid	Large 1	$505	$10	$529	$11	$520	$10
Chicken	Broiler	South	Solid	Large 2	$815	$16	$962	$19	$976	$20
Chicken	Broiler	South	Solid	Medium 1	$294	$6	$295	$6	$295	$6
Chicken	Broiler	South	Solid	Medium 2	$333	$7	$340	$7	$339	$7
Chicken	Broiler	South	Solid	Medium 3	$405	$8	$416	$8	$415	$8
Chicken	Layer: Dry	Midwest	Solid	Large 1	$766	$15	$766	$15	$766	$15
Chicken	Layer: Dry	Midwest	Solid	Large 2	$1,867	$37	$1,867	$37	$1,867	$37
Chicken	Layer: Dry	Midwest	Solid	Medium 1	$268	$5	$268	$5	$268	$5
Chicken	Layer: Dry	Midwest	Solid	Medium 2	$319	$6	$319	$6	$319	$6
Chicken	Layer: Dry	Midwest	Solid	Medium 3	$351	$7	$351	$7	$351	$7
Chicken	Layer: Dry	South	Solid	Large 1	$766	$15	$766	$15	$766	$15
Chicken	Layer: Dry	South	Solid	Large 2	$1,867	$37	$1,867	$37	$1,867	$37
Chicken	Layer: Dry	South	Solid	Medium 1	$268	$5	$268	$5	$268	$5
Chicken	Layer: Dry	South	Solid	Medium 2	$319	$6	$319	$6	$319	$6
Chicken	Layer: Dry	South	Solid	Medium 3	$351	$7	$351	$7	$351	$7
Chicken	Layer: Wet	South	Liquid	Large 1	$531	$11	$475	$10	$554	$11
Chicken	Layer: Wet	South	Liquid	Medium 3	$531	$11	$475	$10	$554	$11

Table A-3d (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Swine	Farrow to Finish	Central	Evapor	Large 1	$850	$17	$1,014	$20	$1,164	$23
Swine	Farrow to Finish	Central	Evapor	Large 2	$1,319	$26	$1,687	$34	$2,928	$59
Swine	Farrow to Finish	Mid-Atlantic	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Large 1	$816	$16	$863	$17	$1,008	$20
Swine	Farrow to Finish	Mid-Atlantic	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Large 2	$1,290	$26	$1,381	$28	$1,722	$34
Swine	Farrow to Finish	Mid-Atlantic	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Medium 1	$535	$11	$489	$10	$554	$11
Swine	Farrow to Finish	Mid-Atlantic	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Medium 2	$628	$13	$566	$11	$647	$13
Swine	Farrow to Finish	Mid-Atlantic	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Medium 3	$713	$14	$640	$13	$735	$15
Swine	Farrow to Finish	Midwest	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Midwest	Liquid	Large 1	$796	$16	$770	$15	$1,021	$20
Swine	Farrow to Finish	Midwest	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Midwest	Liquid	Large 2	$1,142	$23	$1,308	$26	$1,826	$37
Swine	Farrow to Finish	Midwest	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Midwest	Liquid	Medium 1	$531	$11	$475	$10	$554	$11
Swine	Farrow to Finish	Midwest	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Midwest	Liquid	Medium 2	$622	$12	$554	$11	$654	$13
Swine	Farrow to Finish	Midwest	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Farrow to Finish	Midwest	Liquid	Medium 3	$713	$14	$626	$13	$744	$15
Swine	Grow Finish	Central	Evapor	Large 1	$850	$17	$1,014	$20	$1,164	$23
Swine	Grow Finish	Central	Evapor	Large 2	$1,319	$26	$1,687	$34	$2,928	$59
Swine	Grow Finish	Mid-Atlantic	Pit	Large 1	$0	$0	$0	$0	$0	$0

Table A-3d (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Swine	Grow Finish	Mid-Atlantic	Liquid	Large 1	$816	$16	$863	$17	$1,008	$20
Swine	Grow Finish	Mid-Atlantic	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Large 2	$1,290	$26	$1,381	$28	$1,722	$34
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 1	$535	$11	$489	$10	$554	$11
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 2	$628	$13	$566	$11	$647	$13
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 3	$713	$14	$640	$13	$735	$15
Swine	Grow Finish	Midwest	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Large 1	$796	$16	$770	$15	$1,021	$20
Swine	Grow Finish	Midwest	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Large 2	$1,142	$23	$1,308	$26	$1,826	$37
Swine	Grow Finish	Midwest	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Medium 1	$531	$11	$475	$10	$554	$11
Swine	Grow Finish	Midwest	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Medium 2	$622	$12	$554	$11	$654	$13
Swine	Grow Finish	Midwest	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Medium 3	$713	$14	$626	$13	$744	$15
Turkey	Slaughter	Mid-Atlantic	Solid	Large 1	$704	$14	$704	$14	$704	$14
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 1	$287	$6	$287	$6	$287	$6
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 2	$336	$7	$336	$7	$336	$7
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 3	$387	$8	$387	$8	$387	$8
Turkey	Slaughter	Midwest	Solid	Large 1	$704	$14	$704	$14	$704	$14
Turkey	Slaughter	Midwest	Solid	Medium 1	$287	$6	$287	$6	$287	$6

Table A-3d (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Turkey	Slaughter	Midwest	Solid	Medium 2	$336	$7	$336	$7	$336	$7
Turkey	Slaughter	Midwest	Solid	Medium 3	$387	$8	$387	$8	$387	$8

Table A-3e

Costs for Berms for Poultry and Swine Operations Under Option 5, P-based Scenario

Animal	Farm Type	Region	Manure type	Size	Cat 1		Cat 2		Cat 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Chicken	Broiler	Mid-Atlantic	Solid	Large 1	$505	$10	$524	$10	$565	$11
Chicken	Broiler	Mid-Atlantic	Solid	Large 2	$736	$15	$999	$20	$1,144	$23
Chicken	Broiler	Mid-Atlantic	Solid	Medium 1	$295	$6	$296	$6	$295	$6
Chicken	Broiler	Mid-Atlantic	Solid	Medium 2	$335	$7	$341	$7	$336	$7
Chicken	Broiler	Mid-Atlantic	Solid	Medium 3	$408	$8	$417	$8	$410	$8
Chicken	Broiler	South	Solid	Large 1	$505	$10	$531	$11	$526	$11
Chicken	Broiler	South	Solid	Large 2	$736	$15	$974	$19	$1,028	$21
Chicken	Broiler	South	Solid	Medium 1	$293	$6	$295	$6	$295	$6
Chicken	Broiler	South	Solid	Medium 2	$331	$7	$340	$7	$340	$7
Chicken	Broiler	South	Solid	Medium 3	$402	$8	$416	$8	$416	$8
Chicken	Layer: Dry	Midwest	Solid	Large 1	$766	$15	$766	$15	$766	$15
Chicken	Layer: Dry	Midwest	Solid	Large 2	$1,867	$37	$1,867	$37	$1,867	$37
Chicken	Layer: Dry	Midwest	Solid	Medium 1	$268	$5	$268	$5	$268	$5
Chicken	Layer: Dry	Midwest	Solid	Medium 2	$319	$6	$319	$6	$319	$6
Chicken	Layer: Dry	Midwest	Solid	Medium 3	$351	$7	$351	$7	$351	$7
Chicken	Layer: Dry	South	Solid	Large 1	$766	$15	$766	$15	$766	$15
Chicken	Layer: Dry	South	Solid	Large 2	$1,867	$37	$1,867	$37	$1,867	$37
Chicken	Layer: Dry	South	Solid	Medium 1	$268	$5	$268	$5	$268	$5
Chicken	Layer: Dry	South	Solid	Medium 2	$319	$6	$319	$6	$319	$6
Chicken	Layer: Dry	South	Solid	Medium 3	$351	$7	$351	$7	$351	$7
Chicken	Layer: Wet	South	Liquid	Large 1	$138	$3	$138	$3	$138	$3

Table A-3e (Continued)

Animal	Farm Type	Region	Manure type	Size	Cat 1		Cat 2		Cat 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Chicken	Layer: Wet	South	Liquid	Medium 3	$484	$10	$426	$9	$508	$10
Swine	Farrow to	Central	Evapor	Large 1	$12,168	$243	$16,127	$323	$24,472	$489
Swine	Farrow to	Central	Evapor	Large 2	$29,594	$592	$48,624	$972	$172,337	$3,447
Swine	Farrow to	Mid-Atlantic	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Mid-Atlantic	Liquid	Large 1	$749	$15	$781	$16	$961	$19
Swine	Farrow to	Mid-Atlantic	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Mid-Atlantic	Liquid	Large 2	$1,133	$23	$1,272	$25	$1,674	$33
Swine	Farrow to	Mid-Atlantic	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Mid-Atlantic	Liquid	Medium 1	$488	$10	$432	$9	$508	$10
Swine	Farrow to	Mid-Atlantic	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Mid-Atlantic	Liquid	Medium 2	$578	$12	$512	$10	$600	$12
Swine	Farrow to	Mid-Atlantic	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Mid-Atlantic	Liquid	Medium 3	$665	$13	$585	$12	$688	$14
Swine	Farrow to	Midwest	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Midwest	Liquid	Large 1	$749	$15	$669	$13	$964	$19
Swine	Farrow to	Midwest	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Midwest	Liquid	Large 2	$1,023	$20	$1,110	$22	$1,761	$35
Swine	Farrow to	Midwest	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Midwest	Liquid	Medium 1	$484	$10	$426	$9	$508	$10
Swine	Farrow to	Midwest	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Midwest	Liquid	Medium 2	$572	$11	$501	$10	$608	$12
Swine	Farrow to	Midwest	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Farrow to	Midwest	Liquid	Medium 3	$664	$13	$572	$11	$697	$14
Swine	Grow Finish	Central	Evapor	Large 1	$12,168	$243	$16,127	$323	$24,472	$489

Table A-3e (Continued)

Animal	Farm Type	Region	Manure type	Size	Cat 1		Cat 2		Cat 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Swine	Grow Finish	Central	Evapor	Large 2	$29,594	$592	$48,624	$972	$172,337	$3,447
Swine	Grow Finish	Mid-Atlantic	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Large 1	$749	$15	$781	$16	$961	$19
Swine	Grow Finish	Mid-Atlantic	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Large 2	$1,133	$23	$1,272	$25	$1,674	$33
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 1	$488	$10	$432	$9	$508	$10
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 2	$578	$12	$512	$10	$600	$12
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 3	$665	$13	$585	$12	$688	$14
Swine	Grow Finish	Midwest	Pit	Large 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Large 1	$749	$15	$669	$13	$964	$19
Swine	Grow Finish	Midwest	Pit	Large 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Large 2	$1,023	$20	$1,110	$22	$1,761	$35
Swine	Grow Finish	Midwest	Pit	Medium 1	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Medium 1	$484	$10	$426	$9	$508	$10
Swine	Grow Finish	Midwest	Pit	Medium 2	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Medium 2	$572	$11	$501	$10	$608	$12
Swine	Grow Finish	Midwest	Pit	Medium 3	$0	$0	$0	$0	$0	$0
Swine	Grow Finish	Midwest	Liquid	Medium 3	$664	$13	$572	$11	$697	$14
Turkey	Slaughter	Mid-Atlantic	Solid	Large 1	$704	$14	$704	$14	$704	$14
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 1	$287	$6	$287	$6	$287	$6
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 2	$336	$7	$336	$7	$336	$7

Table A-3e (Continued)

Animal	Farm Type	Region	Manure type	Size	Cat 1		Cat 2		Cat 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 3	$387	$8	$387	$8	$387	$8
Turkey	Slaughter	Midwest	Solid	Large 1	$744	$15	$704	$14	$704	$14
Turkey	Slaughter	Midwest	Solid	Medium 1	$287	$6	$287	$6	$287	$6
Turkey	Slaughter	Midwest	Solid	Medium 2	$336	$7	$336	$7	$336	$7
Turkey	Slaughter	Midwest	Solid	Medium 3	$387	$8	$387	$8	$387	$8

Table A-3f

Costs for Berms for Poultry and Swine Operations Under Option 5, N-based Scenario

Animal	Operation Type	Region	Manure type	Size	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Chicken	BR	SO	Solid	Large2	$815	$16	$962	$19	$976	$20
Chicken	BR	SO	Solid	Large1	$505	$10	$529	$11	$520	$10
Chicken	BR	SO	Solid	Medium3	$405	$8	$416	$8	$415	$8
Chicken	BR	SO	Solid	Medium2	$333	$7	$340	$7	$339	$7
Chicken	BR	SO	Solid	Medium1	$294	$6	$295	$6	$295	$6
Chicken	BR	MA	Solid	Large2	$871	$17	$1,007	$20	$1,136	$23
Chicken	BR	MA	Solid	Large1	$505	$10	$526	$11	$569	$11
Chicken	BR	MA	Solid	Medium3	$409	$8	$418	$8	$410	$8
Chicken	BR	MA	Solid	Medium2	$336	$7	$341	$7	$336	$7
Chicken	BR	MA	Solid	Medium1	$296	$6	$296	$6	$295	$6
Swine	FF	CE	Evapor	Large2	$31,735	$635	$54,383	$1,088	$172,730	$3,455
Swine	FF	CE	Evapor	Large1	$11,921	$238	$18,045	$361	$24,472	$489
Swine	FF	MA	Pit	Large2	$0	$0	$0	$0	$0	$0
Swine	FF	MA	Pit	Large1	$0	$0	$0	$0	$0	$0
Swine	FF	MA	Pit	Medium3	$0	$0	$0	$0	$0	$0
Swine	FF	MA	Pit	Medium2	$0	$0	$0	$0	$0	$0
Swine	FF	MA	Pit	Medium1	$0	$0	$0	$0	$0	$0
Swine	FF	MA	Liquid	Large2	$1,290	$26	$1,334	$27	$1,674	$33
Swine	FF	MA	Liquid	Large1	$816	$16	$816	$16	$961	$19
Swine	FF	MA	Liquid	Medium3	$713	$14	$594	$12	$689	$14
Swine	FF	MA	Liquid	Medium2	$628	$13	$520	$10	$601	$12

Table A-3f (Continued)

Animal	Operation Type	Region	Manure type	Size	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Swine	FF	MA	Liquid	Medium1	$535	$11	$444	$9	$508	$10
Swine	FF	MW	Pit	Large2	$0	$0	$0	$0	$0	$0
Swine	FF	MW	Pit	Large1	$0	$0	$0	$0	$0	$0
Swine	FF	MW	Pit	Medium3	$0	$0	$0	$0	$0	$0
Swine	FF	MW	Pit	Medium2	$0	$0	$0	$0	$0	$0
Swine	FF	MW	Pit	Medium1	$0	$0	$0	$0	$0	$0
Swine	FF	MW	Liquid	Large2	$1,142	$23	$1,261	$25	$1,778	$36
Swine	FF	MW	Liquid	Large1	$796	$16	$723	$14	$974	$19
Swine	FF	MW	Liquid	Medium3	$713	$14	$580	$12	$697	$14
Swine	FF	MW	Liquid	Medium2	$622	$12	$508	$10	$608	$12
Swine	FF	MW	Liquid	Medium1	$531	$11	$430	$9	$508	$10
Swine	GF	CE	Evapor	Large2	$31,735	$635	$54,383	$1,088	$172,730	$3,455
Swine	GF	CE	Evapor	Large1	$11,921	$238	$18,045	$361	$24,472	$489
Swine	GF	MA	Pit	Large2	$0	$0	$0	$0	$0	$0
Swine	GF	MA	Pit	Large1	$0	$0	$0	$0	$0	$0
Swine	GF	MA	Pit	Medium3	$0	$0	$0	$0	$0	$0
Swine	GF	MA	Pit	Medium2	$0	$0	$0	$0	$0	$0
Swine	GF	MA	Pit	Medium1	$0	$0	$0	$0	$0	$0
Swine	GF	MA	Liquid	Large2	$1,290	$26	$1,334	$27	$1,674	$33
Swine	GF	MA	Liquid	Large1	$816	$16	$816	$16	$961	$19
Swine	GF	MA	Liquid	Medium3	$713	$14	$594	$12	$689	$14
Swine	GF	MA	Liquid	Medium2	$628	$13	$520	$10	$601	$12
Swine	GF	MA	Liquid	Medium1	$535	$11	$444	$9	$508	$10
Swine	GF	MW	Pit	Large2	$0	$0	$0	$0	$0	$0
Swine	GF	MW	Pit	Large1	$0	$0	$0	$0	$0	$0

Table A-3f (Continued)

Animal	Operation Type	Region	Manure type	Size	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Swine	GF	MW	Pit	Medium3	$0	$0	$0	$0	$0	$0
Swine	GF	MW	Pit	Medium2	$0	$0	$0	$0	$0	$0
Swine	GF	MW	Pit	Medium1	$0	$0	$0	$0	$0	$0
Swine	GF	MW	Liquid	Large2	$1,142	$23	$1,261	$25	$1,778	$36
Swine	GF	MW	Liquid	Large1	$796	$16	$723	$14	$974	$19
Swine	GF	MW	Liquid	Medium3	$713	$14	$580	$12	$697	$14
Swine	GF	MW	Liquid	Medium2	$622	$12	$508	$10	$608	$12
Swine	GF	MW	Liquid	Medium1	$531	$11	$430	$9	$508	$10
Chicken	LA	MW	Solid	Medium1	$268	$5	$268	$5	$268	$5
Chicken	LA	MW	Solid	Medium2	$319	$6	$319	$6	$319	$6
Chicken	LA	MW	Solid	Medium3	$351	$7	$351	$7	$351	$7
Chicken	LA	MW	Solid	Large1	$766	$15	$766	$15	$766	$15
Chicken	LA	MW	Solid	Large2	$1,867	$37	$1,867	$37	$1,867	$37
Chicken	LA	SO	Solid	Medium1	$268	$5	$268	$5	$268	$5
Chicken	LA	SO	Solid	Medium2	$319	$6	$319	$6	$319	$6
Chicken	LA	SO	Solid	Medium3	$351	$7	$351	$7	$351	$7
Chicken	LA	SO	Solid	Large1	$766	$15	$766	$15	$766	$15
Chicken	LA	SO	Solid	Large2	$1,867	$37	$1,867	$37	$1,867	$37
Chicken	LW	SO	Liquid	Medium3	$531	$11	$430	$9	$508	$10
Chicken	LW	SO	Liquid	Large1	$138	$3	$138	$3	$138	$3
Turkey	SL	MA	Solid	Medium1	$287	$6	$287	$6	$287	$6
Turkey	SL	MA	Solid	Medium2	$336	$7	$336	$7	$336	$7
Turkey	SL	MA	Solid	Medium3	$387	$8	$387	$8	$387	$8
Turkey	SL	MA	Solid	Large1	$704	$14	$704	$14	$704	$14
Turkey	SL	MW	Solid	Medium1	$287	$6	$287	$6	$287	$6

Table A-3f (Continued)

Animal	Operation Type	Region	Manure type	Size	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Turkey	SL	MW	Solid	Medium2	$336	$7	$336	$7	$336	$7
Turkey	SL	MW	Solid	Medium3	$387	$8	$387	$8	$387	$8
Turkey	SL	MW	Solid	Large1	$704	$14	$704	$14	$704	$14

Table A-4

Costs for Naturally-Lined Lagoons at Dairies

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Flush	Central	Large 1	$201,552	$10,078
Dairy	Flush	Central	Medium 1	$58,733	$2,937
Dairy	Flush	Central	Medium 2	$83,141	$4,157
Dairy	Flush	Central	Medium 3	$106,812	$5,341
Dairy	Flush	Mid-Atlantic	Large 1	$245,356	$12,268
Dairy	Flush	Mid-Atlantic	Medium 1	$70,374	$3,519
Dairy	Flush	Mid-Atlantic	Medium 2	$100,290	$5,014
Dairy	Flush	Mid-Atlantic	Medium 3	$128,551	$6,428
Dairy	Flush	Midwest	Large 1	$233,917	$11,696
Dairy	Flush	Midwest	Medium 1	$66,044	$3,302
Dairy	Flush	Midwest	Medium 2	$93,768	$4,688
Dairy	Flush	Midwest	Medium 3	$121,258	$6,063
Dairy	Flush	Pacific	Large 1	$250,951	$12,548
Dairy	Flush	Pacific	Medium 1	$73,971	$3,699
Dairy	Flush	Pacific	Medium 2	$104,068	$5,203
Dairy	Flush	Pacific	Medium 3	$134,457	$6,723
Dairy	Flush	South	Large 1	$230,254	$11,513
Dairy	Flush	South	Medium 1	$69,686	$3,484
Dairy	Flush	South	Medium 2	$97,894	$4,895
Dairy	Flush	South	Medium 3	$124,116	$6,206
Dairy	Hose	Central	Large 1	$96,193	$4,810
Dairy	Hose	Central	Medium 1	$27,447	$1,372

Table A-4

Costs for Naturally-Lined Lagoons at Dairies

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Flush	Central	Large 1	$201,552	$10,078
Dairy	Flush	Central	Medium 1	$58,733	$2,937
Dairy	Flush	Central	Medium 2	$83,141	$4,157
Dairy	Flush	Central	Medium 3	$106,812	$5,341
Dairy	Flush	Mid-Atlantic	Large 1	$245,356	$12,268
Dairy	Flush	Mid-Atlantic	Medium 1	$70,374	$3,519
Dairy	Flush	Mid-Atlantic	Medium 2	$100,290	$5,014
Dairy	Flush	Mid-Atlantic	Medium 3	$128,551	$6,428
Dairy	Flush	Midwest	Large 1	$233,917	$11,696
Dairy	Flush	Midwest	Medium 1	$66,044	$3,302
Dairy	Flush	Midwest	Medium 2	$93,768	$4,688
Dairy	Flush	Midwest	Medium 3	$121,258	$6,063
Dairy	Flush	Pacific	Large 1	$250,951	$12,548
Dairy	Flush	Pacific	Medium 1	$73,971	$3,699
Dairy	Flush	Pacific	Medium 2	$104,068	$5,203
Dairy	Flush	Pacific	Medium 3	$134,457	$6,723
Dairy	Flush	South	Large 1	$230,254	$11,513
Dairy	Flush	South	Medium 1	$69,686	$3,484
Dairy	Flush	South	Medium 2	$97,894	$4,895
Dairy	Flush	South	Medium 3	$124,116	$6,206
Dairy	Hose	Central	Large 1	$96,193	$4,810
Dairy	Hose	Central	Medium 1	$27,447	$1,372

Table A-3f (Continued)

Animal	Operation Type	Region	Manure type	Size	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Turkey	SL	MW	Solid	Medium2	$336	$7	$336	$7	$336	$7
Turkey	SL	MW	Solid	Medium3	$387	$8	$387	$8	$387	$8
Turkey	SL	MW	Solid	Large1	$704	$14	$704	$14	$704	$14

Table A-4 (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Hose	Central	Medium 2	$38,063	$1,903
Dairy	Hose	Central	Medium 3	$48,425	$2,421
Dairy	Hose	Mid-Atlantic	Large 1	$134,871	$6,744
Dairy	Hose	Mid-Atlantic	Medium 1	$37,132	$1,857
Dairy	Hose	Mid-Atlantic	Medium 2	$52,514	$2,626
Dairy	Hose	Mid-Atlantic	Medium 3	$66,975	$3,349
Dairy	Hose	Midwest	Large 1	$127,879	$6,394
Dairy	Hose	Midwest	Medium 1	$33,793	$1,690
Dairy	Hose	Midwest	Medium 2	$48,266	$2,413
Dairy	Hose	Midwest	Medium 3	$62,361	$3,118
Dairy	Hose	Pacific	Large 1	$136,355	$6,818
Dairy	Hose	Pacific	Medium 1	$39,573	$1,979
Dairy	Hose	Pacific	Medium 2	$54,965	$2,748
Dairy	Hose	Pacific	Medium 3	$69,723	$3,486
Dairy	Hose	South	Large 1	$116,180	$5,809
Dairy	Hose	South	Medium 1	$35,351	$1,768
Dairy	Hose	South	Medium 2	$48,434	$2,422
Dairy	Hose	South	Medium 3	$60,948	$3,047
Veal	Flush	Central	Medium 1	$20,374	$1,019
Veal	Flush	Central	Medium 2	$22,203	$1,110
Veal	Flush	Central	Medium 3	$27,346	$1,367
Veal	Flush	Mid-Atlantic	Medium 1	$22,902	$1,145
Veal	Flush	Mid-Atlantic	Medium 2	$24,827	$1,241
Veal	Flush	Mid-Atlantic	Medium 3	$30,642	$1,532
Veal	Flush	Midwest	Medium 1	$21,769	$1,088
Veal	Flush	Midwest	Medium 2	$23,526	$1,176

Table A-4 (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Veal	Flush	Midwest	Medium 3	$28,903	$1,445
Veal	Flush	Pacific	Medium 1	$23,211	$1,161
Veal	Flush	Pacific	Medium 2	$25,742	$1,287
Veal	Flush	Pacific	Medium 3	$31,706	$1,585
Veal	Flush	South	Medium 1	$21,502	$1,075
Veal	Flush	South	Medium 2	$24,865	$1,243
Veal	Flush	South	Medium 3	$30,633	$1,532

Table A-5

Costs for Synthetically Lined Lagoons at Dairies and Veal Operations

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Flush	Large 1	Central	$363,000	$18,150
Dairy	Flush	Large 1	Mid-Atlantic	$376,418	$18,821
Dairy	Flush	Large 1	Midwest	$310,862	$15,543
Dairy	Flush	Large 1	Pacific	$431,846	$21,592
Dairy	Flush	Large 1	South	$394,567	$19,728
Dairy	Flush	Medium 1	Central	$131,074	$6,554
Dairy	Flush	Medium 1	Mid-Atlantic	$130,004	$6,500
Dairy	Flush	Medium 1	Midwest	$104,317	$5,216
Dairy	Flush	Medium 1	Pacific	$155,612	$7,781
Dairy	Flush	Medium 1	South	$150,644	$7,532
Dairy	Flush	Medium 2	Central	$146,055	$7,303
Dairy	Flush	Medium 2	Mid-Atlantic	$151,211	$7,561
Dairy	Flush	Medium 2	Midwest	$121,952	$6,098
Dairy	Flush	Medium 2	Pacific	$177,355	$8,868
Dairy	Flush	Medium 2	South	$165,758	$8,288
Dairy	Flush	Medium 3	Central	$188,613	$9,431
Dairy	Flush	Medium 3	Mid-Atlantic	$194,691	$9,735
Dairy	Flush	Medium 3	Midwest	$158,748	$7,937
Dairy	Flush	Medium 3	Pacific	$226,556	$11,328
Dairy	Flush	Medium 3	South	$211,330	$10,567
Dairy	Hose	Large 1	Central	$185,245	$9,262
Dairy	Hose	Large 1	Mid-Atlantic	$217,143	$10,857
Dairy	Hose	Large 1	Midwest	$180,538	$9,027

Table A-5 (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Hose	Large 1	Pacific	$242,889	$12,144
Dairy	Hose	Large 1	South	$200,936	$10,047
Dairy	Hose	Medium 1	Central	$54,632	$2,732
Dairy	Hose	Medium 1	Mid-Atlantic	$61,301	$3,065
Dairy	Hose	Medium 1	Midwest	$48,142	$2,407
Dairy	Hose	Medium 1	Pacific	$74,366	$3,718
Dairy	Hose	Medium 1	South	$67,966	$3,398
Dairy	Hose	Medium 2	Central	$70,597	$3,530
Dairy	Hose	Medium 2	Mid-Atlantic	$81,997	$4,100
Dairy	Hose	Medium 2	Midwest	$66,909	$3,345
Dairy	Hose	Medium 2	Pacific	$94,773	$4,739
Dairy	Hose	Medium 2	South	$81,191	$4,060
Dairy	Hose	Medium 3	Central	$91,004	$4,550
Dairy	Hose	Medium 3	Mid-Atlantic	$107,201	$5,360
Dairy	Hose	Medium 3	Midwest	$87,459	$4,373
Dairy	Hose	Medium 3	Pacific	$121,038	$6,052
Dairy	Hose	Medium 3	South	$103,423	$5,171
Veal	Flush	Medium 1	Central	$0	$0
Veal	Flush	Medium 1	Mid-Atlantic	$0	$0
Veal	Flush	Medium 1	Midwest	$0	$0
Veal	Flush	Medium 1	Pacific	$0	$0
Veal	Flush	Medium 1	South	$0	$0
Veal	Flush	Medium 2	Central	$0	$0
Veal	Flush	Medium 2	Mid-Atlantic	$0	$0
Veal	Flush	Medium 2	Midwest	$0	$0
Veal	Flush	Medium 2	Pacific	$0	$0

Table A-5 (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Veal	Flush	Medium 2	South	$0	$0
Veal	Flush	Medium 3	Central	$0	$0
Veal	Flush	Medium 3	Mid-Atlantic	$0	$0
Veal	Flush	Medium 3	Midwest	$0	$0
Veal	Flush	Medium 3	Pacific	$0	$0
Veal	Flush	Medium 3	South	$0	$0

Table A-6a

Costs for Lagoons at Dairies Under Option 7

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Flush	Central	Large 1	$194,988	$9,749
Dairy	Flush	Central	Medium 1	$57,883	$2,894
Dairy	Flush	Central	Medium 2	$81,904	$4,095
Dairy	Flush	Central	Medium 3	$104,334	$5,217
Dairy	Flush	Mid-Atlantic	Large 1	$193,294	$9,665
Dairy	Flush	Mid-Atlantic	Medium 1	$56,655	$2,833
Dairy	Flush	Mid-Atlantic	Medium 2	$79,952	$3,998
Dairy	Flush	Mid-Atlantic	Medium 3	$102,883	$5,144
Dairy	Flush	Midwest	Large 1	$182,501	$9,125
Dairy	Flush	Midwest	Medium 1	$51,937	$2,597
Dairy	Flush	Midwest	Medium 2	$74,653	$3,733
Dairy	Flush	Midwest	Medium 3	$95,519	$4,776
Dairy	Flush	Pacific	Large 1	$281,922	$14,096
Dairy	Flush	Pacific	Medium 1	$82,243	$4,112
Dairy	Flush	Pacific	Medium 2	$117,155	$5,858
Dairy	Flush	Pacific	Medium 3	$150,125	$7,506
Dairy	Flush	South	Large 1	$352,973	$17,649
Dairy	Flush	South	Medium 1	$101,514	$5,076
Dairy	Flush	South	Medium 2	$145,461	$7,273
Dairy	Flush	South	Medium 3	$186,987	$9,349
Dairy	Hose	Central	Large 1	$91,556	$4,578
Dairy	Hose	Central	Medium 1	$25,988	$1,299
Dairy	Hose	Central	Medium 2	$35,931	$1,797

Table A-6a (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Hose	Central	Medium 3	$45,622	$2,281
Dairy	Hose	Mid-Atlantic	Large 1	$130,629	$6,531
Dairy	Hose	Mid-Atlantic	Medium 1	$35,958	$1,798
Dairy	Hose	Mid-Atlantic	Medium 2	$50,298	$2,515
Dairy	Hose	Mid-Atlantic	Medium 3	$64,829	$3,241
Dairy	Hose	Midwest	Large 1	$122,090	$6,104
Dairy	Hose	Midwest	Medium 1	$32,367	$1,618
Dairy	Hose	Midwest	Medium 2	$46,299	$2,315
Dairy	Hose	Midwest	Medium 3	$59,544	$2,977
Dairy	Hose	Pacific	Large 1	$116,072	$5,804
Dairy	Hose	Pacific	Medium 1	$33,261	$1,663
Dairy	Hose	Pacific	Medium 2	$46,116	$2,306
Dairy	Hose	Pacific	Medium 3	$58,803	$2,940
Dairy	Hose	South	Large 1	$87,821	$4,391
Dairy	Hose	South	Medium 1	$26,813	$1,341
Dairy	Hose	South	Medium 2	$36,255	$1,813
Dairy	Hose	South	Medium 3	$45,653	$2,283

Table A-6b

Costs for Additional Capacity Lagoon for Dairies Under Option 7

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Flush	Central	Large 1	$219,834	$10,992
Dairy	Flush	Central	Large 1	$219,834	$10,992
Dairy	Flush	Central	Large 1	$219,834	$10,992
Dairy	Flush	Central	Large 1	$219,834	$10,992
Dairy	Flush	Central	Medium 1	$66,256	$3,313
Dairy	Flush	Central	Medium 1	$66,256	$3,313
Dairy	Flush	Central	Medium 1	$66,256	$3,313
Dairy	Flush	Central	Medium 1	$66,256	$3,313
Dairy	Flush	Central	Medium 2	$92,975	$4,649
Dairy	Flush	Central	Medium 2	$92,975	$4,649
Dairy	Flush	Central	Medium 2	$92,975	$4,649
Dairy	Flush	Central	Medium 2	$92,975	$4,649
Dairy	Flush	Central	Medium 3	$118,371	$5,919
Dairy	Flush	Central	Medium 3	$118,371	$5,919
Dairy	Flush	Central	Medium 3	$118,371	$5,919
Dairy	Flush	Central	Medium 3	$118,371	$5,919
Dairy	Flush	Mid-Atlantic	Large 1	$340,273	$17,014
Dairy	Flush	Mid-Atlantic	Large 1	$340,273	$17,014
Dairy	Flush	Mid-Atlantic	Large 1	$340,273	$17,014
Dairy	Flush	Mid-Atlantic	Large 1	$340,273	$17,014
Dairy	Flush	Mid-Atlantic	Medium 1	$99,020	$4,951
Dairy	Flush	Mid-Atlantic	Medium 1	$99,020	$4,951
Dairy	Flush	Mid-Atlantic	Medium 1	$99,020	$4,951

Table A-6b (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Flush	Mid-Atlantic	Medium 1	$99,020	$4,951
Dairy	Flush	Mid-Atlantic	Medium 2	$141,315	$7,066
Dairy	Flush	Mid-Atlantic	Medium 2	$141,315	$7,066
Dairy	Flush	Mid-Atlantic	Medium 2	$141,315	$7,066
Dairy	Flush	Mid-Atlantic	Medium 2	$141,315	$7,066
Dairy	Flush	Mid-Atlantic	Medium 3	$181,277	$9,064
Dairy	Flush	Mid-Atlantic	Medium 3	$181,277	$9,064
Dairy	Flush	Mid-Atlantic	Medium 3	$181,277	$9,064
Dairy	Flush	Mid-Atlantic	Medium 3	$181,277	$9,064
Dairy	Flush	Midwest	Large 1	$260,242	$13,012
Dairy	Flush	Midwest	Large 1	$260,242	$13,012
Dairy	Flush	Midwest	Large 1	$260,242	$13,012
Dairy	Flush	Midwest	Large 1	$260,242	$13,012
Dairy	Flush	Midwest	Medium 1	$75,705	$3,785
Dairy	Flush	Midwest	Medium 1	$75,705	$3,785
Dairy	Flush	Midwest	Medium 1	$75,705	$3,785
Dairy	Flush	Midwest	Medium 1	$75,705	$3,785
Dairy	Flush	Midwest	Medium 2	$107,138	$5,357
Dairy	Flush	Midwest	Medium 2	$107,138	$5,357
Dairy	Flush	Midwest	Medium 2	$107,138	$5,357
Dairy	Flush	Midwest	Medium 2	$107,138	$5,357
Dairy	Flush	Midwest	Medium 3	$136,990	$6,850
Dairy	Flush	Midwest	Medium 3	$136,990	$6,850
Dairy	Flush	Midwest	Medium 3	$136,990	$6,850
Dairy	Flush	Midwest	Medium 3	$136,990	$6,850
Dairy	Flush	Pacific	Large 1	$235,430	$11,772

Table A-6b (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Flush	Pacific	Large 1	$235,430	$11,772
Dairy	Flush	Pacific	Large 1	$235,430	$11,772
Dairy	Flush	Pacific	Large 1	$235,430	$11,772
Dairy	Flush	Pacific	Medium 1	$72,203	$3,610
Dairy	Flush	Pacific	Medium 1	$72,203	$3,610
Dairy	Flush	Pacific	Medium 1	$72,203	$3,610
Dairy	Flush	Pacific	Medium 1	$72,203	$3,610
Dairy	Flush	Pacific	Medium 2	$100,655	$5,033
Dairy	Flush	Pacific	Medium 2	$100,655	$5,033
Dairy	Flush	Pacific	Medium 2	$100,655	$5,033
Dairy	Flush	Pacific	Medium 2	$100,655	$5,033
Dairy	Flush	Pacific	Medium 3	$127,812	$6,391
Dairy	Flush	Pacific	Medium 3	$127,812	$6,391
Dairy	Flush	Pacific	Medium 3	$127,812	$6,391
Dairy	Flush	Pacific	Medium 3	$127,812	$6,391
Dairy	Flush	South	Large 1	$105,328	$5,266
Dairy	Flush	South	Large 1	$105,328	$5,266
Dairy	Flush	South	Large 1	$105,328	$5,266
Dairy	Flush	South	Large 1	$105,328	$5,266
Dairy	Flush	South	Medium 1	$35,101	$1,755
Dairy	Flush	South	Medium 1	$35,101	$1,755
Dairy	Flush	South	Medium 1	$35,101	$1,755
Dairy	Flush	South	Medium 1	$35,101	$1,755
Dairy	Flush	South	Medium 2	$46,422	$2,321
Dairy	Flush	South	Medium 2	$46,422	$2,321
Dairy	Flush	South	Medium 2	$46,422	$2,321

Table A-6b (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Flush	South	Medium 2	$46,422	$2,321
Dairy	Flush	South	Medium 3	$57,655	$2,883
Dairy	Flush	South	Medium 3	$57,655	$2,883
Dairy	Flush	South	Medium 3	$57,655	$2,883
Dairy	Flush	South	Medium 3	$57,655	$2,883
Dairy	Hose	Central	Large 1	$101,274	$5,064
Dairy	Hose	Central	Large 1	$101,274	$5,064
Dairy	Hose	Central	Large 1	$101,274	$5,064
Dairy	Hose	Central	Large 1	$101,274	$5,064
Dairy	Hose	Central	Medium 1	$29,309	$1,465
Dairy	Hose	Central	Medium 1	$29,309	$1,465
Dairy	Hose	Central	Medium 1	$29,309	$1,465
Dairy	Hose	Central	Medium 1	$29,309	$1,465
Dairy	Hose	Central	Medium 2	$40,605	$2,030
Dairy	Hose	Central	Medium 2	$40,605	$2,030
Dairy	Hose	Central	Medium 2	$40,605	$2,030
Dairy	Hose	Central	Medium 2	$40,605	$2,030
Dairy	Hose	Central	Medium 3	$51,592	$2,580
Dairy	Hose	Central	Medium 3	$51,592	$2,580
Dairy	Hose	Central	Medium 3	$51,592	$2,580
Dairy	Hose	Central	Medium 3	$51,592	$2,580
Dairy	Hose	Mid-Atlantic	Large 1	$147,107	$7,355
Dairy	Hose	Mid-Atlantic	Large 1	$147,107	$7,355
Dairy	Hose	Mid-Atlantic	Large 1	$147,107	$7,355
Dairy	Hose	Mid-Atlantic	Large 1	$147,107	$7,355
Dairy	Hose	Mid-Atlantic	Medium 1	$41,952	$2,098

Table A-6b (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Hose	Mid-Atlantic	Medium 1	$41,952	$2,098
Dairy	Hose	Mid-Atlantic	Medium 1	$41,952	$2,098
Dairy	Hose	Mid-Atlantic	Medium 1	$41,952	$2,098
Dairy	Hose	Mid-Atlantic	Medium 2	$58,066	$2,903
Dairy	Hose	Mid-Atlantic	Medium 2	$58,066	$2,903
Dairy	Hose	Mid-Atlantic	Medium 2	$58,066	$2,903
Dairy	Hose	Mid-Atlantic	Medium 2	$58,066	$2,903
Dairy	Hose	Mid-Atlantic	Medium 3	$74,474	$3,724
Dairy	Hose	Mid-Atlantic	Medium 3	$74,474	$3,724
Dairy	Hose	Mid-Atlantic	Medium 3	$74,474	$3,724
Dairy	Hose	Mid-Atlantic	Medium 3	$74,474	$3,724
Dairy	Hose	Midwest	Large 1	$130,132	$6,507
Dairy	Hose	Midwest	Large 1	$130,132	$6,507
Dairy	Hose	Midwest	Large 1	$130,132	$6,507
Dairy	Hose	Midwest	Large 1	$130,132	$6,507
Dairy	Hose	Midwest	Medium 1	$35,387	$1,769
Dairy	Hose	Midwest	Medium 1	$35,387	$1,769
Dairy	Hose	Midwest	Medium 1	$35,387	$1,769
Dairy	Hose	Midwest	Medium 1	$35,387	$1,769
Dairy	Hose	Midwest	Medium 2	$50,037	$2,502
Dairy	Hose	Midwest	Medium 2	$50,037	$2,502
Dairy	Hose	Midwest	Medium 2	$50,037	$2,502
Dairy	Hose	Midwest	Medium 2	$50,037	$2,502
Dairy	Hose	Midwest	Medium 3	$64,506	$3,225
Dairy	Hose	Midwest	Medium 3	$64,506	$3,225
Dairy	Hose	Midwest	Medium 3	$64,506	$3,225

Table A-6b (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Hose	Midwest	Medium 3	$64,506	$3,225
Dairy	Hose	Pacific	Large 1	$125,982	$6,299
Dairy	Hose	Pacific	Large 1	$125,982	$6,299
Dairy	Hose	Pacific	Large 1	$125,982	$6,299
Dairy	Hose	Pacific	Large 1	$125,982	$6,299
Dairy	Hose	Pacific	Medium 1	$37,117	$1,856
Dairy	Hose	Pacific	Medium 1	$37,117	$1,856
Dairy	Hose	Pacific	Medium 1	$37,117	$1,856
Dairy	Hose	Pacific	Medium 1	$37,117	$1,856
Dairy	Hose	Pacific	Medium 2	$51,082	$2,554
Dairy	Hose	Pacific	Medium 2	$51,082	$2,554
Dairy	Hose	Pacific	Medium 2	$51,082	$2,554
Dairy	Hose	Pacific	Medium 2	$51,082	$2,554
Dairy	Hose	Pacific	Medium 3	$64,462	$3,223
Dairy	Hose	Pacific	Medium 3	$64,462	$3,223
Dairy	Hose	Pacific	Medium 3	$64,462	$3,223
Dairy	Hose	Pacific	Medium 3	$64,462	$3,223
Dairy	Hose	South	Large 1	$85,542	$4,277
Dairy	Hose	South	Large 1	$85,542	$4,277
Dairy	Hose	South	Large 1	$85,542	$4,277
Dairy	Hose	South	Large 1	$85,542	$4,277
Dairy	Hose	South	Medium 1	$25,922	$1,296
Dairy	Hose	South	Medium 1	$25,922	$1,296
Dairy	Hose	South	Medium 1	$25,922	$1,296
Dairy	Hose	South	Medium 1	$25,922	$1,296
Dairy	Hose	South	Medium 2	$35,152	$1,758

Table A-6b (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Hose	South	Medium 2	$35,152	$1,758
Dairy	Hose	South	Medium 2	$35,152	$1,758
Dairy	Hose	South	Medium 2	$35,152	$1,758
Dairy	Hose	South	Medium 3	$44,245	$2,212
Dairy	Hose	South	Medium 3	$44,245	$2,212
Dairy	Hose	South	Medium 3	$44,245	$2,212
Dairy	Hose	South	Medium 3	$44,245	$2,212

Table A-7

Costs for Naturally-Lined Ponds at Beef Feedlots and Heifer Operations

Animal	Farm Type	Region	Size Class	Capital	Annual
Beef	Beef	Central	Large 1	$19,458	$973
Beef	Beef	Central	Large 2	$83,318	$4,166
Beef	Beef	Central	Medium 1	$11,264	$563
Beef	Beef	Central	Medium 2	$12,503	$625
Beef	Beef	Central	Medium 3	$13,786	$689
Beef	Beef	Mid-Atlantic	Large 1	$33,990	$1,700
Beef	Beef	Mid-Atlantic	Large 2	$167,623	$8,381
Beef	Beef	Mid-Atlantic	Medium 1	$15,934	$797
Beef	Beef	Mid-Atlantic	Medium 2	$18,778	$939
Beef	Beef	Mid-Atlantic	Medium 3	$21,797	$1,090
Beef	Beef	Midwest	Large 1	$25,307	$1,265
Beef	Beef	Midwest	Large 2	$116,765	$5,838
Beef	Beef	Midwest	Medium 1	$13,139	$657
Beef	Beef	Midwest	Medium 2	$14,999	$750
Beef	Beef	Midwest	Medium 3	$16,984	$849
Beef	Beef	Pacific	Large 1	$43,420	$2,171
Beef	Beef	Pacific	Large 2	$217,952	$10,898
Beef	Beef	Pacific	Medium 1	$19,011	$951
Beef	Beef	Pacific	Medium 2	$22,843	$1,142
Beef	Beef	Pacific	Medium 3	$26,865	$1,343
Beef	Beef	South	Large 1	$39,617	$1,981
Beef	Beef	South	Large 2	$194,161	$9,708
Beef	Beef	South	Medium 1	$17,860	$893

Table A-7(Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Beef	Beef	South	Medium 2	$21,274	$1,064
Beef	Beef	South	Medium 3	$24,843	$1,242
Heifers	Heifers	Central	Large 1	$17,392	$870
Heifers	Heifers	Central	Medium 1	$11,315	$566
Heifers	Heifers	Central	Medium 2	$12,704	$635
Heifers	Heifers	Central	Medium 3	$14,204	$710
Heifers	Heifers	Mid-Atlantic	Large 1	$29,313	$1,466
Heifers	Heifers	Mid-Atlantic	Medium 1	$16,050	$802
Heifers	Heifers	Mid-Atlantic	Medium 2	$19,283	$964
Heifers	Heifers	Mid-Atlantic	Medium 3	$22,440	$1,122
Heifers	Heifers	Midwest	Large 1	$22,140	$1,107
Heifers	Heifers	Midwest	Medium 1	$13,215	$661
Heifers	Heifers	Midwest	Medium 2	$15,318	$766
Heifers	Heifers	Midwest	Medium 3	$17,433	$872
Heifers	Heifers	Pacific	Large 1	$37,141	$1,857
Heifers	Heifers	Pacific	Medium 1	$19,172	$959
Heifers	Heifers	Pacific	Medium 2	$23,589	$1,179
Heifers	Heifers	Pacific	Medium 3	$27,790	$1,389
Heifers	Heifers	South	Large 1	$34,419	$1,721
Heifers	Heifers	South	Medium 1	$18,005	$900
Heifers	Heifers	South	Medium 2	$21,751	$1,088
Heifers	Heifers	South	Medium 3	$25,660	$1,283

Table A-8

Costs for Synthetically Lined Ponds at Beef and Heifer Operations

Animal	Farm Type	Region	Size Class	Capital	Annual
Beef	Beef	Large 1	Central	$48,923	$2,446
Beef	Beef	Large 1	Mid-Atlantic	$85,682	$4,284
Beef	Beef	Large 1	Midwest	$64,160	$3,208
Beef	Beef	Large 1	Pacific	$109,089	$5,454
Beef	Beef	Large 1	South	$100,979	$5,049
Beef	Beef	Large 2	Central	$249,710	$12,485
Beef	Beef	Large 2	Mid-Atlantic	$494,952	$24,748
Beef	Beef	Large 2	Midwest	$346,870	$17,343
Beef	Beef	Large 2	Pacific	$662,726	$33,136
Beef	Beef	Large 2	South	$611,550	$30,578
Beef	Beef	Medium 1	Central	$25,448	$1,272
Beef	Beef	Medium 1	Mid-Atlantic	$39,253	$1,963
Beef	Beef	Medium 1	Midwest	$31,210	$1,561
Beef	Beef	Medium 1	Pacific	$47,315	$2,366
Beef	Beef	Medium 1	South	$44,113	$2,206
Beef	Beef	Medium 2	Central	$29,264	$1,463
Beef	Beef	Medium 2	Mid-Atlantic	$46,609	$2,330
Beef	Beef	Medium 2	Midwest	$36,352	$1,818
Beef	Beef	Medium 2	Pacific	$56,830	$2,841
Beef	Beef	Medium 2	South	$52,964	$2,648
Beef	Beef	Medium 3	Central	$33,054	$1,653
Beef	Beef	Medium 3	Mid-Atlantic	$53,964	$2,698
Beef	Beef	Medium 3	Midwest	$41,770	$2,089

Table A-8 (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Beef	Beef	Medium 3	Pacific	$66,788	$3,339
Beef	Beef	Medium 3	South	$62,231	$3,112
Heifers	Heifers	Large 1	Central	$43,172	$2,159
Heifers	Heifers	Large 1	Mid-Atlantic	$74,059	$3,703
Heifers	Heifers	Large 1	Midwest	$55,689	$2,784
Heifers	Heifers	Large 1	Pacific	$93,408	$4,670
Heifers	Heifers	Large 1	South	$86,496	$4,325
Heifers	Heifers	Medium 1	Central	$25,593	$1,280
Heifers	Heifers	Medium 1	Mid-Atlantic	$39,386	$1,969
Heifers	Heifers	Medium 1	Midwest	$31,300	$1,565
Heifers	Heifers	Medium 1	Pacific	$47,521	$2,376
Heifers	Heifers	Medium 1	South	$44,462	$2,223
Heifers	Heifers	Medium 2	Central	$29,763	$1,488
Heifers	Heifers	Medium 2	Mid-Atlantic	$47,779	$2,389
Heifers	Heifers	Medium 2	Midwest	$37,114	$1,856
Heifers	Heifers	Medium 2	Pacific	$58,445	$2,922
Heifers	Heifers	Medium 2	South	$54,437	$2,722
Heifers	Heifers	Medium 3	Central	$33,887	$1,694
Heifers	Heifers	Medium 3	Mid-Atlantic	$56,083	$2,804
Heifers	Heifers	Medium 3	Midwest	$43,008	$2,150
Heifers	Heifers	Medium 3	Pacific	$69,469	$3,473
Heifers	Heifers	Medium 3	South	$64,685	$3,234

Table A-9a

Costs for Ponds for Beef Feedlots and Heifer Operations Under Option 7

Animal	Farm Type	Region	Size Class	Capital	Annual
Beef	Beef	Central	Large 1	$16,792	$840
Beef	Beef	Central	Large 2	$54,026	$2,701
Beef	Beef	Central	Medium 1	$11,700	$585
Beef	Beef	Central	Medium 2	$12,486	$624
Beef	Beef	Central	Medium 3	$13,351	$668
Beef	Beef	Mid-Atlantic	Large 1	$31,003	$1,550
Beef	Beef	Mid-Atlantic	Large 2	$133,734	$6,687
Beef	Beef	Mid-Atlantic	Medium 1	$16,916	$846
Beef	Beef	Mid-Atlantic	Medium 2	$19,104	$955
Beef	Beef	Mid-Atlantic	Medium 3	$21,458	$1,073
Beef	Beef	Midwest	Large 1	$21,578	$1,079
Beef	Beef	Midwest	Large 2	$82,255	$4,113
Beef	Beef	Midwest	Medium 1	$13,506	$675
Beef	Beef	Midwest	Medium 2	$14,827	$741
Beef	Beef	Midwest	Medium 3	$16,106	$805
Beef	Beef	Pacific	Large 1	$33,888	$1,694
Beef	Beef	Pacific	Large 2	$148,564	$7,428
Beef	Beef	Pacific	Medium 1	$18,049	$902
Beef	Beef	Pacific	Medium 2	$20,567	$1,028
Beef	Beef	Pacific	Medium 3	$23,281	$1,164
Beef	Beef	South	Large 1	$33,897	$1,695
Beef	Beef	South	Large 2	$147,833	$7,392
Beef	Beef	South	Medium 1	$17,837	$892

Table A-9a (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Beef	Beef	South	Medium 2	$20,386	$1,019
Beef	Beef	South	Medium 3	$23,052	$1,153
Dairy	Flush	Central	Large 1	$15,009	$750
Dairy	Flush	Mid-Atlantic	Large 1	$16,245	$812
Dairy	Flush	Midwest	Large 1	$15,611	$781
Dairy	Flush	Pacific	Large 1	$16,713	$836
Dairy	Flush	South	Large 1	$16,301	$815
Dairy	Hose	Central	Large 1	$13,080	$654
Dairy	Hose	Mid-Atlantic	Large 1	$14,712	$736
Dairy	Hose	Midwest	Large 1	$13,878	$694
Dairy	Hose	Pacific	Large 1	$15,323	$766
Dairy	Hose	South	Large 1	$14,787	$739
Heifers	Heifers	Central	Large 1	$15,518	$776
Heifers	Heifers	Central	Medium 1	$11,680	$584
Heifers	Heifers	Central	Medium 2	$12,647	$632
Heifers	Heifers	Central	Medium 3	$13,519	$676
Heifers	Heifers	Mid-Atlantic	Large 1	$27,571	$1,379
Heifers	Heifers	Mid-Atlantic	Medium 1	$17,013	$851
Heifers	Heifers	Mid-Atlantic	Medium 2	$19,461	$973
Heifers	Heifers	Mid-Atlantic	Medium 3	$21,958	$1,098
Heifers	Heifers	Midwest	Large 1	$19,680	$984
Heifers	Heifers	Midwest	Medium 1	$13,562	$678
Heifers	Heifers	Midwest	Medium 2	$15,005	$750
Heifers	Heifers	Midwest	Medium 3	$16,524	$826
Heifers	Heifers	Pacific	Large 1	$29,864	$1,493
Heifers	Heifers	Pacific	Medium 1	$18,158	$908

Table A-9a (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Heifers	Heifers	Pacific	Medium 2	$20,981	$1,049
Heifers	Heifers	Pacific	Medium 3	$23,864	$1,193
Heifers	Heifers	South	Large 1	$29,902	$1,495
Heifers	Heifers	South	Medium 1	$17,948	$897
Heifers	Heifers	South	Medium 2	$20,898	$1,045
Heifers	Heifers	South	Medium 3	$23,636	$1,182

Table A-9b

Costs for Additional Capacity Lagoon for Dairies Under Option 7

Animal	Farm Type	Region	Size Class	Capital	Annual
Beef	Beef	Central	Large 1	$7,790	$389
Beef	Beef	Central	Large 2	$38,719	$1,936
Beef	Beef	Central	Medium 1	$11,226	$561
Beef	Beef	Central	Medium 2	$11,923	$596
Beef	Beef	Central	Medium 3	$12,570	$628
Beef	Beef	Mid-Atlantic	Large 1	$19,883	$994
Beef	Beef	Mid-Atlantic	Large 2	$106,428	$5,321
Beef	Beef	Mid-Atlantic	Medium 1	$15,615	$781
Beef	Beef	Mid-Atlantic	Medium 2	$17,545	$877
Beef	Beef	Mid-Atlantic	Medium 3	$19,514	$976
Beef	Beef	Midwest	Large 1	$5,588	$279
Beef	Beef	Midwest	Large 2	$25,426	$1,271
Beef	Beef	Midwest	Medium 1	$10,625	$531
Beef	Beef	Midwest	Medium 2	$11,048	$552
Beef	Beef	Midwest	Medium 3	$11,473	$574
Beef	Beef	Pacific	Large 1	$17,849	$892
Beef	Beef	Pacific	Large 2	$93,347	$4,667
Beef	Beef	Pacific	Medium 1	$15,029	$751
Beef	Beef	Pacific	Medium 2	$16,615	$831
Beef	Beef	Pacific	Medium 3	$18,322	$916
Beef	Beef	South	Large 1	$0	$0
Beef	Beef	South	Large 2	$0	$0
Beef	Beef	South	Medium 1	$0	$0

Table A-9b (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Beef	Beef	South	Medium 2	$0	$0
Beef	Beef	South	Medium 3	$0	$0
Heifers	Heifers	Central	Large 1	$6,444	$322
Heifers	Heifers	Central	Medium 1	$11,150	$558
Heifers	Heifers	Central	Medium 2	$11,891	$595
Heifers	Heifers	Central	Medium 3	$12,559	$628
Heifers	Heifers	Mid-Atlantic	Large 1	$21,179	$1,059
Heifers	Heifers	Mid-Atlantic	Medium 1	$17,527	$876
Heifers	Heifers	Mid-Atlantic	Medium 2	$20,112	$1,006
Heifers	Heifers	Mid-Atlantic	Medium 3	$22,899	$1,145
Heifers	Heifers	Midwest	Large 1	$10,082	$504
Heifers	Heifers	Midwest	Medium 1	$12,747	$637
Heifers	Heifers	Midwest	Medium 2	$13,985	$699
Heifers	Heifers	Midwest	Medium 3	$15,122	$756
Heifers	Heifers	Pacific	Large 1	$15,075	$754
Heifers	Heifers	Pacific	Medium 1	$15,011	$751
Heifers	Heifers	Pacific	Medium 2	$16,972	$849
Heifers	Heifers	Pacific	Medium 3	$18,864	$943
Heifers	Heifers	South	Large 1	$5,105	$255
Heifers	Heifers	South	Medium 1	$10,752	$538
Heifers	Heifers	South	Medium 2	$11,231	$562
Heifers	Heifers	South	Medium 3	$11,753	$588

Table A-10a

Costs for Nutrient Management Planning at Dairies, Beef Feedlots, Veal and Heifer Operations P-Based Scenario

Animal	Farm Type	Region	Size Class	Category 1			Category 2			Category 3		
				Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring
Beef	Beef	Central	Large 1	$8,976	$5,753	$2,020	$3,774	$2,727	$620	$1,045	$1,350	$20
Beef	Beef	Central	Large 2	$106,174	$62,302	$28,140	$32,077	$19,193	$8,220	$1,045	$1,350	$20
Beef	Beef	Central	Medium 1	$3,039	$2,159	$420	$2,176	$1,657	$180	$1,045	$1,210	$20
Beef	Beef	Central	Medium 2	$3,774	$2,587	$620	$2,912	$2,085	$380	$1,045	$1,210	$20
Beef	Beef	Central	Medium 3	$4,641	$3,091	$860	$3,778	$2,589	$620	$1,045	$1,210	$20
Beef	Beef	Mid-Atlantic	Large 1	$6,654	$4,402	$1,400	$2,800	$2,160	$360	$1,045	$1,350	$20
Beef	Beef	Mid-Atlantic	Large 2	$73,505	$43,296	$19,360	$18,574	$11,338	$4,600	$1,045	$1,350	$20
Beef	Beef	Mid-Atlantic	Medium 1	$2,573	$1,888	$300	$1,934	$1,516	$120	$1,045	$1,210	$20
Beef	Beef	Mid-Atlantic	Medium 2	$3,077	$2,182	$420	$2,438	$1,810	$260	$1,045	$1,210	$20
Beef	Beef	Mid-Atlantic	Medium 3	$3,674	$2,529	$600	$3,035	$2,157	$420	$1,045	$1,210	$20
Beef	Beef	Midwest	Large 1	$7,417	$4,846	$1,600	$2,985	$2,268	$400	$1,045	$1,350	$20
Beef	Beef	Midwest	Large 2	$84,243	$49,543	$22,240	$21,116	$12,816	$5,280	$1,045	$1,350	$20
Beef	Beef	Midwest	Medium 1	$2,727	$1,978	$340	$1,992	$1,550	$140	$1,045	$1,210	$20
Beef	Beef	Midwest	Medium 2	$3,308	$2,316	$500	$2,573	$1,888	$300	$1,045	$1,210	$20
Beef	Beef	Midwest	Medium 3	$3,990	$2,712	$680	$3,258	$2,287	$480	$1,045	$1,210	$20
Beef	Beef	Pacific	Large 1	$6,616	$4,380	$1,380	$3,151	$2,364	$440	$1,045	$1,350	$20
Beef	Beef	Pacific	Large 2	$72,943	$42,969	$19,220	$23,572	$14,245	$5,940	$1,045	$1,350	$20
Beef	Beef	Pacific	Medium 1	$2,565	$1,884	$300	$1,992	$1,550	$140	$1,045	$1,210	$20
Beef	Beef	Pacific	Medium 2	$3,066	$2,175	$420	$2,492	$1,841	$280	$1,045	$1,210	$20
Beef	Beef	Pacific	Medium 3	$3,659	$2,520	$580	$3,081	$2,184	$440	$1,045	$1,210	$20
Beef	Beef	South	Large 1	$4,533	$3,168	$820	$2,277	$1,856	$220	$1,045	$1,350	$20
Beef	Beef	South	Large 2	$43,620	$25,909	$11,320	$11,502	$7,223	$2,700	$1,045	$1,350	$20

Table A-10a (Continued)

Animal	Farm Type	Region	Size Class	Category 1			Category 2			Category 3		
				Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring
Beef	Beef	South	Medium 1	$2,146	$1,639	$180	$1,772	$1,422	$80	$1,045	$1,210	$20
Beef	Beef	South	Medium 2	$2,442	$1,812	$260	$2,069	$1,595	$160	$1,045	$1,210	$20
Beef	Beef	South	Medium 3	$2,789	$2,014	$360	$2,415	$1,796	$260	$1,045	$1,210	$20
Dairy	Flush	Central	Large 1	$9,211	$5,890	$2,080	$3,089	$2,328	$440	$1,045	$1,350	$20
Dairy	Flush	Central	Medium 1	$2,885	$2,070	$380	$2,654	$1,935	$320	$1,045	$1,210	$20
Dairy	Flush	Central	Medium 2	$3,824	$2,616	$640	$2,234	$1,691	$200	$1,045	$1,210	$20
Dairy	Flush	Central	Medium 3	$4,760	$3,160	$880	$3,170	$2,235	$460	$1,045	$1,210	$20
Dairy	Flush	Mid-Atlantic	Large 1	$9,754	$6,206	$2,220	$2,750	$2,131	$340	$1,045	$1,350	$20
Dairy	Flush	Mid-Atlantic	Medium 1	$2,981	$2,126	$400	$2,719	$1,973	$340	$1,045	$1,210	$20
Dairy	Flush	Mid-Atlantic	Medium 2	$3,986	$2,710	$680	$2,165	$1,651	$180	$1,045	$1,210	$20
Dairy	Flush	Mid-Atlantic	Medium 3	$4,991	$3,295	$940	$3,166	$2,233	$460	$1,045	$1,210	$20
Dairy	Flush	Midwest	Large 1	$10,543	$6,665	$2,440	$3,539	$2,590	$560	$1,045	$1,350	$20
Dairy	Flush	Midwest	Medium 1	$3,120	$2,206	$440	$2,854	$2,052	$360	$1,045	$1,210	$20
Dairy	Flush	Midwest	Medium 2	$4,221	$2,847	$740	$2,400	$1,787	$240	$1,045	$1,210	$20
Dairy	Flush	Midwest	Medium 3	$5,322	$3,487	$1,040	$3,497	$2,426	$540	$1,045	$1,210	$20
Dairy	Flush	Pacific	Large 1	$6,327	$4,212	$1,300	$2,246	$1,838	$200	$1,045	$1,350	$20
Dairy	Flush	Pacific	Medium 1	$2,380	$1,776	$240	$2,226	$1,686	$200	$1,045	$1,210	$20
Dairy	Flush	Pacific	Medium 2	$2,966	$2,117	$400	$1,907	$1,501	$120	$1,045	$1,210	$20
Dairy	Flush	Pacific	Medium 3	$3,551	$2,457	$560	$2,488	$1,839	$280	$1,045	$1,210	$20
Dairy	Flush	South	Large 1	$4,229	$2,991	$740	$1,576	$1,448	$20	$1,045	$1,350	$20
Dairy	Flush	South	Medium 1	$2,015	$1,563	$140	$1,915	$1,505	$120	$1,045	$1,210	$20
Dairy	Flush	South	Medium 2	$2,342	$1,754	$240	$1,653	$1,353	$40	$1,045	$1,210	$20
Dairy	Flush	South	Medium 3	$2,673	$1,946	$320	$1,980	$1,543	$140	$1,045	$1,210	$20
Dairy	Hose	Central	Large 1	$9,211	$5,890	$2,080	$3,089	$2,328	$440	$1,045	$1,350	$20
Dairy	Hose	Central	Medium 1	$2,885	$2,070	$380	$2,654	$1,935	$320	$1,045	$1,210	$20
Dairy	Hose	Central	Medium 2	$3,824	$2,616	$640	$2,234	$1,691	$200	$1,045	$1,210	$20

Table A-10a (Continued)

Animal	Farm Type	Region	Size Class	Category 1			Category 2			Category 3		
				Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring
Dairy	Hose	Central	Medium 3	$4,760	$3,160	$880	$3,170	$2,235	$460	$1,045	$1,210	$20
Dairy	Hose	Mid-Atlantic	Large 1	$9,754	$6,206	$2,220	$2,750	$2,131	$340	$1,045	$1,350	$20
Dairy	Hose	Mid-Atlantic	Medium 1	$2,981	$2,126	$400	$2,719	$1,973	$340	$1,045	$1,210	$20
Dairy	Hose	Mid-Atlantic	Medium 2	$3,986	$2,710	$680	$2,165	$1,651	$180	$1,045	$1,210	$20
Dairy	Hose	Mid-Atlantic	Medium 3	$4,991	$3,295	$940	$3,166	$2,233	$460	$1,045	$1,210	$20
Dairy	Hose	Midwest	Large 1	$10,543	$6,665	$2,440	$3,539	$2,590	$560	$1,045	$1,350	$20
Dairy	Hose	Midwest	Medium 1	$3,120	$2,206	$440	$2,854	$2,052	$360	$1,045	$1,210	$20
Dairy	Hose	Midwest	Medium 2	$4,221	$2,847	$740	$2,400	$1,787	$240	$1,045	$1,210	$20
Dairy	Hose	Midwest	Medium 3	$5,322	$3,487	$1,040	$3,497	$2,426	$540	$1,045	$1,210	$20
Dairy	Hose	Pacific	Large 1	$6,327	$4,212	$1,300	$2,246	$1,838	$200	$1,045	$1,350	$20
Dairy	Hose	Pacific	Medium 1	$2,380	$1,776	$240	$2,226	$1,686	$200	$1,045	$1,210	$20
Dairy	Hose	Pacific	Medium 2	$2,966	$2,117	$400	$1,907	$1,501	$120	$1,045	$1,210	$20
Dairy	Hose	Pacific	Medium 3	$3,551	$2,457	$560	$2,488	$1,839	$280	$1,045	$1,210	$20
Dairy	Hose	South	Large 1	$4,229	$2,991	$740	$1,576	$1,448	$20	$1,045	$1,350	$20
Dairy	Hose	South	Medium 1	$2,015	$1,563	$140	$1,915	$1,505	$120	$1,045	$1,210	$20
Dairy	Hose	South	Medium 2	$2,342	$1,754	$240	$1,653	$1,353	$40	$1,045	$1,210	$20
Dairy	Hose	South	Medium 3	$2,673	$1,946	$320	$1,980	$1,543	$140	$1,045	$1,210	$20
Heifers	Heifers	Central	Large 1	$3,208	$2,398	$460	$2,970	$2,259	$400	$1,045	$1,350	$20
Heifers	Heifers	Central	Medium 1	$1,988	$1,548	$140	$1,749	$1,409	$80	$1,045	$1,210	$20
Heifers	Heifers	Central	Medium 2	$2,238	$1,693	$200	$1,999	$1,554	$140	$1,045	$1,210	$20
Heifers	Heifers	Central	Medium 3	$2,515	$1,854	$280	$2,277	$1,716	$220	$1,045	$1,210	$20
Heifers	Heifers	Mid-Atlantic	Large 1	$3,308	$2,456	$500	$3,035	$2,297	$420	$1,045	$1,350	$20
Heifers	Heifers	Mid-Atlantic	Medium 1	$2,015	$1,563	$140	$1,741	$1,404	$80	$1,045	$1,210	$20
Heifers	Heifers	Mid-Atlantic	Medium 2	$2,280	$1,718	$220	$2,007	$1,559	$140	$1,045	$1,210	$20
Heifers	Heifers	Mid-Atlantic	Medium 3	$2,573	$1,888	$300	$2,303	$1,731	$220	$1,045	$1,210	$20
Heifers	Heifers	Midwest	Large 1	$3,308	$2,456	$500	$3,035	$2,297	$420	$1,045	$1,350	$20

Table A-10a (Continued)

Animal	Farm Type	Region	Size Class	Category 1			Category 2			Category 3		
				Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring
Heifers	Heifers	Midwest	Medium 1	$2,015	$1,563	$140	$1,741	$1,404	$80	$1,045	$1,210	$20
Heifers	Heifers	Midwest	Medium 2	$2,280	$1,718	$220	$2,007	$1,559	$140	$1,045	$1,210	$20
Heifers	Heifers	Midwest	Medium 3	$2,573	$1,888	$300	$2,303	$1,731	$220	$1,045	$1,210	$20
Heifers	Heifers	Pacific	Large 1	$2,681	$2,091	$320	$2,523	$1,999	$280	$1,045	$1,350	$20
Heifers	Heifers	Pacific	Medium 1	$1,849	$1,467	$100	$1,687	$1,373	$60	$1,045	$1,210	$20
Heifers	Heifers	Pacific	Medium 2	$2,019	$1,566	$140	$1,861	$1,474	$100	$1,045	$1,210	$20
Heifers	Heifers	Pacific	Medium 3	$2,207	$1,675	$200	$2,049	$1,583	$160	$1,045	$1,210	$20
Heifers	Heifers	South	Large 1	$2,215	$1,820	$200	$2,111	$1,759	$180	$1,045	$1,350	$20
Heifers	Heifers	South	Medium 1	$1,722	$1,393	$60	$1,618	$1,333	$40	$1,045	$1,210	$20
Heifers	Heifers	South	Medium 2	$1,822	$1,451	$100	$1,722	$1,393	$60	$1,045	$1,210	$20
Heifers	Heifers	South	Medium 3	$1,934	$1,516	$120	$1,830	$1,456	$100	$1,045	$1,210	$20
Veal	Flush	Central	Medium 1	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Central	Medium 2	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Central	Medium 3	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Mid-Atlantic	Medium 1	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Mid-Atlantic	Medium 2	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Mid-Atlantic	Medium 3	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Midwest	Medium 1	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Midwest	Medium 2	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Midwest	Medium 3	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Pacific	Medium 1	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Pacific	Medium 2	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Pacific	Medium 3	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	South	Medium 1	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	South	Medium 2	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	South	Medium 3	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20

Table A-10b

Costs for Nutrient Management Planning at Dairies, Beef Feedlots, Veal and Heifer Operations N-Based Scenario

Animal	Farm Type	Region	Size Class	Category 1			Category 2			Category 3		
				Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring
Beef	Beef	Central	Large 1	$2,727	$2,118	$340	$1,711	$1,526	$60	$1,045	$1,350	$20
Beef	Beef	Central	Large 2	$18,189	$11,114	$4,500	$6,481	$4,302	$1,340	$1,045	$1,350	$20
Beef	Beef	Central	Medium 1	$1,784	$1,429	$80	$1,599	$1,321	$40	$1,045	$1,210	$20
Beef	Beef	Central	Medium 2	$1,899	$1,496	$120	$1,718	$1,391	$60	$1,045	$1,210	$20
Beef	Beef	Central	Medium 3	$2,038	$1,577	$160	$1,853	$1,469	$100	$1,045	$1,210	$20
Beef	Beef	Mid-Atlantic	Large 1	$2,176	$1,797	$180	$1,591	$1,457	$40	$1,045	$1,350	$20
Beef	Beef	Mid-Atlantic	Large 2	$10,420	$6,593	$2,400	$3,690	$2,678	$600	$1,045	$1,350	$20
Beef	Beef	Mid-Atlantic	Medium 1	$1,672	$1,364	$60	$1,568	$1,303	$20	$1,045	$1,210	$20
Beef	Beef	Mid-Atlantic	Medium 2	$1,734	$1,400	$60	$1,630	$1,339	$40	$1,045	$1,210	$20
Beef	Beef	Mid-Atlantic	Medium 3	$1,807	$1,442	$80	$1,703	$1,382	$60	$1,045	$1,210	$20
Beef	Beef	Midwest	Large 1	$2,246	$1,838	$200	$1,599	$1,461	$40	$1,045	$1,350	$20
Beef	Beef	Midwest	Large 2	$11,409	$7,169	$2,660	$3,928	$2,817	$660	$1,045	$1,350	$20
Beef	Beef	Midwest	Medium 1	$1,687	$1,373	$60	$1,568	$1,303	$20	$1,045	$1,210	$20
Beef	Beef	Midwest	Medium 2	$1,757	$1,413	$80	$1,637	$1,344	$40	$1,045	$1,210	$20
Beef	Beef	Midwest	Medium 3	$1,838	$1,460	$100	$1,722	$1,393	$60	$1,045	$1,210	$20
Beef	Beef	Pacific	Large 1	$2,142	$1,777	$180	$1,641	$1,486	$40	$1,045	$1,350	$20
Beef	Beef	Pacific	Large 2	$9,973	$6,333	$2,280	$4,182	$2,964	$720	$1,045	$1,350	$20
Beef	Beef	Pacific	Medium 1	$1,664	$1,359	$60	$1,576	$1,308	$20	$1,045	$1,210	$20
Beef	Beef	Pacific	Medium 2	$1,726	$1,395	$60	$1,634	$1,342	$40	$1,045	$1,210	$20
Beef	Beef	Pacific	Medium 3	$1,795	$1,436	$80	$1,703	$1,382	$60	$1,045	$1,210	$20
Beef	Beef	South	Large 1	$2,515	$1,994	$280	$1,618	$1,473	$40	$1,045	$1,350	$20

Table A-10b (Continued)

Animal	Farm Type	Region	Size Class	Category 1			Category 2			Category 3		
				Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring
Beef	Beef	South	Large 2	$15,221	$9,386	$3,700	$4,848	$3,352	$900	$1,045	$1,350	$20
Beef	Beef	South	Medium 1	$1,741	$1,404	$80	$1,580	$1,310	$20	$1,045	$1,210	$20
Beef	Beef	South	Medium 2	$1,838	$1,460	$100	$1,676	$1,366	$60	$1,045	$1,210	$20
Beef	Beef	South	Medium 3	$1,949	$1,525	$120	$1,788	$1,431	$80	$1,045	$1,210	$20
Dairy	Flush	Central	Large 1	$3,543	$2,593	$560	$2,046	$1,721	$160	$1,045	$1,350	$20
Dairy	Flush	Central	Medium 1	$1,895	$1,494	$120	$1,818	$1,449	$100	$1,045	$1,210	$20
Dairy	Flush	Central	Medium 2	$2,138	$1,635	$180	$1,707	$1,384	$60	$1,045	$1,210	$20
Dairy	Flush	Central	Medium 3	$2,384	$1,778	$240	$1,953	$1,527	$120	$1,045	$1,210	$20
Dairy	Flush	Mid-Atlantic	Large 1	$3,193	$2,389	$460	$1,872	$1,620	$100	$1,045	$1,350	$20
Dairy	Flush	Mid-Atlantic	Medium 1	$1,834	$1,458	$100	$1,764	$1,418	$80	$1,045	$1,210	$20
Dairy	Flush	Mid-Atlantic	Medium 2	$2,034	$1,574	$140	$1,657	$1,355	$40	$1,045	$1,210	$20
Dairy	Flush	Mid-Atlantic	Medium 3	$2,238	$1,693	$200	$1,857	$1,471	$100	$1,045	$1,210	$20
Dairy	Flush	Midwest	Large 1	$3,351	$2,481	$500	$2,030	$1,712	$140	$1,045	$1,350	$20
Dairy	Flush	Midwest	Medium 1	$1,861	$1,474	$100	$1,791	$1,433	$80	$1,045	$1,210	$20
Dairy	Flush	Midwest	Medium 2	$2,080	$1,601	$160	$1,703	$1,382	$60	$1,045	$1,210	$20
Dairy	Flush	Midwest	Medium 3	$2,303	$1,731	$220	$1,922	$1,510	$120	$1,045	$1,210	$20
Dairy	Flush	Pacific	Large 1	$2,469	$1,968	$260	$1,730	$1,538	$60	$1,045	$1,350	$20
Dairy	Flush	Pacific	Medium 1	$1,707	$1,384	$60	$1,668	$1,362	$60	$1,045	$1,210	$20
Dairy	Flush	Pacific	Medium 2	$1,818	$1,449	$100	$1,607	$1,326	$40	$1,045	$1,210	$20
Dairy	Flush	Pacific	Medium 3	$1,934	$1,516	$120	$1,718	$1,391	$60	$1,045	$1,210	$20
Dairy	Flush	South	Large 1	$2,977	$2,263	$400	$1,649	$1,490	$40	$1,045	$1,350	$20
Dairy	Flush	South	Medium 1	$1,795	$1,436	$80	$1,726	$1,395	$60	$1,045	$1,210	$20
Dairy	Flush	South	Medium 2	$1,969	$1,536	$140	$1,587	$1,315	$20	$1,045	$1,210	$20
Dairy	Flush	South	Medium 3	$2,146	$1,639	$180	$1,764	$1,418	$80	$1,045	$1,210	$20
Dairy	Hose	Central	Large 1	$3,543	$2,593	$560	$2,046	$1,721	$160	$1,045	$1,350	$20
Dairy	Hose	Central	Medium 1	$1,895	$1,494	$120	$1,818	$1,449	$100	$1,045	$1,210	$20

Table A-10b (Continued)

Animal	Farm Type	Region	Size Class	Category 1			Category 2			Category 3		
				Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring
Dairy	Hose	Central	Medium 2	$2,138	$1,635	$180	$1,707	$1,384	$60	$1,045	$1,210	$20
Dairy	Hose	Central	Medium 3	$2,384	$1,778	$240	$1,953	$1,527	$120	$1,045	$1,210	$20
Dairy	Hose	Mid-Atlantic	Large 1	$3,193	$2,389	$460	$1,872	$1,620	$100	$1,045	$1,350	$20
Dairy	Hose	Mid-Atlantic	Medium 1	$1,834	$1,458	$100	$1,764	$1,418	$80	$1,045	$1,210	$20
Dairy	Hose	Mid-Atlantic	Medium 2	$2,034	$1,574	$140	$1,657	$1,355	$40	$1,045	$1,210	$20
Dairy	Hose	Mid-Atlantic	Medium 3	$2,238	$1,693	$200	$1,857	$1,471	$100	$1,045	$1,210	$20
Dairy	Hose	Midwest	Large 1	$3,351	$2,481	$500	$2,030	$1,712	$140	$1,045	$1,350	$20
Dairy	Hose	Midwest	Medium 1	$1,861	$1,474	$100	$1,791	$1,433	$80	$1,045	$1,210	$20
Dairy	Hose	Midwest	Medium 2	$2,080	$1,601	$160	$1,703	$1,382	$60	$1,045	$1,210	$20
Dairy	Hose	Midwest	Medium 3	$2,303	$1,731	$220	$1,922	$1,510	$120	$1,045	$1,210	$20
Dairy	Hose	Pacific	Large 1	$2,469	$1,968	$260	$1,730	$1,538	$60	$1,045	$1,350	$20
Dairy	Hose	Pacific	Medium 1	$1,707	$1,384	$60	$1,668	$1,362	$60	$1,045	$1,210	$20
Dairy	Hose	Pacific	Medium 2	$1,818	$1,449	$100	$1,607	$1,326	$40	$1,045	$1,210	$20
Dairy	Hose	Pacific	Medium 3	$1,934	$1,516	$120	$1,718	$1,391	$60	$1,045	$1,210	$20
Dairy	Hose	South	Large 1	$2,977	$2,263	$400	$1,649	$1,490	$40	$1,045	$1,350	$20
Dairy	Hose	South	Medium 1	$1,795	$1,436	$80	$1,726	$1,395	$60	$1,045	$1,210	$20
Dairy	Hose	South	Medium 2	$1,969	$1,536	$140	$1,587	$1,315	$20	$1,045	$1,210	$20
Dairy	Hose	South	Medium 3	$2,146	$1,639	$180	$1,764	$1,418	$80	$1,045	$1,210	$20
Heifers	Heifers	Central	Large 1	$1,830	$1,596	$100	$1,795	$1,576	$80	$1,045	$1,350	$20
Heifers	Heifers	Central	Medium 1	$1,622	$1,335	$40	$1,587	$1,315	$20	$1,045	$1,210	$20
Heifers	Heifers	Central	Medium 2	$1,664	$1,359	$60	$1,630	$1,339	$40	$1,045	$1,210	$20
Heifers	Heifers	Central	Medium 3	$1,711	$1,386	$60	$1,676	$1,366	$60	$1,045	$1,210	$20
Heifers	Heifers	Mid-Atlantic	Large 1	$1,780	$1,567	$80	$1,749	$1,549	$80	$1,045	$1,350	$20
Heifers	Heifers	Mid-Atlantic	Medium 1	$1,607	$1,326	$40	$1,576	$1,308	$20	$1,045	$1,210	$20
Heifers	Heifers	Mid-Atlantic	Medium 2	$1,641	$1,346	$40	$1,610	$1,328	$40	$1,045	$1,210	$20
Heifers	Heifers	Mid-Atlantic	Medium 3	$1,680	$1,368	$60	$1,653	$1,353	$40	$1,045	$1,210	$20

Table A-10b (Continued)

Animal	Farm Type	Region	Size Class	Category 1			Category 2			Category 3		
				Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring
Heifers	Heifers	Midwest	Large 1	$1,780	$1,567	$80	$1,749	$1,549	$80	$1,045	$1,350	$20
Heifers	Heifers	Midwest	Medium 1	$1,607	$1,326	$40	$1,576	$1,308	$20	$1,045	$1,210	$20
Heifers	Heifers	Midwest	Medium 2	$1,641	$1,346	$40	$1,610	$1,328	$40	$1,045	$1,210	$20
Heifers	Heifers	Midwest	Medium 3	$1,680	$1,368	$60	$1,653	$1,353	$40	$1,045	$1,210	$20
Heifers	Heifers	Pacific	Large 1	$1,691	$1,515	$60	$1,672	$1,504	$60	$1,045	$1,350	$20
Heifers	Heifers	Pacific	Medium 1	$1,584	$1,312	$20	$1,568	$1,303	$20	$1,045	$1,210	$20
Heifers	Heifers	Pacific	Medium 2	$1,607	$1,326	$40	$1,587	$1,315	$20	$1,045	$1,210	$20
Heifers	Heifers	Pacific	Medium 3	$1,630	$1,339	$40	$1,614	$1,330	$40	$1,045	$1,210	$20
Heifers	Heifers	South	Large 1	$1,780	$1,567	$80	$1,749	$1,549	$80	$1,045	$1,350	$20
Heifers	Heifers	South	Medium 1	$1,607	$1,326	$40	$1,576	$1,308	$20	$1,045	$1,210	$20
Heifers	Heifers	South	Medium 2	$1,641	$1,346	$40	$1,614	$1,330	$40	$1,045	$1,210	$20
Heifers	Heifers	South	Medium 3	$1,684	$1,371	$60	$1,653	$1,353	$40	$1,045	$1,210	$20
Veal	Flush	Central	Medium 1	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Central	Medium 2	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Central	Medium 3	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Mid-Atlantic	Medium 1	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Mid-Atlantic	Medium 2	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Mid-Atlantic	Medium 3	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Midwest	Medium 1	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Midwest	Medium 2	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Midwest	Medium 3	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Pacific	Medium 1	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Pacific	Medium 2	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	Pacific	Medium 3	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	South	Medium 1	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20
Veal	Flush	South	Medium 2	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20

Table A-10b (Continued)

Animal	Farm Type	Region	Size Class	Category 1			Category 2			Category 3		
				Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring	Fixed	Annual	3-yr Recurring
Veal	Flush	South	Medium 3	$1,930	$1,514	$120	$1,545	$1,290	$20	$1,045	$1,210	$20

Table A-10c

Costs for Buffers for Poultry and Swine Operations Under Option 1 (N-Basis)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Chicken	Broiler	Mid-Atlantic	Solid	Large 1	$1,486	$922	$462	$287	$0	$0
Chicken	Broiler	Mid-Atlantic	Solid	Large 2	$3,256	$2,020	$815	$505	$0	$0
Chicken	Broiler	Mid-Atlantic	Solid	Medium 1	$473	$293	$236	$146	$0	$0
Chicken	Broiler	Mid-Atlantic	Solid	Medium 2	$665	$413	$308	$191	$0	$0
Chicken	Broiler	Mid-Atlantic	Solid	Medium 3	$1,021	$633	$427	$265	$0	$0
Chicken	Broiler	South	Solid	Large 1	$1,909	$1,184	$465	$288	$0	$0
Chicken	Broiler	South	Solid	Large 2	$3,835	$2,378	$770	$478	$0	$0
Chicken	Broiler	South	Solid	Medium 1	$597	$370	$252	$157	$0	$0
Chicken	Broiler	South	Solid	Medium 2	$839	$520	$288	$179	$0	$0
Chicken	Broiler	South	Solid	Medium 3	$1,289	$800	$404	$251	$0	$0
Chicken	Layer: Dry	Midwest	Solid	Large 1	$5,830	$3,616	$232	$144	$0	$0
Chicken	Layer: Dry	Midwest	Solid	Large 2	$17,149	$10,637	$299	$186	$0	$0
Chicken	Layer: Dry	Midwest	Solid	Medium 1	$722	$448	$422	$261	$0	$0
Chicken	Layer: Dry	Midwest	Solid	Medium 2	$1,236	$767	$780	$484	$0	$0
Chicken	Layer: Dry	Midwest	Solid	Medium 3	$1,573	$976	$1,842	$1,142	$0	$0
Chicken	Layer: Dry	South	Solid	Large 1	$5,410	$3,355	$232	$144	$0	$0
Chicken	Layer: Dry	South	Solid	Large 2	$15,911	$9,869	$299	$186	$0	$0
Chicken	Layer: Dry	South	Solid	Medium 1	$670	$416	$422	$261	$0	$0
Chicken	Layer: Dry	South	Solid	Medium 2	$1,147	$711	$780	$484	$0	$0
Chicken	Layer: Dry	South	Solid	Medium 3	$1,459	$905	$1,842	$1,142	$0	$0

Table A-10c (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Chicken	Layer: Wet	South	Liquid	Large 1	$2,721	$1,687	$780	$484	$0	$0
Chicken	Layer: Wet	South	Liquid	Medium 3	$362	$225	$407	$252	$0	$0
Swine	Farrow to Finish	Central	Evapor	Large 1	$172	$107	$374	$232	$0	$0
Swine	Farrow to Finish	Central	Evapor	Large 2	$451	$279	$1,120	$694	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Large 1	$285	$177	$284	$176	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Large 2	$838	$520	$849	$527	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Medium 1	$95	$59	$152	$95	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Medium 2	$146	$91	$175	$109	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Medium 3	$203	$126	$244	$151	$0	$0
Swine	Farrow to Finish	Midwest	Liquid	Large 1	$163	$101	$369	$229	$0	$0
Swine	Farrow to Finish	Midwest	Liquid	Large 2	$386	$239	$1,344	$834	$0	$0
Swine	Farrow to Finish	Midwest	Liquid	Medium 1	$57	$35	$197	$122	$0	$0
Swine	Farrow to Finish	Midwest	Liquid	Medium 2	$87	$54	$257	$160	$0	$0
Swine	Farrow to Finish	Midwest	Liquid	Medium 3	$124	$77	$357	$222	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Pit	Large 1	$484	$300	$284	$176	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Pit	Large 2	$1,425	$884	$849	$527	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Pit	Medium 1	$162	$100	$158	$98	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Pit	Medium 2	$249	$154	$182	$113	$0	$0
Swine	Farrow to Finish	Mid-Atlantic	Pit	Medium 3	$345	$214	$252	$156	$0	$0
Swine	Farrow to Finish	Midwest	Pit	Large 1	$277	$172	$369	$229	$0	$0
Swine	Farrow to Finish	Midwest	Pit	Large 2	$656	$407	$1,344	$834	$0	$0
Swine	Farrow to Finish	Midwest	Pit	Medium 1	$96	$60	$197	$122	$0	$0
Swine	Farrow to Finish	Midwest	Pit	Medium 2	$147	$91	$257	$160	$0	$0
Swine	Farrow to Finish	Midwest	Pit	Medium 3	$210	$130	$357	$222	$0	$0

Table A-10c (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Swine	Grow Finish	Central	Evapor	Large 1	$172	$107	$374	$232	$0	$0
Swine	Grow Finish	Central	Evapor	Large 2	$451	$279	$1,120	$694	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Large 1	$285	$177	$284	$176	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Large 2	$838	$520	$849	$527	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 1	$95	$59	$152	$95	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 2	$146	$91	$175	$109	$0	$0
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 3	$203	$126	$244	$151	$0	$0
Swine	Grow Finish	Midwest	Liquid	Large 1	$163	$101	$369	$229	$0	$0
Swine	Grow Finish	Midwest	Liquid	Large 2	$386	$239	$1,344	$834	$0	$0
Swine	Grow Finish	Midwest	Liquid	Medium 1	$57	$35	$197	$122	$0	$0
Swine	Grow Finish	Midwest	Liquid	Medium 2	$87	$54	$257	$160	$0	$0
Swine	Grow Finish	Midwest	Liquid	Medium 3	$124	$77	$357	$222	$0	$0
Swine	Grow Finish	Mid-Atlantic	Pit	Large 1	$484	$300	$284	$176	$0	$0
Swine	Grow Finish	Mid-Atlantic	Pit	Large 2	$1,425	$884	$849	$527	$0	$0
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 1	$162	$100	$158	$98	$0	$0
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 2	$249	$154	$182	$113	$0	$0
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 3	$345	$214	$252	$156	$0	$0
Swine	Grow Finish	Midwest	Pit	Large 1	$277	$172	$369	$229	$0	$0
Swine	Grow Finish	Midwest	Pit	Large 2	$656	$407	$1,344	$834	$0	$0
Swine	Grow Finish	Midwest	Pit	Medium 1	$96	$60	$197	$122	$0	$0
Swine	Grow Finish	Midwest	Pit	Medium 2	$147	$91	$257	$160	$0	$0
Swine	Grow Finish	Midwest	Pit	Medium 3	$210	$130	$357	$222	$0	$0
Turkey	Slaughter	Mid-Atlantic	Solid	Large 1	$4,591	$2,847	$974	$604	$0	$0
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 1	$802	$497	$413	$256	$0	$0

Table A-10c (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2		Category 3	
					Capital	Annual	Capital	Annual	Capital	Annual
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 2	$1,248	$774	$504	$313	$0	$0
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 3	$1,713	$1,062	$685	$425	$0	$0
Turkey	Slaughter	Midwest	Solid	Large 1	$3,808	$2,362	$974	$604	$0	$0
Turkey	Slaughter	Midwest	Solid	Medium 1	$665	$412	$413	$256	$0	$0
Turkey	Slaughter	Midwest	Solid	Medium 2	$1,035	$642	$504	$313	$0	$0
Turkey	Slaughter	Midwest	Solid	Medium 3	$1,421	$881	$685	$425	$0	$0

Table A-10d

Costs for Buffers for Poultry and Swine Operations Under Option 2, P-based Scenario

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2	
					Capital	Annual	Capital	Annual
Chicken	Broiler	Mid-	Solid	Large 1	$3,349	$2,077	$751	$466
Chicken	Broiler	Mid-	Solid	Large 2	$5,874	$3,644	$1,279	$794
Chicken	Broiler	Mid-	Solid	Medium 1	$1,062	$659	$390	$242
Chicken	Broiler	Mid-	Solid	Medium 2	$1,490	$924	$472	$293
Chicken	Broiler	Mid-	Solid	Medium 3	$2,287	$1,419	$661	$410
Chicken	Broiler	South	Solid	Large 1	$6,629	$4,112	$499	$309
Chicken	Broiler	South	Solid	Large 2	$11,628	$7,212	$831	$516
Chicken	Broiler	South	Solid	Medium 1	$2,058	$1,276	$280	$174
Chicken	Broiler	South	Solid	Medium 2	$2,861	$1,774	$326	$203
Chicken	Broiler	South	Solid	Medium 3	$4,397	$2,727	$451	$280
Chicken	Layer: Dry	Midwest	Solid	Large 1	$22,712	$14,087	$232	$144
Chicken	Layer: Dry	Midwest	Solid	Large 2	$66,802	$41,435	$299	$186
Chicken	Layer: Dry	Midwest	Solid	Medium 1	$2,813	$1,745	$422	$261
Chicken	Layer: Dry	Midwest	Solid	Medium 2	$4,816	$2,987	$780	$484
Chicken	Layer: Dry	Midwest	Solid	Medium 3	$6,127	$3,800	$2,922	$1,813
Chicken	Layer: Dry	South	Solid	Large 1	$21,073	$13,071	$232	$144
Chicken	Layer: Dry	South	Solid	Large 2	$61,981	$38,444	$299	$186
Chicken	Layer: Dry	South	Solid	Medium 1	$2,610	$1,619	$422	$261
Chicken	Layer: Dry	South	Solid	Medium 2	$4,468	$2,771	$780	$484
Chicken	Layer: Dry	South	Solid	Medium 3	$5,685	$3,526	$2,922	$1,813

Table A-10d (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2	
					Capital	Annual	Capital	Annual
Chicken	Layer: Wet	South	Liquid	Large 1	$10,598	$6,573	$1,194	$741
Chicken	Layer: Wet	South	Liquid	Medium 3	$1,411	$875	$974	$604
Swine	Farrow to Finish	Central	Evapor	Large 1	$1,316	$816	$871	$540
Swine	Farrow to Finish	Central	Evapor	Large 2	$3,177	$1,971	$2,608	$1,617
Swine	Farrow to Finish	Mid-	Pit	Large 1	$2,616	$1,623	$630	$391
Swine	Farrow to Finish	Mid-	Liquid	Large 1	$2,616	$1,623	$630	$391
Swine	Farrow to Finish	Mid-	Pit	Large 2	$6,687	$4,148	$1,887	$1,170
Swine	Farrow to Finish	Mid-	Liquid	Large 2	$6,687	$4,148	$1,887	$1,170
Swine	Farrow to Finish	Mid-	Pit	Medium 1	$924	$573	$543	$337
Swine	Farrow to Finish	Mid-	Liquid	Medium 1	$924	$573	$543	$337
Swine	Farrow to Finish	Mid-	Pit	Medium 2	$1,408	$873	$467	$290
Swine	Farrow to Finish	Mid-	Liquid	Medium 2	$1,408	$873	$467	$290
Swine	Farrow to Finish	Mid-	Pit	Medium 3	$1,975	$1,225	$649	$403
Swine	Farrow to Finish	Mid-	Liquid	Medium 3	$1,975	$1,225	$649	$403
Swine	Farrow to Finish	Midwest	Pit	Large 1	$1,684	$1,045	$1,039	$645
Swine	Farrow to Finish	Midwest	Liquid	Large 1	$1,684	$1,045	$1,039	$645
Swine	Farrow to Finish	Midwest	Pit	Large 2	$3,431	$2,128	$3,218	$1,996
Swine	Farrow to Finish	Midwest	Liquid	Large 2	$3,431	$2,128	$3,218	$1,996
Swine	Farrow to Finish	Midwest	Pit	Medium 1	$581	$361	$524	$325
Swine	Farrow to Finish	Midwest	Liquid	Medium 1	$581	$361	$524	$325
Swine	Farrow to Finish	Midwest	Pit	Medium 2	$883	$548	$738	$458
Swine	Farrow to Finish	Midwest	Liquid	Medium 2	$883	$548	$738	$458
Swine	Farrow to Finish	Midwest	Pit	Medium 3	$1,269	$787	$1,026	$636

Table A-10d (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2	
					Capital	Annual	Capital	Annual
Swine	Farrow to Finish	Midwest	Liquid	Medium 3	$1,269	$787	$1,026	$636
Swine	Grow Finish	Central	Evapor	Large 1	$1,316	$816	$871	$540
Swine	Grow Finish	Central	Evapor	Large 2	$3,177	$1,971	$2,608	$1,617
Swine	Grow Finish	Mid-	Pit	Large 1	$2,616	$1,623	$630	$391
Swine	Grow Finish	Mid-	Liquid	Large 1	$2,616	$1,623	$630	$391
Swine	Grow Finish	Mid-	Pit	Large 2	$6,687	$4,148	$1,887	$1,170
Swine	Grow Finish	Mid-	Liquid	Large 2	$6,687	$4,148	$1,887	$1,170
Swine	Grow Finish	Mid-	Pit	Medium 1	$924	$573	$543	$337
Swine	Grow Finish	Mid-	Liquid	Medium 1	$924	$573	$543	$337
Swine	Grow Finish	Mid-	Pit	Medium 2	$1,408	$873	$467	$290
Swine	Grow Finish	Mid-	Liquid	Medium 2	$1,408	$873	$467	$290
Swine	Grow Finish	Mid-	Pit	Medium 3	$1,975	$1,225	$649	$403
Swine	Grow Finish	Mid-	Liquid	Medium 3	$1,975	$1,225	$649	$403
Swine	Grow Finish	Midwest	Pit	Large 1	$1,684	$1,045	$1,039	$645
Swine	Grow Finish	Midwest	Liquid	Large 1	$1,684	$1,045	$1,039	$645
Swine	Grow Finish	Midwest	Pit	Large 2	$3,431	$2,128	$3,218	$1,996
Swine	Grow Finish	Midwest	Liquid	Large 2	$3,431	$2,128	$3,218	$1,996
Swine	Grow Finish	Midwest	Pit	Medium 1	$581	$361	$524	$325
Swine	Grow Finish	Midwest	Liquid	Medium 1	$581	$361	$524	$325
Swine	Grow Finish	Midwest	Pit	Medium 2	$883	$548	$738	$458
Swine	Grow Finish	Midwest	Liquid	Medium 2	$883	$548	$738	$458
Swine	Grow Finish	Midwest	Pit	Medium 3	$1,269	$787	$1,026	$636
Swine	Grow Finish	Midwest	Liquid	Medium 3	$1,269	$787	$1,026	$636

Table A-10d (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1		Category 2	
					Capital	Annual	Capital	Annual
Turkey	Slaughter	Mid-	Solid	Large 1	$26,116	$16,199	$2,011	$1,248
Turkey	Slaughter	Mid-	Solid	Medium 1	$4,560	$2,829	$758	$470
Turkey	Slaughter	Mid-	Solid	Medium 2	$7,101	$4,405	$766	$475
Turkey	Slaughter	Mid-	Solid	Medium 3	$9,744	$6,044	$1,254	$778
Turkey	Slaughter	Midwest	Solid	Large 1	$33,385	$20,708	$2,011	$1,248
Turkey	Slaughter	Midwest	Solid	Medium 1	$5,830	$3,616	$758	$470
Turkey	Slaughter	Midwest	Solid	Medium 2	$9,078	$5,631	$766	$475
Turkey	Slaughter	Midwest	Solid	Medium 3	$12,457	$7,726	$1,254	$778

Table A-10e

Costs for Buffers for Poultry and Swine Operations Under Option 2, N-based Scenario

Animal	Farm Type	Region	Manure type	Size	Category 1		Category 2	
					Capital	Annual	Capital	Annual
Chicken	Broiler	Mid-Atlantic	Solid	Large 1	$1,486	$922	$462	$287
Chicken	Broiler	Mid-Atlantic	Solid	Large 2	$3,256	$2,020	$815	$505
Chicken	Broiler	Mid-Atlantic	Solid	Medium 1	$473	$293	$236	$146
Chicken	Broiler	Mid-Atlantic	Solid	Medium 2	$665	$413	$308	$191
Chicken	Broiler	Mid-Atlantic	Solid	Medium 3	$1,021	$633	$427	$265
Chicken	Broiler	South	Solid	Large 1	$1,909	$1,184	$465	$289
Chicken	Broiler	South	Solid	Large 2	$3,835	$2,379	$768	$476
Chicken	Broiler	South	Solid	Medium 1	$597	$370	$251	$156
Chicken	Broiler	South	Solid	Medium 2	$839	$520	$287	$178
Chicken	Broiler	South	Solid	Medium 3	$1,289	$800	$402	$249
Chicken	Layer: Dry	Midwest	Solid	Large 1	$5,830	$3,616	$232	$144
Chicken	Layer: Dry	Midwest	Solid	Large 2	$17,149	$10,637	$299	$186
Chicken	Layer: Dry	Midwest	Solid	Medium 1	$722	$448	$422	$261
Chicken	Layer: Dry	Midwest	Solid	Medium 2	$1,236	$767	$780	$484
Chicken	Layer: Dry	Midwest	Solid	Medium 3	$1,573	$976	$1,842	$1,142
Chicken	Layer: Dry	South	Solid	Large 1	$5,410	$3,355	$232	$144
Chicken	Layer: Dry	South	Solid	Large 2	####	$9,869	$299	$186
Chicken	Layer: Dry	South	Solid	Medium 1	$670	$416	$422	$261
Chicken	Layer: Dry	South	Solid	Medium 2	$1,147	$711	$780	$484
Chicken	Layer: Dry	South	Solid	Medium 3	$1,459	$905	$1,842	$1,142
Chicken	Layer: Wet	South	Liquid	Large 1	$2,721	$1,687	$780	$484

Table A-10e (Continued)

Animal	Farm Type	Region	Manure type	Size	Category 1		Category 2	
					Capital	Annual	Capital	Annual
Chicken	Layer: Wet	South	Liquid	Medium 3	$362	$225	$407	$252
Swine	Farrow to Finish	Central	Evapor	Large 1	$172	$107	$374	$232
Swine	Farrow to Finish	Central	Evapor	Large 2	$450	$279	$1,119	$694
Swine	Farrow to Finish	Mid-Atlantic	Pit	Large 1	$484	$300	$284	$176
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Large 1	$285	$177	$284	$176
Swine	Farrow to Finish	Mid-Atlantic	Pit	Large 2	$1,425	$884	$849	$527
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Large 2	$838	$520	$849	$527
Swine	Farrow to Finish	Mid-Atlantic	Pit	Medium 1	$162	$100	$161	$100
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Medium 1	$95	$59	$155	$96
Swine	Farrow to Finish	Mid-Atlantic	Pit	Medium 2	$249	$154	$184	$114
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Medium 2	$146	$91	$178	$110
Swine	Farrow to Finish	Mid-Atlantic	Pit	Medium 3	$346	$214	$256	$159
Swine	Farrow to Finish	Mid-Atlantic	Liquid	Medium 3	$203	$126	$247	$153
Swine	Farrow to Finish	Midwest	Pit	Large 1	$277	$172	$369	$229
Swine	Farrow to Finish	Midwest	Liquid	Large 1	$163	$101	$369	$229
Swine	Farrow to Finish	Midwest	Pit	Large 2	$656	$407	$1,344	$834
Swine	Farrow to Finish	Midwest	Liquid	Large 2	$386	$239	$1,344	$834
Swine	Farrow to Finish	Midwest	Pit	Medium 1	$96	$60	$198	$123
Swine	Farrow to Finish	Midwest	Liquid	Medium 1	$57	$35	$198	$123
Swine	Farrow to Finish	Midwest	Pit	Medium 2	$147	$91	$257	$160
Swine	Farrow to Finish	Midwest	Liquid	Medium 2	$87	$54	$257	$160
Swine	Farrow to Finish	Midwest	Pit	Medium 3	$210	$130	$358	$222
Swine	Farrow to Finish	Midwest	Liquid	Medium 3	$124	$77	$358	$222
Swine	Grow Finish	Central	Evapor	Large 1	$172	$107	$374	$232
Swine	Grow Finish	Central	Evapor	Large 2	$450	$279	$1,119	$694

Table A-10e (Continued)

Animal	Farm Type	Region	Manure type	Size	Category 1		Category 2	
					Capital	Annual	Capital	Annual
Swine	Grow Finish	Mid-Atlantic	Pit	Large 1	$484	$300	$284	$176
Swine	Grow Finish	Mid-Atlantic	Liquid	Large 1	$285	$177	$284	$176
Swine	Grow Finish	Mid-Atlantic	Pit	Large 2	$1,425	$884	$849	$527
Swine	Grow Finish	Mid-Atlantic	Liquid	Large 2	$838	$520	$849	$527
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 1	$162	$100	$161	$100
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 1	$95	$59	$155	$96
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 2	$249	$154	$184	$114
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 2	$146	$91	$178	$110
Swine	Grow Finish	Mid-Atlantic	Pit	Medium 3	$346	$214	$256	$159
Swine	Grow Finish	Mid-Atlantic	Liquid	Medium 3	$203	$126	$247	$153
Swine	Grow Finish	Midwest	Pit	Large 1	$277	$172	$369	$229
Swine	Grow Finish	Midwest	Liquid	Large 1	$163	$101	$369	$229
Swine	Grow Finish	Midwest	Pit	Large 2	$656	$407	$1,344	$834
Swine	Grow Finish	Midwest	Liquid	Large 2	$386	$239	$1,344	$834
Swine	Grow Finish	Midwest	Pit	Medium 1	$96	$60	$198	$123
Swine	Grow Finish	Midwest	Liquid	Medium 1	$57	$35	$198	$123
Swine	Grow Finish	Midwest	Pit	Medium 2	$147	$91	$257	$160
Swine	Grow Finish	Midwest	Liquid	Medium 2	$87	$54	$257	$160
Swine	Grow Finish	Midwest	Pit	Medium 3	$210	$130	$358	$222
Swine	Grow Finish	Midwest	Liquid	Medium 3	$124	$77	$358	$222
Turkey	Slaughter	Mid-Atlantic	Solid	Large 1	$4,591	$2,847	$974	$604
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 1	$802	$497	$413	$256
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 2	$1,248	$774	$504	$313
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 3	$1,713	$1,062	$685	$425
Turkey	Slaughter	Midwest	Solid	Large 1	$3,808	$2,362	$974	$604

Table A-10e (Continued)

Animal	Farm Type	Region	Manure type	Size	Category 1		Category 2	
					Capital	Annual	Capital	Annual
Turkey	Slaughter	Midwest	Solid	Medium 1	$665	$412	$413	$256
Turkey	Slaughter	Midwest	Solid	Medium 2	$1,035	$642	$504	$313
Turkey	Slaughter	Midwest	Solid	Medium 3	$1,421	$881	$685	$425

Table A-10f

Costs for Buffers for Poultry and Swine Operations Under Option 5, P-based Scenario

Animal	Farm Type	Region	Manure type	Size	Cat 1		Cat 2	
					Capital	Annual	Capital	Annual
Chicken	Broiler	Mid-	Solid	Large 1	$3,349	$2,077	$751	$466
Chicken	Broiler	Mid-	Solid	Large 2	$5,874	$3,644	$1,279	$794
Chicken	Broiler	Mid-	Solid	Medium 1	$1,062	$659	$390	$242
Chicken	Broiler	Mid-	Solid	Medium 2	$1,490	$924	$472	$293
Chicken	Broiler	Mid-	Solid	Medium 3	$2,287	$1,419	$661	$410
Chicken	Broiler	South	Solid	Large 1	$6,629	$4,112	$499	$309
Chicken	Broiler	South	Solid	Large 2	$11,628	$7,212	$831	$516
Chicken	Broiler	South	Solid	Medium 1	$2,058	$1,276	$280	$174
Chicken	Broiler	South	Solid	Medium 2	$2,861	$1,774	$326	$203
Chicken	Broiler	South	Solid	Medium 3	$4,397	$2,727	$451	$280
Chicken	Layer:	Midwest	Solid	Large 1	$22,712	$14,087	$232	$144
Chicken	Layer:	Midwest	Solid	Large 2	$66,802	$41,435	$299	$186
Chicken	Layer:	Midwest	Solid	Medium 1	$2,813	$1,745	$422	$261
Chicken	Layer:	Midwest	Solid	Medium 2	$4,816	$2,987	$780	$484
Chicken	Layer:	Midwest	Solid	Medium 3	$6,127	$3,800	$2,922	$1,813
Chicken	Layer:	South	Solid	Large 1	$21,073	$13,071	$232	$144
Chicken	Layer:	South	Solid	Large 2	$61,981	$38,444	$299	$186
Chicken	Layer:	South	Solid	Medium 1	$2,610	$1,619	$422	$261
Chicken	Layer:	South	Solid	Medium 2	$4,468	$2,771	$780	$484
Chicken	Layer:	South	Solid	Medium 3	$5,685	$3,526	$2,922	$1,813

Table A-10f (Continued)

Animal	Farm Type	Region	Manure type	Size	Cat 1		Cat 2	
					Capital	Annual	Capital	Annual
Chicken	Layer:	South	Liquid	Large 1	$10,598	$6,573	$1,194	$741
Chicken	Layer:	South	Liquid	Medium 3	$1,411	$875	$974	$604
Swine	Farrow to	Central	Evapor	Large 1	$1,316	$816	$871	$540
Swine	Farrow to	Central	Evapor	Large 2	$3,177	$1,971	$2,608	$1,617
Swine	Farrow to	Mid-	Pit	Large 1	$2,616	$1,623	$630	$391
Swine	Farrow to	Mid-	Liquid	Large 1	$2,616	$1,623	$630	$391
Swine	Farrow to	Mid-	Pit	Large 2	$6,687	$4,148	$1,887	$1,170
Swine	Farrow to	Mid-	Liquid	Large 2	$6,687	$4,148	$1,887	$1,170
Swine	Farrow to	Mid-	Pit	Medium 1	$924	$573	$543	$337
Swine	Farrow to	Mid-	Liquid	Medium 1	$924	$573	$543	$337
Swine	Farrow to	Mid-	Pit	Medium 2	$1,408	$873	$467	$290
Swine	Farrow to	Mid-	Liquid	Medium 2	$1,408	$873	$467	$290
Swine	Farrow to	Mid-	Pit	Medium 3	$1,975	$1,225	$649	$403
Swine	Farrow to	Mid-	Liquid	Medium 3	$1,975	$1,225	$649	$403
Swine	Farrow to	Midwest	Pit	Large 1	$1,684	$1,045	$1,039	$645
Swine	Farrow to	Midwest	Liquid	Large 1	$1,684	$1,045	$1,039	$645
Swine	Farrow to	Midwest	Pit	Large 2	$3,431	$2,128	$3,218	$1,996
Swine	Farrow to	Midwest	Liquid	Large 2	$3,431	$2,128	$3,218	$1,996
Swine	Farrow to	Midwest	Pit	Medium 1	$581	$361	$524	$325
Swine	Farrow to	Midwest	Liquid	Medium 1	$581	$361	$524	$325
Swine	Farrow to	Midwest	Pit	Medium 2	$883	$548	$738	$458
Swine	Farrow to	Midwest	Liquid	Medium 2	$883	$548	$738	$458
Swine	Farrow to	Midwest	Pit	Medium 3	$1,269	$787	$1,026	$636
Swine	Farrow to	Midwest	Liquid	Medium 3	$1,269	$787	$1,026	$636
Swine	Grow	Central	Evapor	Large 1	$1,316	$816	$871	$540

Table A-10f (Continued)

Animal	Farm Type	Region	Manure type	Size	Cat 1		Cat 2	
					Capital	Annual	Capital	Annual
Swine	Grow	Central	Evapor	Large 2	$3,177	$1,971	$2,608	$1,617
Swine	Grow	Mid-	Pit	Large 1	$2,616	$1,623	$630	$391
Swine	Grow	Mid-	Liquid	Large 1	$2,616	$1,623	$630	$391
Swine	Grow	Mid-	Pit	Large 2	$6,687	$4,148	$1,887	$1,170
Swine	Grow	Mid-	Liquid	Large 2	$6,687	$4,148	$1,887	$1,170
Swine	Grow	Mid-	Pit	Medium 1	$924	$573	$543	$337
Swine	Grow	Mid-	Liquid	Medium 1	$924	$573	$543	$337
Swine	Grow	Mid-	Pit	Medium 2	$1,408	$873	$467	$290
Swine	Grow	Mid-	Liquid	Medium 2	$1,408	$873	$467	$290
Swine	Grow	Mid-	Pit	Medium 3	$1,975	$1,225	$649	$403
Swine	Grow	Mid-	Liquid	Medium 3	$1,975	$1,225	$649	$403
Swine	Grow	Midwest	Pit	Large 1	$1,684	$1,045	$1,039	$645
Swine	Grow	Midwest	Liquid	Large 1	$1,684	$1,045	$1,039	$645
Swine	Grow	Midwest	Pit	Large 2	$3,431	$2,128	$3,218	$1,996
Swine	Grow	Midwest	Liquid	Large 2	$3,431	$2,128	$3,218	$1,996
Swine	Grow	Midwest	Pit	Medium 1	$581	$361	$524	$325
Swine	Grow	Midwest	Liquid	Medium 1	$581	$361	$524	$325
Swine	Grow	Midwest	Pit	Medium 2	$883	$548	$738	$458
Swine	Grow	Midwest	Liquid	Medium 2	$883	$548	$738	$458
Swine	Grow	Midwest	Pit	Medium 3	$1,269	$787	$1,026	$636
Swine	Grow	Midwest	Liquid	Medium 3	$1,269	$787	$1,026	$636
Turkey	Slaughter	Mid-	Solid	Large 1	$26,116	$16,199	$2,011	$1,248
Turkey	Slaughter	Mid-	Solid	Medium 1	$4,560	$2,829	$758	$470
Turkey	Slaughter	Mid-	Solid	Medium 2	$7,101	$4,405	$766	$475
Turkey	Slaughter	Mid-	Solid	Medium 3	$9,744	$6,044	$1,254	$778

Table A-10f (Continued)

Animal	Farm Type	Region	Manure type	Size	Cat 1		Cat 2	
					Capital	Annual	Capital	Annual
Turkey	Slaughter	Midwest	Solid	Large 1	$36,006	$22,333	$2,011	$1,248
Turkey	Slaughter	Midwest	Solid	Medium 1	$5,830	$3,616	$758	$470
Turkey	Slaughter	Midwest	Solid	Medium 2	$9,078	$5,631	$766	$475
Turkey	Slaughter	Midwest	Solid	Medium 3	$12,457	$7,726	$1,254	$778

Table A-10g

Costs for Buffers for Poultry and Swine Operations Under Option 5, N-based Scenario

Animal	Operation type	Region	Manure Type	Size	Category 1		Category 2	
					Capital	Annual	Capital	Annual
Chicken	Broiler	SO	Solid	Large2	$3,835	$2,379	$768	$476
Chicken	Broiler	SO	Solid	Large1	$1,909	$1,184	$465	$289
Chicken	Broiler	SO	Solid	Medium3	$1,289	$800	$402	$249
Chicken	Broiler	SO	Solid	Medium2	$839	$520	$287	$178
Chicken	Broiler	SO	Solid	Medium1	$597	$370	$251	$156
Chicken	Broiler	MA	Solid	Large2	$3,256	$2,020	$815	$505
Chicken	Broiler	MA	Solid	Large1	$1,486	$922	$462	$287
Chicken	Broiler	MA	Solid	Medium3	$1,021	$633	$427	$265
Chicken	Broiler	MA	Solid	Medium2	$665	$413	$308	$191
Chicken	Broiler	MA	Solid	Medium1	$473	$293	$236	$146
Swine	Farrow to Finish	CE	Evapor	Large2	$1,531	$950	$1,160	$719
Swine	Farrow to Finish	CE	Evapor	Large1	$584	$363	$387	$240
Swine	Farrow to Finish	MA	Pit	Large2	$1,425	$884	$849	$527
Swine	Farrow to Finish	MA	Pit	Large1	$484	$300	$284	$176
Swine	Farrow to Finish	MA	Pit	Medium3	$346	$214	$256	$159
Swine	Farrow to Finish	MA	Pit	Medium2	$249	$154	$184	$114
Swine	Farrow to Finish	MA	Pit	Medium1	$162	$100	$161	$100
Swine	Farrow to Finish	MA	Liquid	Large2	$2,849	$1,767	$849	$527
Swine	Farrow to Finish	MA	Liquid	Large1	$969	$601	$284	$176
Swine	Farrow to Finish	MA	Liquid	Medium3	$691	$429	$256	$159
Swine	Farrow to Finish	MA	Liquid	Medium2	$498	$309	$184	$114

Table A-10g (Continued)

Animal	Operation type	Region	Manure Type	Size	Category 1		Category 2	
					Capital	Annual	Capital	Annual
Swine	Farrow to Finish	MA	Liquid	Medium1	$323	$201	$161	$100
Swine	Farrow to Finish	MW	Pit	Large2	$656	$407	$1,344	$834
Swine	Farrow to Finish	MW	Pit	Large1	$277	$172	$369	$229
Swine	Farrow to Finish	MW	Pit	Medium3	$210	$130	$358	$222
Swine	Farrow to Finish	MW	Pit	Medium2	$147	$91	$257	$160
Swine	Farrow to Finish	MW	Pit	Medium1	$96	$60	$198	$123
Swine	Farrow to Finish	MW	Liquid	Large2	$1,312	$814	$1,393	$864
Swine	Farrow to Finish	MW	Liquid	Large1	$554	$344	$382	$237
Swine	Farrow to Finish	MW	Liquid	Medium3	$420	$261	$371	$230
Swine	Farrow to Finish	MW	Liquid	Medium2	$295	$183	$267	$165
Swine	Farrow to Finish	MW	Liquid	Medium1	$193	$120	$198	$123
Swine	Grow Finish	CE	Evapor	Large2	$1,531	$950	$1,160	$719
Swine	Grow Finish	CE	Evapor	Large1	$584	$363	$387	$240
Swine	Grow Finish	MA	Pit	Large2	$1,425	$884	$849	$527
Swine	Grow Finish	MA	Pit	Large1	$484	$300	$284	$176
Swine	Grow Finish	MA	Pit	Medium3	$346	$214	$256	$159
Swine	Grow Finish	MA	Pit	Medium2	$249	$154	$184	$114
Swine	Grow Finish	MA	Pit	Medium1	$162	$100	$161	$100
Swine	Grow Finish	MA	Liquid	Large2	$2,849	$1,767	$849	$527
Swine	Grow Finish	MA	Liquid	Large1	$969	$601	$284	$176
Swine	Grow Finish	MA	Liquid	Medium3	$691	$429	$256	$159
Swine	Grow Finish	MA	Liquid	Medium2	$498	$309	$184	$114
Swine	Grow Finish	MA	Liquid	Medium1	$323	$201	$161	$100
Swine	Grow Finish	MW	Pit	Large2	$656	$407	$1,344	$834

Table A-10g (Continued)

Animal	Operation type	Region	Manure Type	Size	Category 1		Category 2	
					Capital	Annual	Capital	Annual
Swine	Grow Finish	MW	Pit	Large1	$277	$172	$369	$229
Swine	Grow Finish	MW	Pit	Medium3	$210	$130	$358	$222
Swine	Grow Finish	MW	Pit	Medium2	$147	$91	$257	$160
Swine	Grow Finish	MW	Pit	Medium1	$96	$60	$198	$123
Swine	Grow Finish	MW	Liquid	Large2	$1,312	$814	$1,393	$864
Swine	Grow Finish	MW	Liquid	Large1	$554	$344	$382	$237
Swine	Grow Finish	MW	Liquid	Medium3	$420	$261	$371	$230
Swine	Grow Finish	MW	Liquid	Medium2	$295	$183	$267	$165
Swine	Grow Finish	MW	Liquid	Medium1	$193	$120	$198	$123
Chicken	Layer -Dry	MW	Solid	Medium1	$722	$448	$422	$261
Chicken	Layer -Dry	MW	Solid	Medium2	$1,236	$767	$780	$484
Chicken	Layer -Dry	MW	Solid	Medium3	$1,573	$976	$1,842	$1,142
Chicken	Layer -Dry	MW	Solid	Large1	$5,830	$3,616	$232	$144
Chicken	Layer -Dry	MW	Solid	Large2	$17,149	$10,637	$299	$186
Chicken	Layer -Dry	SO	Solid	Medium1	$670	$416	$422	$261
Chicken	Layer -Dry	SO	Solid	Medium2	$1,147	$711	$780	$484
Chicken	Layer -Dry	SO	Solid	Medium3	$1,459	$905	$1,842	$1,142
Chicken	Layer -Dry	SO	Solid	Large1	$5,410	$3,355	$232	$144
Chicken	Layer -Dry	SO	Solid	Large2	$15,911	$9,869	$299	$186
Chicken	Layer - Wet	SO	Liquid	Medium3	$1,232	$764	$422	$261
Chicken	Layer -Wet	SO	Liquid	Large1	$9,250	$5,737	$780	$484
Turkey	Slaughter	MA	Solid	Medium1	$802	$497	$413	$256
Turkey	Slaughter	MA	Solid	Medium2	$1,248	$774	$504	$313
Turkey	Slaughter	MA	Solid	Medium3	$1,713	$1,062	$685	$425

Table A-10g (Continued)

Animal	Operation type	Region	Manure Type	Size	Category 1		Category 2	
					Capital	Annual	Capital	Annual
Turkey	Slaughter	MA	Solid	Large1	$4,591	$2,847	$974	$604
Turkey	Slaughter	MW	Solid	Medium1	$665	$412	$413	$256
Turkey	Slaughter	MW	Solid	Medium2	$1,035	$642	$504	$313
Turkey	Slaughter	MW	Solid	Medium3	$1,421	$881	$685	$425
Turkey	Slaughter	MW	Solid	Large1	$3,808	$2,362	$974	$604

Table A-11

Costs for Supplemental Commercial Nitrogen at Dairies, Beef Feedlots, Veal and Heifer Operations P-Based Scenario

Animal	Farm Type	Region	Size Class	Category 1	Category 2
				Annual Costs	Annual Costs
Beef	Beef	Central	Large 1	$28,320	$12,131
Beef	Beef	Central	Large 2	$398,808	$166,261
Beef	Beef	Central	Medium 1	$5,698	$3,446
Beef	Beef	Central	Medium 2	$8,501	$7,450
Beef	Beef	Central	Medium 3	$11,796	$12,158
Beef	Beef	Mid-Atlantic	Large 1	$35,337	$12,382
Beef	Beef	Mid-Atlantic	Large 2	$497,622	$168,227
Beef	Beef	Mid-Atlantic	Medium 1	$7,110	$3,843
Beef	Beef	Mid-Atlantic	Medium 2	$10,607	$8,839
Beef	Beef	Mid-Atlantic	Medium 3	$14,719	$14,714
Beef	Beef	Midwest	Large 1	$36,697	$12,859
Beef	Beef	Midwest	Large 2	$516,770	$174,700
Beef	Beef	Midwest	Medium 1	$7,383	$3,991
Beef	Beef	Midwest	Medium 2	$11,015	$9,179
Beef	Beef	Midwest	Medium 3	$15,285	$15,280
Beef	Beef	Pacific	Large 1	$40,991	$18,523
Beef	Beef	Pacific	Large 2	$577,240	$254,388
Beef	Beef	Pacific	Medium 1	$8,247	$5,147
Beef	Beef	Pacific	Medium 2	$12,304	$10,943
Beef	Beef	Pacific	Medium 3	$17,074	$17,757
Beef	Beef	South	Large 1	$10,322	$3,617
Beef	Beef	South	Large 2	$145,356	$49,139
Beef	Beef	South	Medium 1	$2,077	$1,123
Beef	Beef	South	Medium 2	$3,098	$2,582
Beef	Beef	South	Medium 3	$4,299	$4,298
Dairy	Flush	Central	Large 1	$25,361	$7,300
Dairy	Flush	Central	Medium 1	$4,434	$5,248
Dairy	Flush	Central	Medium 2	$7,537	$3,254
Dairy	Flush	Central	Medium 3	$10,641	$7,673

Table A-11 (Continued)

Animal	Farm Type	Region	Size Class	Category 1 Annual Costs	Category 2 Annual Costs
Dairy	Flush	Mid-Atlantic	Large 1	$33,456	$7,016
Dairy	Flush	Mid-Atlantic	Medium 1	$5,849	$6,826
Dairy	Flush	Mid-Atlantic	Medium 2	$9,943	$3,614
Dairy	Flush	Mid-Atlantic	Medium 3	$14,037	$9,443
Dairy	Flush	Midwest	Large 1	$36,664	$11,599
Dairy	Flush	Midwest	Medium 1	$6,410	$7,627
Dairy	Flush	Midwest	Medium 2	$10,897	$4,976
Dairy	Flush	Midwest	Medium 3	$15,383	$11,365
Dairy	Flush	Pacific	Large 1	$35,061	$7,352
Dairy	Flush	Pacific	Medium 1	$6,130	$7,153
Dairy	Flush	Pacific	Medium 2	$10,420	$3,788
Dairy	Flush	Pacific	Medium 3	$14,711	$9,896
Dairy	Flush	South	Large 1	$6,160	$100
Dairy	Flush	South	Medium 1	$1,077	$1,212
Dairy	Flush	South	Medium 2	$1,831	$356
Dairy	Flush	South	Medium 3	$2,585	$1,428
Dairy	Hose	Central	Large 1	$25,361	$7,300
Dairy	Hose	Central	Medium 1	$4,434	$5,248
Dairy	Hose	Central	Medium 2	$7,537	$3,254
Dairy	Hose	Central	Medium 3	$10,641	$7,673
Dairy	Hose	Mid-Atlantic	Large 1	$33,456	$7,016
Dairy	Hose	Mid-Atlantic	Medium 1	$5,849	$6,826
Dairy	Hose	Mid-Atlantic	Medium 2	$9,943	$3,614
Dairy	Hose	Mid-Atlantic	Medium 3	$14,037	$9,443
Dairy	Hose	Midwest	Large 1	$36,664	$11,599
Dairy	Hose	Midwest	Medium 1	$6,410	$7,627
Dairy	Hose	Midwest	Medium 2	$10,897	$4,976
Dairy	Hose	Midwest	Medium 3	$15,383	$11,365
Dairy	Hose	Pacific	Large 1	$35,061	$7,352
Dairy	Hose	Pacific	Medium 1	$6,130	$7,153
Dairy	Hose	Pacific	Medium 2	$10,420	$3,788
Dairy	Hose	Pacific	Medium 3	$14,711	$9,896
Dairy	Hose	South	Large 1	$6,160	$100

Table A-11 (Continued)

Animal	Farm Type	Region	Size Class	Category 1 Annual Costs	Category 2 Annual Costs
Dairy	Hose	South	Medium 1	$1,077	$1,212
Dairy	Hose	South	Medium 2	$1,831	$356
Dairy	Hose	South	Medium 3	$2,585	$1,428
Heifers	Heifers	Central	Large 1	$6,243	$7,639
Heifers	Heifers	Central	Medium 1	$1,665	$1,099
Heifers	Heifers	Central	Medium 2	$2,601	$2,437
Heifers	Heifers	Central	Medium 3	$3,642	$3,923
Heifers	Heifers	Mid-Atlantic	Large 1	$7,881	$9,518
Heifers	Heifers	Mid-Atlantic	Medium 1	$2,102	$1,261
Heifers	Heifers	Mid-Atlantic	Medium 2	$3,284	$2,950
Heifers	Heifers	Mid-Atlantic	Medium 3	$4,597	$4,827
Heifers	Heifers	Midwest	Large 1	$7,881	$9,518
Heifers	Heifers	Midwest	Medium 1	$2,102	$1,261
Heifers	Heifers	Midwest	Medium 2	$3,284	$2,950
Heifers	Heifers	Midwest	Medium 3	$4,597	$4,827
Heifers	Heifers	Pacific	Large 1	$9,081	$11,156
Heifers	Heifers	Pacific	Medium 1	$2,422	$1,642
Heifers	Heifers	Pacific	Medium 2	$3,784	$3,588
Heifers	Heifers	Pacific	Medium 3	$5,297	$5,750
Heifers	Heifers	South	Large 1	$2,224	$2,686
Heifers	Heifers	South	Medium 1	$593	$356
Heifers	Heifers	South	Medium 2	$927	$833
Heifers	Heifers	South	Medium 3	$1,297	$1,362
Veal	Flush	Central	Medium 1	$0	$0
Veal	Flush	Central	Medium 2	$0	$0
Veal	Flush	Central	Medium 3	$0	$0
Veal	Flush	Mid-Atlantic	Medium 1	$0	$0
Veal	Flush	Mid-Atlantic	Medium 2	$0	$0
Veal	Flush	Mid-Atlantic	Medium 3	$0	$0
Veal	Flush	Midwest	Medium 1	$0	$0
Veal	Flush	Midwest	Medium 2	$0	$0
Veal	Flush	Midwest	Medium 3	$0	$0
Veal	Flush	Pacific	Medium 1	$0	$0

Table A-11 (Continued)

Animal	Farm Type	Region	Size Class	Category 1 Annual Costs	Category 2 Annual Costs
Veal	Flush	Pacific	Medium 2	$0	$0
Veal	Flush	Pacific	Medium 3	$0	$0
Veal	Flush	South	Medium 1	$0	$0
Veal	Flush	South	Medium 2	$0	$0
Veal	Flush	South	Medium 3	$0	$0

Table A-12a

Costs for Liquid Land Application at Dairies, Beef Feedlots, and Heifer Operations P-Based Scenario

Animal	Farm Type	Region	Size Class	Category 1		Category 2		Category 3	
				Capital	Annual	Capital	Annual	Capital	Annual
Beef	Beef	Central	Large 1	$59,036	$3,457	$59,036	$3,457	$0	$0
Beef	Beef	Central	Large 2	$245,427	$13,915	$245,427	$13,915	$0	$0
Beef	Beef	Central	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Central	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Central	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Mid-Atlantic	Large 1	$67,596	$6,917	$67,596	$6,917	$0	$0
Beef	Beef	Mid-Atlantic	Large 2	$975,615	$17,375	$975,615	$17,375	$0	$0
Beef	Beef	Mid-Atlantic	Medium 1	$56,561	$577	$56,561	$577	$0	$0
Beef	Beef	Mid-Atlantic	Medium 2	$57,651	$2,159	$57,651	$2,159	$0	$0
Beef	Beef	Mid-Atlantic	Medium 3	$59,033	$3,454	$59,033	$3,454	$0	$0
Beef	Beef	Midwest	Large 1	$61,405	$4,885	$61,405	$4,885	$0	$0
Beef	Beef	Midwest	Large 2	$414,548	$15,343	$414,548	$15,343	$0	$0
Beef	Beef	Midwest	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Midwest	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Midwest	Medium 3	$57,079	$1,422	$57,079	$1,422	$0	$0
Beef	Beef	Pacific	Large 1	$67,107	$6,801	$67,107	$6,801	$0	$0
Beef	Beef	Pacific	Large 2	$926,679	$17,259	$926,679	$17,259	$0	$0
Beef	Beef	Pacific	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Pacific	Medium 2	$57,552	$2,043	$57,552	$2,043	$0	$0
Beef	Beef	Pacific	Medium 3	$58,885	$3,338	$58,885	$3,338	$0	$0
Beef	Beef	South	Large 1	$62,783	$5,480	$62,783	$5,480	$0	$0
Beef	Beef	South	Large 2	$526,675	$15,938	$526,675	$15,938	$0	$0
Beef	Beef	South	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0

Table A-12a (Continued)

Animal	Farm Type	Region	Size Class	Category 1		Category 2		Category 3	
				Capital	Annual	Capital	Annual	Capital	Annual
Beef	Beef	South	Medium 2	$56,641	$722	$56,641	$722	$0	$0
Beef	Beef	South	Medium 3	$57,531	$2,017	$57,531	$2,017	$0	$0
Dairy	Hose	Central	Large 1	$56,657	$750	$56,657	$750	$0	$0
Dairy	Hose	Central	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Central	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Central	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Mid-Atlantic	Large 1	$61,638	$4,994	$61,638	$4,994	$0	$0
Dairy	Hose	Mid-Atlantic	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Mid-Atlantic	Medium 2	$56,658	$751	$56,658	$751	$0	$0
Dairy	Hose	Mid-Atlantic	Medium 3	$57,482	$1,958	$57,482	$1,958	$0	$0
Dairy	Hose	Midwest	Large 1	$58,289	$2,823	$58,289	$2,823	$0	$0
Dairy	Hose	Midwest	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Midwest	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Midwest	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Pacific	Large 1	$58,631	$3,129	$58,631	$3,129	$0	$0
Dairy	Hose	Pacific	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Pacific	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Pacific	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	South	Large 1	$57,332	$1,767	$26,848	$1,342	$0	$0
Dairy	Hose	South	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	South	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	South	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Central	Large 1	$57,863	$2,394	$57,863	$2,394	$0	$0
Heifers	Heifers	Central	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Central	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Central	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Central	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Mid-Atlantic	Large 1	$70,782	$7,571	$70,782	$7,571	$0	$0

Table A-12a (Continued)

Animal	Farm Type	Region	Size Class	Category 1		Category 2		Category 3	
				Capital	Annual	Capital	Annual	Capital	Annual
Heifers	Heifers	Mid-Atlantic	Medium 1	$57,816	$2,344	$57,816	$2,344	$0	$0
Heifers	Heifers	Mid-Atlantic	Medium 1	$57,816	$2,344	$57,816	$2,344	$0	$0
Heifers	Heifers	Mid-Atlantic	Medium 2	$59,981	$4,109	$59,981	$4,109	$0	$0
Heifers	Heifers	Mid-Atlantic	Medium 3	$62,680	$5,439	$62,680	$5,439	$0	$0
Heifers	Heifers	Midwest	Large 1	$61,625	$4,988	$61,625	$4,988	$0	$0
Heifers	Heifers	Midwest	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Midwest	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Midwest	Medium 2	$57,153	$1,527	$57,153	$1,527	$0	$0
Heifers	Heifers	Midwest	Medium 3	$58,326	$2,857	$58,326	$2,857	$0	$0
Heifers	Heifers	Pacific	Large 1	$63,482	$5,740	$63,482	$5,740	$0	$0
Heifers	Heifers	Pacific	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Pacific	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Pacific	Medium 2	$57,757	$2,279	$57,757	$2,279	$0	$0
Heifers	Heifers	Pacific	Medium 3	$59,239	$3,609	$59,239	$3,609	$0	$0
Heifers	Heifers	South	Large 1	$60,506	$4,419	$60,506	$4,419	$0	$0
Heifers	Heifers	South	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	South	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	South	Medium 2	$56,779	$958	$56,779	$958	$0	$0
Heifers	Heifers	South	Medium 3	$57,765	$2,288	$57,765	$2,288	$0	$0

Table A-12b

Costs for Liquid Land Application at Dairies, Beef Feedlots, and Heifer Operations
N-Based Scenario

Animal	Farm Type	Region	Size Class	Category 1		Category 2		Category 3	
				Capital	Annual	Capital	Annual	Capital	Annual
Beef	Beef	Central	Large 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Central	Large 2	$91,590	$9,882	$91,590	$9,882	$0	$0
Beef	Beef	Central	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Central	Medium 2	$26,848	$11,333	$26,848	$1,342	$0	$0
Beef	Beef	Central	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Mid-Atlantic	Large 1	$61,187	$4,778	$26,848	$1,342	$0	$0
Beef	Beef	Mid-Atlantic	Large 2	$397,647	$15,236	$138,377	$11,967	$0	$0
Beef	Beef	Mid-Atlantic	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Mid-Atlantic	Medium 2	$26,848	$7,058	$26,848	$1,342	$0	$0
Beef	Beef	Mid-Atlantic	Medium 3	$57,007	$1,316	$26,848	$1,342	$0	$0
Beef	Beef	Midwest	Large 1	$26,848	$4,793	$26,848	$1,342	$0	$0
Beef	Beef	Midwest	Large 2	$95,867	$10,172	$95,867	$10,172	$0	$0
Beef	Beef	Midwest	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Midwest	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Midwest	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Pacific	Large 1	$57,198	$1,589	$26,848	$1,342	$0	$0
Beef	Beef	Pacific	Large 2	$141,168	$12,047	$141,168	$12,047	$0	$0
Beef	Beef	Pacific	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Pacific	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	Pacific	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	South	Large 1	$60,250	$4,272	$26,848	$1,342	$0	$0
Beef	Beef	South	Large 2	$327,934	$14,730	$226,664	$13,677	$0	$0
Beef	Beef	South	Medium 1	$26,848	$2,835	$26,848	$1,342	$0	$0

Table A-12b (Continued)

Animal	Farm Type	Region	Size Class	Category 1		Category 2		Category 3	
				Capital	Annual	Capital	Annual	Capital	Annual
Beef	Beef	South	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Beef	Beef	South	Medium 3	$56,691	$809	$56,691	$809	$0	$0
Dairy	Hose	Central	Large 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Central	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Central	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Central	Medium 3	$26,848	$0	$26,848	$1,342	$0	$0
Dairy	Hose	Mid-Atlantic	Large 1	$56,920	$1,184	$26,848	$1,342	$0	$0
Dairy	Hose	Mid-Atlantic	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Mid-Atlantic	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Mid-Atlantic	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Midwest	Large 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Midwest	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Midwest	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Midwest	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Pacific	Large 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Pacific	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Pacific	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	Pacific	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	South	Large 1	$56,552	$559	$26,848	$1,342	$0	$0
Dairy	Hose	South	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	South	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Dairy	Hose	South	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Central	Large 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Central	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Central	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Central	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Central	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Mid-Atlantic	Large 1	$59,390	$3,718	$57,968	$2,506	$0	$0

Table A-12b (Continued)

Animal	Farm Type	Region	Size Class	Category 1		Category 2		Category 3	
				Capital	Annual	Capital	Annual	Capital	Annual
Heifers	Heifers	Mid-Atlantic	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Mid-Atlantic	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Mid-Atlantic	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Mid-Atlantic	Medium 3	$57,196	$1,586	$26,848	$1,342	$0	$0
Heifers	Heifers	Midwest	Large 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Midwest	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Midwest	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Midwest	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Midwest	Medium 3	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Pacific	Large 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Pacific	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Pacific	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Pacific	Medium 2	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	Pacific	Medium 3	$26,848	$2,898	$26,848	$1,342	$0	$0
Heifers	Heifers	South	Large 1	$58,729	$3,211	$58,133	$2,672	$0	$0
Heifers	Heifers	South	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	South	Medium 1	$26,848	$1,342	$26,848	$1,342	$0	$0
Heifers	Heifers	South	Medium 2	$26,848	$2,907	$26,848	$1,342	$0	$0
Heifers	Heifers	South	Medium 3	$56,854	$1,080	$26,848	$1,342	$0	$0

Table A-13a

Transportation Costs for Dairies, Beef Feedlots, and Heifer Operations
N-Based Scenario

Animal	Farm Type	Region	Size Class	Contract Hauling Costs		Purchase Truck Costs			
				Category 2	Category 3	Category 2		Category 3	
				Annual	Annual	Capital	Annual	Capital	Annual
Beef	Beef	Central	Large 1	$211	$0	$11,925	$351	$0	$0
Beef	Beef	Central	Large 2	$2,437	$0	$31,337	$1,463	$0	$0
Beef	Beef	Central	Medium 1	$292	$0	$91,728	$485	$0	$0
Beef	Beef	Central	Medium 2	$292	$0	$91,728	$485	$0	$0
Beef	Beef	Central	Medium 3	$292	$0	$91,728	$485	$0	$0
Beef	Beef	Mid-Atlantic	Large 1	$26,762	$0	$123,193	$11,110	$0	$0
Beef	Beef	Mid-Atlantic	Large 2	$50,170	$0	$172,471	$21,270	$0	$0
Beef	Beef	Mid-Atlantic	Medium 1	$6,217	$0	$137,272	$5,749	$0	$0
Beef	Beef	Mid-Atlantic	Medium 2	$154	$0	$71,548	$340	$0	$0
Beef	Beef	Mid-Atlantic	Medium 3	$154	$0	$71,548	$340	$0	$0
Beef	Beef	Midwest	Large 1	$1,959	$0	$13,951	$827	$0	$0
Beef	Beef	Midwest	Large 2	$768	$0	$14,463	$538	$0	$0
Beef	Beef	Midwest	Medium 1	$199	$0	$91,728	$404	$0	$0
Beef	Beef	Midwest	Medium 2	$199	$0	$91,728	$404	$0	$0
Beef	Beef	Midwest	Medium 3	$199	$0	$91,728	$404	$0	$0
Beef	Beef	Pacific	Large 1	$105,427	$0	$373,312	$34,490	$0	$0
Beef	Beef	Pacific	Large 2	$25,954	$0	$241,054	$15,118	$0	$0
Beef	Beef	Pacific	Medium 1	$2,243	$0	$175,990	$1,864	$0	$0
Beef	Beef	Pacific	Medium 2	$404	$0	$91,728	$642	$0	$0
Beef	Beef	Pacific	Medium 3	$404	$0	$91,728	$642	$0	$0

Table A-13a (Continued)

Animal	Farm Type	Region	Size Class	Contract Hauling Costs		Purchase Truck Costs			
				Category 2	Category 3	Category 2		Category 3	
				Annual	Annual	Capital	Annual	Capital	Annual
Beef	Beef	South	Large 1	$111,475	$0	$373,312	$44,213	$0	$0
Beef	Beef	South	Large 2	$489,829	$0	$522,638	$191,595	$0	$0
Beef	Beef	South	Medium 1	$13,323	$0	$204,789	$8,042	$0	$0
Beef	Beef	South	Medium 2	$232	$0	$91,728	$491	$0	$0
Beef	Beef	South	Medium 3	$232	$0	$91,728	$491	$0	$0
Dairy	Flush	Central	Large 1	$68,850	$0	$171,724	$21,932	$0	$0
Dairy	Flush	Central	Medium 1	$40	$0	$91,728	$77	$0	$0
Dairy	Flush	Central	Medium 2	$64,177	$0	$373,312	$20,383	$0	$0
Dairy	Flush	Central	Medium 3	$220	$0	$91,728	$383	$0	$0
Dairy	Flush	Mid-Atlantic	Large 1	$116,295	$0	$287,450	$46,432	$0	$0
Dairy	Flush	Mid-Atlantic	Medium 1	$20	$0	$75,217	$55	$0	$0
Dairy	Flush	Mid-Atlantic	Medium 2	$44,882	$0	$306,116	$17,911	$0	$0
Dairy	Flush	Mid-Atlantic	Medium 3	$6,928	$0	$144,312	$6,344	$0	$0
Dairy	Flush	Midwest	Large 1	$25,500	$0	$126,926	$9,644	$0	$0
Dairy	Flush	Midwest	Medium 1	$23	$0	$91,728	$55	$0	$0
Dairy	Flush	Midwest	Medium 2	$33,928	$0	$232,520	$12,756	$0	$0
Dairy	Flush	Midwest	Medium 3	$127	$0	$91,728	$257	$0	$0
Dairy	Flush	Pacific	Large 1	$350,409	$0	$373,312	$107,079	$0	$0
Dairy	Flush	Pacific	Medium 1	$56	$0	$91,728	$112	$0	$0
Dairy	Flush	Pacific	Medium 2	$126,522	$0	$373,312	$38,659	$0	$0
Dairy	Flush	Pacific	Medium 3	$22,204	$0	$204,789	$10,463	$0	$0
Dairy	Flush	South	Large 1	$151,226	$0	$201,588	$58,065	$0	$0
Dairy	Flush	South	Medium 1	$37	$0	$91,728	$88	$0	$0
Dairy	Flush	South	Medium 2	$93,973	$0	$373,312	$36,080	$0	$0

Table A-13a (Continued)

Animal	Farm Type	Region	Size Class	Contract Hauling Costs		Purchase Truck Costs			
				Category 2	Category 3	Category 2		Category 3	
				Annual	Annual	Capital	Annual	Capital	Annual
Dairy	Flush	South	Medium 3	$57,589	$0	$373,312	$22,238	$0	$0
Dairy	Hose	Central	Large 1	$1,050	$0	$42,195	$1,736	$0	$0
Dairy	Hose	Central	Medium 1	$120	$0	$91,728	$204	$0	$0
Dairy	Hose	Central	Medium 2	$662	$0	$91,728	$1,097	$0	$0
Dairy	Hose	Central	Medium 3	$660	$0	$91,728	$1,097	$0	$0
Dairy	Hose	Mid-Atlantic	Large 1	$978	$0	$70,631	$2,128	$0	$0
Dairy	Hose	Mid-Atlantic	Medium 1	$55	$0	$75,217	$124	$0	$0
Dairy	Hose	Mid-Atlantic	Medium 2	$302	$0	$75,217	$659	$0	$0
Dairy	Hose	Mid-Atlantic	Medium 3	$302	$0	$75,217	$659	$0	$0
Dairy	Hose	Midwest	Large 1	$452	$0	$31,188	$911	$0	$0
Dairy	Hose	Midwest	Medium 1	$70	$0	$91,728	$147	$0	$0
Dairy	Hose	Midwest	Medium 2	$385	$0	$91,728	$789	$0	$0
Dairy	Hose	Midwest	Medium 3	$384	$0	$91,728	$789	$0	$0
Dairy	Hose	Pacific	Large 1	$2,901	$0	$91,728	$4,630	$0	$0
Dairy	Hose	Pacific	Medium 1	$153	$0	$91,728	$251	$0	$0
Dairy	Hose	Pacific	Medium 2	$842	$0	$91,728	$1,339	$0	$0
Dairy	Hose	Pacific	Medium 3	$840	$0	$91,728	$1,339	$0	$0
Dairy	Hose	South	Large 1	$5,267	$0	$95,035	$5,609	$0	$0
Dairy	Hose	South	Medium 1	$87	$0	$91,728	$193	$0	$0
Dairy	Hose	South	Medium 2	$478	$0	$91,728	$1,000	$0	$0
Dairy	Hose	South	Medium 3	$477	$0	$91,728	$1,000	$0	$0
Heifers	Heifers	Central	Large 1	$164	$0	$91,728	$281	$0	$0
Heifers	Heifers	Central	Medium 1	$164	$0	$91,728	$281	$0	$0
Heifers	Heifers	Central	Medium 2	$164	$0	$91,728	$281	$0	$0

Table A-13a (Continued)

Animal	Farm Type	Region	Size Class	Contract Hauling Costs		Purchase Truck Costs			
				Category 2	Category 3	Category 2		Category 3	
				Annual	Annual	Capital	Annual	Capital	Annual
Heifers	Heifers	Central	Medium 3	$75	$0	$42,195	$129	$0	$0
Heifers	Heifers	Mid-Atlantic	Large 1	$345	$0	$75,217	$756	$0	$0
Heifers	Heifers	Mid-Atlantic	Medium 1	$7,213	$0	$144,312	$6,612	$0	$0
Heifers	Heifers	Mid-Atlantic	Medium 2	$5,289	$0	$144,312	$4,978	$0	$0
Heifers	Heifers	Mid-Atlantic	Medium 3	$2,960	$0	$135,512	$2,966	$0	$0
Heifers	Heifers	Midwest	Large 1	$141	$0	$91,728	$294	$0	$0
Heifers	Heifers	Midwest	Medium 1	$141	$0	$91,728	$294	$0	$0
Heifers	Heifers	Midwest	Medium 2	$141	$0	$91,728	$294	$0	$0
Heifers	Heifers	Midwest	Medium 3	$48	$0	$31,188	$100	$0	$0
Heifers	Heifers	Pacific	Large 1	$779	$0	$91,728	$1,255	$0	$0
Heifers	Heifers	Pacific	Medium 1	$17,759	$0	$175,990	$12,116	$0	$0
Heifers	Heifers	Pacific	Medium 2	$11,172	$0	$175,990	$7,883	$0	$0
Heifers	Heifers	Pacific	Medium 3	$3,852	$0	$175,990	$3,212	$0	$0
Heifers	Heifers	South	Large 1	$14,677	$0	$204,789	$9,406	$0	$0
Heifers	Heifers	South	Medium 1	$14,287	$0	$204,789	$8,546	$0	$0
Heifers	Heifers	South	Medium 2	$14,367	$0	$204,789	$8,721	$0	$0
Heifers	Heifers	South	Medium 3	$7,806	$0	$110,586	$4,814	$0	$0

Table A-13b

Transportation Costs for Dairies, Beef Feedlots, and Heifer Operations
P-Based Scenario

Animal	Farm Type	Region	Size Class	Contract Hauling Costs		Purchase Truck Costs			
				Category 2	Category 3	Category 2		Category 3	
				Annual	Annual	Capital	Annual	Capital	Annual
Beef	Beef	Central	Large 2	$22,683	$242,144	$366,914	$29,896	$522,638	$201,146
Beef	Beef	Central	Medium 1	$319	$3,460	$91,728	$788	$175,990	$6,592
Beef	Beef	Central	Medium 2	$459	$5,161	$91,728	$1,096	$175,990	$9,837
Beef	Beef	Central	Medium 3	$611	$7,162	$91,728	$1,473	$204,789	$9,474
Beef	Beef	Mid-Atlantic	Large 1	$3,011	$249,971	$91,728	$6,389	$373,312	$140,500
Beef	Beef	Mid-Atlantic	Large 2	$42,423	$3,520,113	$388,045	$34,470	$623,549	$1,931,239
Beef	Beef	Mid-Atlantic	Medium 1	$601	$50,293	$91,728	$1,300	$373,312	$28,377
Beef	Beef	Mid-Atlantic	Medium 2	$875	$75,032	$91,728	$1,866	$373,312	$42,249
Beef	Beef	Mid-Atlantic	Medium 3	$1,181	$104,120	$91,728	$2,544	$373,312	$58,605
Beef	Beef	Midwest	Large 1	$983	$18,302	$91,728	$2,678	$373,312	$19,654
Beef	Beef	Midwest	Large 2	$13,857	$257,736	$241,054	$13,620	$522,638	$262,078
Beef	Beef	Midwest	Medium 1	$196	$3,682	$91,728	$550	$175,990	$8,728
Beef	Beef	Midwest	Medium 2	$284	$5,494	$91,728	$789	$204,789	$8,828
Beef	Beef	Midwest	Medium 3	$381	$7,624	$91,728	$1,052	$232,520	$8,204
Beef	Beef	Pacific	Large 1	$2,116	$97,185	$91,728	$4,728	$373,312	$67,847
Beef	Beef	Pacific	Large 2	$29,805	$1,368,575	$308,531	$25,265	$522,638	$932,305
Beef	Beef	Pacific	Medium 1	$422	$19,553	$91,728	$971	$232,520	$13,662
Beef	Beef	Pacific	Medium 2	$615	$29,171	$91,728	$1,393	$373,312	$20,404
Beef	Beef	Pacific	Medium 3	$830	$40,481	$91,728	$1,857	$373,312	$28,312
Beef	Beef	South	Large 1	$1,436	$100,979	$91,728	$3,512	$373,312	$71,532

Table A-13b (Continued)

Animal	Farm Type	Region	Size Class	Contract Hauling Costs		Purchase Truck Costs			
				Category 2	Category 3	Category 2		Category 3	
				Annual	Annual	Capital	Annual	Capital	Annual
Beef	Beef	South	Large 2	$20,226	$1,421,992	$366,914	$27,423	$522,638	$985,305
Beef	Beef	South	Medium 1	$287	$20,317	$91,728	$715	$317,850	$21,522
Beef	Beef	South	Medium 2	$423	$30,310	$91,728	$1,057	$373,312	$21,482
Beef	Beef	South	Medium 3	$578	$42,061	$91,728	$1,429	$373,312	$29,842
Dairy	Flush	Central	Large 1	$30,400	$130,758	$373,312	$46,494	$373,312	$106,031
Dairy	Flush	Central	Medium 1	$86	$27,702	$91,728	$206	$373,312	$22,447
Dairy	Flush	Central	Medium 2	$167	$46,434	$91,728	$411	$373,312	$37,634
Dairy	Flush	Central	Medium 3	$231	$65,166	$91,728	$548	$373,312	$52,821
Dairy	Flush	Mid-Atlantic	Large 1	$155,619	$654,692	$373,312	$215,206	$373,312	$357,293
Dairy	Flush	Mid-Atlantic	Medium 1	$159	$136,465	$91,728	$339	$373,312	$74,441
Dairy	Flush	Mid-Atlantic	Medium 2	$29,181	$228,995	$373,312	$40,520	$373,312	$124,903
Dairy	Flush	Mid-Atlantic	Medium 3	$430	$321,525	$91,728	$961	$373,312	$175,483
Dairy	Flush	Midwest	Large 1	$11,938	$85,794	$373,312	$20,683	$373,312	$86,216
Dairy	Flush	Midwest	Medium 1	$51	$18,080	$91,728	$143	$373,312	$18,155
Dairy	Flush	Midwest	Medium 2	$101	$30,317	$91,728	$287	$373,312	$30,464
Dairy	Flush	Midwest	Medium 3	$139	$42,554	$91,728	$383	$373,312	$42,742
Dairy	Flush	Pacific	Large 1	$112,021	$238,216	$373,312	$162,410	$373,312	$161,642
Dairy	Flush	Pacific	Medium 1	$118	$49,569	$91,728	$296	$373,312	$33,631
Dairy	Flush	Pacific	Medium 2	$21,260	$83,189	$373,312	$30,971	$373,312	$56,425
Dairy	Flush	Pacific	Medium 3	$305	$116,809	$91,728	$718	$373,312	$79,220
Dairy	Flush	South	Large 1	$145,283	$228,210	$373,312	$225,972	$373,312	$157,624
Dairy	Flush	South	Medium 1	$83	$47,380	$91,728	$218	$373,312	$32,736
Dairy	Flush	South	Medium 2	$35,063	$79,527	$373,312	$54,623	$373,312	$54,904
Dairy	Flush	South	Medium 3	$4,287	$111,674	$175,990	$14,336	$373,312	$77,121

Table A-13b (Continued)

Animal	Farm Type	Region	Size Class	Contract Hauling Costs		Purchase Truck Costs			
				Category 2	Category 3	Category 2		Category 3	
				Annual	Annual	Capital	Annual	Capital	Annual
Dairy	Hose	Central	Large 1	$2,759	$9,024	$91,728	$6,543	$204,789	$13,725
Dairy	Hose	Central	Medium 1	$399	$2,562	$91,728	$959	$175,990	$5,099
Dairy	Hose	Central	Medium 2	$813	$3,658	$91,728	$1,953	$175,990	$7,386
Dairy	Hose	Central	Medium 3	$1,118	$4,754	$91,728	$2,672	$175,990	$9,656
Dairy	Hose	Mid-Atlantic	Large 1	$5,122	$101,353	$91,728	$10,855	$373,312	$63,076
Dairy	Hose	Mid-Atlantic	Medium 1	$735	$22,194	$91,728	$1,583	$232,520	$13,507
Dairy	Hose	Mid-Atlantic	Medium 2	$1,510	$34,560	$91,728	$3,223	$317,850	$30,204
Dairy	Hose	Mid-Atlantic	Medium 3	$2,073	$46,926	$91,728	$4,410	$373,312	$28,924
Dairy	Hose	Midwest	Large 1	$1,667	$8,327	$91,728	$4,544	$232,520	$10,639
Dairy	Hose	Midwest	Medium 1	$235	$2,082	$91,728	$646	$175,990	$5,136
Dairy	Hose	Midwest	Medium 2	$491	$3,096	$91,728	$1,339	$175,990	$7,715
Dairy	Hose	Midwest	Medium 3	$672	$4,110	$91,728	$1,841	$175,990	$10,281
Dairy	Hose	Pacific	Large 1	$3,621	$39,014	$91,728	$8,105	$373,312	$30,134
Dairy	Hose	Pacific	Medium 1	$562	$8,431	$91,728	$1,266	$204,789	$9,211
Dairy	Hose	Pacific	Medium 2	$1,071	$13,193	$91,728	$2,406	$232,520	$10,043
Dairy	Hose	Pacific	Medium 3	$1,488	$17,954	$91,728	$3,335	$232,520	$13,726
Dairy	Hose	South	Large 1	$23,402	$40,075	$373,312	$38,533	$373,312	$31,200
Dairy	Hose	South	Medium 1	$401	$8,527	$91,728	$994	$204,789	$9,461
Dairy	Hose	South	Medium 2	$727	$13,419	$91,728	$1,802	$232,520	$10,339
Dairy	Hose	South	Medium 3	$1,017	$18,311	$91,728	$2,486	$232,520	$14,133
Heifers	Heifers	Central	Large 1	$790	$13,101	$91,728	$1,884	$232,520	$11,578
Heifers	Heifers	Central	Medium 1	$255	$3,494	$91,728	$617	$175,990	$6,612
Heifers	Heifers	Central	Medium 2	$381	$5,459	$91,728	$925	$175,990	$10,306
Heifers	Heifers	Central	Medium 3	$511	$7,642	$91,728	$1,233	$204,789	$9,941

Table A-13b (Continued)

Animal	Farm Type	Region	Size Class	Contract Hauling Costs		Purchase Truck Costs			
				Category 2	Category 3	Category 2		Category 3	
				Annual	Annual	Capital	Annual	Capital	Annual
Heifers	Heifers	Mid-Atlantic	Large 1	$1,572	$190,930	$91,728	$3,336	$373,312	$106,624
Heifers	Heifers	Mid-Atlantic	Medium 1	$484	$50,915	$91,728	$1,074	$373,312	$28,537
Heifers	Heifers	Mid-Atlantic	Medium 2	$733	$79,554	$91,728	$1,583	$373,312	$44,468
Heifers	Heifers	Mid-Atlantic	Medium 3	$993	$111,376	$91,728	$2,148	$373,312	$62,203
Heifers	Heifers	Midwest	Large 1	$487	$13,965	$91,728	$1,339	$373,312	$14,792
Heifers	Heifers	Midwest	Medium 1	$156	$3,724	$91,728	$430	$175,990	$8,785
Heifers	Heifers	Midwest	Medium 2	$234	$5,819	$91,728	$646	$204,789	$9,282
Heifers	Heifers	Midwest	Medium 3	$314	$8,146	$91,728	$861	$232,520	$8,623
Heifers	Heifers	Pacific	Large 1	$1,159	$74,238	$91,728	$2,617	$373,312	$51,494
Heifers	Heifers	Pacific	Medium 1	$340	$19,797	$91,728	$760	$232,520	$13,756
Heifers	Heifers	Pacific	Medium 2	$521	$30,932	$91,728	$1,182	$373,312	$21,497
Heifers	Heifers	Pacific	Medium 3	$713	$43,305	$91,728	$1,604	$373,312	$30,072
Heifers	Heifers	South	Large 1	$824	$77,143	$91,728	$2,020	$373,312	$54,346
Heifers	Heifers	South	Medium 1	$1,793	$20,571	$175,990	$5,886	$317,850	$21,721
Heifers	Heifers	South	Medium 2	$357	$32,143	$91,728	$901	$373,312	$22,684
Heifers	Heifers	South	Medium 3	$494	$45,000	$91,728	$1,212	$373,312	$31,684

Table A-14

Costs for Concrete Pads for Beef, Dairy, Heifer, and Veal Operations

Animal	Farm Type	Region	Size Class	Capital	Annual
Beef	Beef	Central	Large 1	$134,541	$2,691
Beef	Beef	Central	Large 2	$1,730,701	$34,614
Beef	Beef	Central	Medium 1	$31,232	$625
Beef	Beef	Central	Medium 2	$44,504	$890
Beef	Beef	Central	Medium 3	$59,816	$1,196
Beef	Beef	Mid-Atlantic	Large 1	$132,317	$2,646
Beef	Beef	Mid-Atlantic	Large 2	$1,700,762	$34,015
Beef	Beef	Mid-Atlantic	Medium 1	$30,751	$615
Beef	Beef	Mid-Atlantic	Medium 2	$43,803	$876
Beef	Beef	Mid-Atlantic	Medium 3	$58,859	$1,177
Beef	Beef	Midwest	Large 1	$133,861	$2,677
Beef	Beef	Midwest	Large 2	$1,721,541	$34,431
Beef	Beef	Midwest	Medium 1	$31,085	$622
Beef	Beef	Midwest	Medium 2	$44,290	$886
Beef	Beef	Midwest	Medium 3	$59,523	$1,190
Beef	Beef	Pacific	Large 1	$132,058	$2,641
Beef	Beef	Pacific	Large 2	$1,697,279	$33,946
Beef	Beef	Pacific	Medium 1	$30,695	$614
Beef	Beef	Pacific	Medium 2	$43,722	$874
Beef	Beef	Pacific	Medium 3	$58,747	$1,175
Beef	Beef	South	Large 1	$131,707	$2,634
Beef	Beef	South	Large 2	$1,692,566	$33,851
Beef	Beef	South	Medium 1	$30,620	$612
Beef	Beef	South	Medium 2	$43,611	$872
Beef	Beef	South	Medium 3	$58,596	$1,172
Dairy	Flush	Central	Large 1	$93,642	$1,873
Dairy	Flush	Central	Medium 1	$21,276	$426
Dairy	Flush	Central	Medium 2	$32,762	$655
Dairy	Flush	Central	Medium 3	$43,796	$876
Dairy	Flush	Mid-Atlantic	Large 1	$93,642	$1,873
Dairy	Flush	Mid-Atlantic	Medium 1	$21,276	$426
Dairy	Flush	Mid-Atlantic	Medium 2	$32,762	$655
Dairy	Flush	Mid-Atlantic	Medium 3	$43,796	$876

Table A-14 (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Flush	Midwest	Large 1	$93,642	$1,873
Dairy	Flush	Midwest	Medium 1	$21,276	$426
Dairy	Flush	Midwest	Medium 2	$32,762	$655
Dairy	Flush	Midwest	Medium 3	$43,796	$876
Dairy	Flush	Pacific	Large 1	$93,642	$1,873
Dairy	Flush	Pacific	Medium 1	$21,276	$426
Dairy	Flush	Pacific	Medium 2	$32,762	$655
Dairy	Flush	Pacific	Medium 3	$43,796	$876
Dairy	Flush	South	Large 1	$93,642	$1,873
Dairy	Flush	South	Medium 1	$21,276	$426
Dairy	Flush	South	Medium 2	$32,762	$655
Dairy	Flush	South	Medium 3	$43,796	$876
Dairy	Hose	Central	Large 1	$42,615	$852
Dairy	Hose	Central	Medium 1	$10,723	$214
Dairy	Hose	Central	Medium 2	$15,933	$319
Dairy	Hose	Central	Medium 3	$20,855	$417
Dairy	Hose	Mid-Atlantic	Large 1	$42,615	$852
Dairy	Hose	Mid-Atlantic	Medium 1	$10,723	$214
Dairy	Hose	Mid-Atlantic	Medium 2	$15,933	$319
Dairy	Hose	Mid-Atlantic	Medium 3	$20,855	$417
Dairy	Hose	Midwest	Large 1	$42,615	$852
Dairy	Hose	Midwest	Medium 1	$10,723	$214
Dairy	Hose	Midwest	Medium 2	$15,933	$319
Dairy	Hose	Midwest	Medium 3	$20,855	$417
Dairy	Hose	Pacific	Large 1	$42,615	$852
Dairy	Hose	Pacific	Medium 1	$10,723	$214
Dairy	Hose	Pacific	Medium 2	$15,933	$319
Dairy	Hose	Pacific	Medium 3	$20,855	$417
Dairy	Hose	South	Large 1	$42,615	$852
Dairy	Hose	South	Medium 1	$10,723	$214
Dairy	Hose	South	Medium 2	$15,933	$319
Dairy	Hose	South	Medium 3	$20,855	$417
Heifers	Heifers	Central	Large 1	$651	$13
Heifers	Heifers	Central	Medium 1	$570	$11
Heifers	Heifers	Central	Medium 2	$591	$12
Heifers	Heifers	Central	Medium 3	$611	$12

Table A-14 (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Heifers	Heifers	Mid-Atlantic	Large 1	$797	$16
Heifers	Heifers	Mid-Atlantic	Medium 1	$639	$13
Heifers	Heifers	Mid-Atlantic	Medium 2	$679	$14
Heifers	Heifers	Mid-Atlantic	Medium 3	$718	$14
Heifers	Heifers	Midwest	Large 1	$704	$14
Heifers	Heifers	Midwest	Medium 1	$595	$12
Heifers	Heifers	Midwest	Medium 2	$623	$12
Heifers	Heifers	Midwest	Medium 3	$650	$13
Heifers	Heifers	Pacific	Large 1	$811	$16
Heifers	Heifers	Pacific	Medium 1	$645	$13
Heifers	Heifers	Pacific	Medium 2	$687	$14
Heifers	Heifers	Pacific	Medium 3	$727	$15
Heifers	Heifers	South	Large 1	$828	$17
Heifers	Heifers	South	Medium 1	$653	$13
Heifers	Heifers	South	Medium 2	$698	$14
Heifers	Heifers	South	Medium 3	$740	$15
Veal	Flush	Central	Medium 1	$2,276	$46
Veal	Flush	Central	Medium 2	$2,689	$54
Veal	Flush	Central	Medium 3	$4,117	$82
Veal	Flush	Mid-Atlantic	Medium 1	$2,276	$46
Veal	Flush	Mid-Atlantic	Medium 2	$2,689	$54
Veal	Flush	Mid-Atlantic	Medium 3	$4,117	$82
Veal	Flush	Midwest	Medium 1	$2,276	$46
Veal	Flush	Midwest	Medium 2	$2,689	$54
Veal	Flush	Midwest	Medium 3	$4,117	$82
Veal	Flush	Pacific	Medium 1	$2,276	$46
Veal	Flush	Pacific	Medium 2	$2,689	$54
Veal	Flush	Pacific	Medium 3	$4,117	$82
Veal	Flush	South	Medium 1	$2,276	$46
Veal	Flush	South	Medium 2	$2,689	$54
Veal	Flush	South	Medium 3	$4,117	$82

Table A-15

Costs for Composting at Dairies, Beef, and Heifer Operations

Animal	Farm Type	Region	Size Class	Capital	Annual
Beef	Beef	Central	Large 1	$9,157	$67,803
Beef	Beef	Central	Large 2	$9,157	$954,694
Beef	Beef	Central	Medium 1	$9,157	$13,653
Beef	Beef	Central	Medium 2	$9,157	$20,356
Beef	Beef	Central	Medium 3	$9,157	$28,251
Beef	Beef	Mid-Atlantic	Large 1	$9,157	$58,841
Beef	Beef	Mid-Atlantic	Large 2	$9,157	$828,603
Beef	Beef	Mid-Atlantic	Medium 1	$9,157	$11,839
Beef	Beef	Mid-Atlantic	Medium 2	$9,157	$17,662
Beef	Beef	Mid-Atlantic	Medium 3	$9,157	$24,509
Beef	Beef	Midwest	Large 1	$9,157	$60,390
Beef	Beef	Midwest	Large 2	$9,157	$850,412
Beef	Beef	Midwest	Medium 1	$9,157	$12,167
Beef	Beef	Midwest	Medium 2	$9,157	$18,127
Beef	Beef	Midwest	Medium 3	$9,157	$25,167
Beef	Beef	Pacific	Large 1	$9,157	$58,860
Beef	Beef	Pacific	Large 2	$9,157	$828,877
Beef	Beef	Pacific	Medium 1	$9,157	$11,842
Beef	Beef	Pacific	Medium 2	$9,157	$17,668
Beef	Beef	Pacific	Medium 3	$9,157	$24,517
Beef	Beef	South	Large 1	$9,157	$58,784
Beef	Beef	South	Large 2	$9,157	$827,804
Beef	Beef	South	Medium 1	$9,157	$11,827
Beef	Beef	South	Medium 2	$9,157	$17,645
Beef	Beef	South	Medium 3	$9,157	$24,485
Dairy	Flush	Central	Large 1	$9,157	$7,995
Dairy	Flush	Central	Medium 1	$9,157	$1,413
Dairy	Flush	Central	Medium 2	$9,157	$2,380
Dairy	Flush	Central	Medium 3	$9,157	$3,365
Dairy	Flush	Mid-Atlantic	Large 1	$9,157	$4,261
Dairy	Flush	Mid-Atlantic	Medium 1	$9,157	$744
Dairy	Flush	Mid-Atlantic	Medium 2	$9,157	$1,265

Table A-15 (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Flush	Mid-Atlantic	Medium 3	$9,157	$1,786
Dairy	Flush	Midwest	Large 1	$9,157	$7,196
Dairy	Flush	Midwest	Medium 1	$9,157	$1,264
Dairy	Flush	Midwest	Medium 2	$9,157	$2,138
Dairy	Flush	Midwest	Medium 3	$9,157	$3,031
Dairy	Flush	Pacific	Large 1	$9,157	$2,867
Dairy	Flush	Pacific	Medium 1	$9,157	$503
Dairy	Flush	Pacific	Medium 2	$9,157	$856
Dairy	Flush	Pacific	Medium 3	$9,157	$1,210
Dairy	Flush	South	Large 1	$9,157	$1,567
Dairy	Flush	South	Medium 1	$9,157	$280
Dairy	Flush	South	Medium 2	$9,157	$466
Dairy	Flush	South	Medium 3	$9,157	$653
Dairy	Hose	Central	Large 1	$9,157	$7,995
Dairy	Hose	Central	Medium 1	$9,157	$1,413
Dairy	Hose	Central	Medium 2	$9,157	$2,380
Dairy	Hose	Central	Medium 3	$9,157	$3,365
Dairy	Hose	Mid-Atlantic	Large 1	$9,157	$4,261
Dairy	Hose	Mid-Atlantic	Medium 1	$9,157	$744
Dairy	Hose	Mid-Atlantic	Medium 2	$9,157	$1,265
Dairy	Hose	Mid-Atlantic	Medium 3	$9,157	$1,786
Dairy	Hose	Midwest	Large 1	$9,157	$7,196
Dairy	Hose	Midwest	Medium 1	$9,157	$1,264
Dairy	Hose	Midwest	Medium 2	$9,157	$2,138
Dairy	Hose	Midwest	Medium 3	$9,157	$3,031
Dairy	Hose	Pacific	Large 1	$9,157	$2,867
Dairy	Hose	Pacific	Medium 1	$9,157	$503
Dairy	Hose	Pacific	Medium 2	$9,157	$856
Dairy	Hose	Pacific	Medium 3	$9,157	$1,210
Dairy	Hose	South	Large 1	$9,157	$1,567
Dairy	Hose	South	Medium 1	$9,157	$280
Dairy	Hose	South	Medium 2	$9,157	$466
Dairy	Hose	South	Medium 3	$9,157	$653
Heifers	Heifers	Central	Large 1	$9,157	$26,997

Table A-15 (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Heifers	Heifers	Central	Medium 1	$9,157	$7,209
Heifers	Heifers	Central	Medium 2	$9,157	$11,260
Heifers	Heifers	Central	Medium 3	$9,157	$15,756
Heifers	Heifers	Mid-Atlantic	Large 1	$9,157	$19,064
Heifers	Heifers	Mid-Atlantic	Medium 1	$9,157	$5,091
Heifers	Heifers	Mid-Atlantic	Medium 2	$9,157	$7,952
Heifers	Heifers	Mid-Atlantic	Medium 3	$9,157	$11,111
Heifers	Heifers	Midwest	Large 1	$9,157	$22,780
Heifers	Heifers	Midwest	Medium 1	$9,157	$6,076
Heifers	Heifers	Midwest	Medium 2	$9,157	$9,495
Heifers	Heifers	Midwest	Medium 3	$9,157	$13,285
Heifers	Heifers	Pacific	Large 1	$9,157	$19,473
Heifers	Heifers	Pacific	Medium 1	$9,157	$5,203
Heifers	Heifers	Pacific	Medium 2	$9,157	$8,120
Heifers	Heifers	Pacific	Medium 3	$9,157	$11,371
Heifers	Heifers	South	Large 1	$9,157	$16,537
Heifers	Heifers	South	Medium 1	$9,157	$4,422
Heifers	Heifers	South	Medium 2	$9,157	$6,894
Heifers	Heifers	South	Medium 3	$9,157	$9,662

Table A-16

Costs for Digesters for Large Dairies for all Regions

Animal	Farm Type	Size Class	Digester Type	Capital	O&M
Dairy	Hose	Large 1	Complete Mix	$377,447	($45,560)
Dairy	Flush	Large 1	Covered Lagoon	$214,353	($42,062)

Table A-17a
Capital Costs for Storage for Poultry Operations
Under Option 1, N-Based Scenario

Animal	Farm Type	Region	Manure type	Size	Category 1	Category 2	Category 3
Chicken	Broiler	Mid-Atlantic	Solid	Large 1	$87,699	$93,613	$106,069
Chicken	Broiler	Mid-Atlantic	Solid	Large 2	$192,172	$231,178	$267,927
Chicken	Broiler	Mid-Atlantic	Solid	Medium 1	$27,913	$27,953	$27,789
Chicken	Broiler	Mid-Atlantic	Solid	Medium 2	$39,263	$40,945	$39,412
Chicken	Broiler	Mid-Atlantic	Solid	Medium 3	$60,242	$62,844	$60,577
Chicken	Broiler	South	Solid	Large 1	$87,699	$94,654	$92,622
Chicken	Broiler	South	Solid	Large 2	$176,189	$220,369	$228,606
Chicken	Broiler	South	Solid	Medium 1	$27,414	$27,652	$27,656
Chicken	Broiler	South	Solid	Medium 2	$38,532	$40,471	$40,381
Chicken	Broiler	South	Solid	Medium 3	$59,231	$62,189	$62,102
Chicken	Layer: Dry	Midwest	Solid	Large 1	$162,199	$162,199	$162,199
Chicken	Layer: Dry	Midwest	Solid	Large 2	$477,076	$477,076	$477,076
Chicken	Layer: Dry	Midwest	Solid	Medium 1	$20,093	$20,093	$20,093
Chicken	Layer: Dry	Midwest	Solid	Medium 2	$34,392	$34,392	$34,392
Chicken	Layer: Dry	Midwest	Solid	Medium 3	$43,757	$43,757	$43,757
Chicken	Layer: Dry	South	Solid	Large 1	$162,199	$162,199	$162,199
Chicken	Layer: Dry	South	Solid	Large 2	$477,076	$477,076	$477,076
Chicken	Layer: Dry	South	Solid	Medium 1	$20,093	$20,093	$20,093
Chicken	Layer: Dry	South	Solid	Medium 2	$34,392	$34,392	$34,392
Chicken	Layer: Dry	South	Solid	Medium 3	$43,757	$43,757	$43,757
Turkey	Slaughter	Mid-Atlantic	Solid	Large 1	$144,607	$144,607	$144,607
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 1	$25,252	$25,252	$25,252

Table A-17a (Continued)

Animal	Farm Type	Region	Manure type	Size	Category 1	Category 2	Category 3
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 2	$39,320	$39,320	$39,320
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 3	$53,956	$53,956	$53,956
Turkey	Slaughter	Midwest	Solid	Large 1	$144,607	$144,607	$144,607
Turkey	Slaughter	Midwest	Solid	Medium 1	$25,252	$25,252	$25,252
Turkey	Slaughter	Midwest	Solid	Medium 2	$39,320	$39,320	$39,320
Turkey	Slaughter	Midwest	Solid	Medium 3	$53,956	$53,956	$53,956

Table A-17b

Capital Costs for Storage for Poultry Operations Under Option 2, P-based Scenario

Animal	Farm Type	Region	Manure type	Size Class	Category 1	Category 2	Category 3
Chicken	Broiler	Mid-Atlantic	Solid	Large 1	$87,699	$93,098	$104,743
Chicken	Broiler	Mid-Atlantic	Solid	Large 2	$153,822	$228,892	$270,221
Chicken	Broiler	Mid-Atlantic	Solid	Medium 1	$27,813	$27,959	$27,789
Chicken	Broiler	Mid-Atlantic	Solid	Medium 2	$39,021	$40,769	$39,412
Chicken	Broiler	Mid-Atlantic	Solid	Medium 3	$59,884	$62,562	$60,577
Chicken	Broiler	South	Solid	Large 1	$87,699	$95,074	$93,645
Chicken	Broiler	South	Solid	Large 2	$153,822	$221,876	$237,290
Chicken	Broiler	South	Solid	Medium 1	$27,223	$27,663	$27,663
Chicken	Broiler	South	Solid	Medium 2	$37,846	$40,453	$40,394
Chicken	Broiler	South	Solid	Medium 3	$58,167	$62,177	$62,124
Chicken	Layer: Dry	Midwest	Solid	Large 1	$162,199	$162,199	$162,199
Chicken	Layer: Dry	Midwest	Solid	Large 2	$477,076	$477,076	$477,076
Chicken	Layer: Dry	Midwest	Solid	Medium 1	$20,093	$20,093	$20,093
Chicken	Layer: Dry	Midwest	Solid	Medium 2	$34,392	$34,392	$34,392
Chicken	Layer: Dry	Midwest	Solid	Medium 3	$43,757	$43,757	$43,757
Chicken	Layer: Dry	South	Solid	Large 1	$162,199	$162,199	$162,199
Chicken	Layer: Dry	South	Solid	Large 2	$477,076	$477,076	$477,076
Chicken	Layer: Dry	South	Solid	Medium 1	$20,093	$20,093	$20,093
Chicken	Layer: Dry	South	Solid	Medium 2	$34,392	$34,392	$34,392
Chicken	Layer: Dry	South	Solid	Medium 3	$43,757	$43,757	$43,757

Table A-17b (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1	Category 2	Category 3
Turkey	Slaughter	Mid-Atlantic	Solid	Large 1	$144,606	$144,607	$144,607
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 1	$25,252	$25,252	$25,252
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 2	$39,320	$39,320	$39,320
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 3	$53,956	$53,956	$53,956
Turkey	Slaughter	Midwest	Solid	Large 1	$144,606	$144,607	$144,607
Turkey	Slaughter	Midwest	Solid	Medium 1	$25,252	$25,252	$25,252
Turkey	Slaughter	Midwest	Solid	Medium 2	$39,320	$39,320	$39,320
Turkey	Slaughter	Midwest	Solid	Medium 3	$53,956	$53,956	$53,956

Table A-17c

Capital Costs for Storage for Poultry Operations Under Option 2, N-based Scenario

Animal	Farm Type	Region	Manure type	Size Class	Category 1	Category 2	Category 3
Chicken	Broiler	Mid-Atlantic	Solid	Large 1	$87,699	$93,613	$106,069
Chicken	Broiler	Mid-Atlantic	Solid	Large 2	$192,172	$231,178	$267,927
Chicken	Broiler	Mid-Atlantic	Solid	Medium 1	$27,913	$27,953	$27,789
Chicken	Broiler	Mid-Atlantic	Solid	Medium 2	$39,263	$40,945	$39,412
Chicken	Broiler	Mid-Atlantic	Solid	Medium 3	$60,242	$62,844	$60,577
Chicken	Broiler	South	Solid	Large 1	$87,699	$94,436	$91,881
Chicken	Broiler	South	Solid	Large 2	$176,217	$218,345	$222,311
Chicken	Broiler	South	Solid	Medium 1	$27,439	$27,651	$27,651
Chicken	Broiler	South	Solid	Medium 2	$38,548	$40,460	$40,372
Chicken	Broiler	South	Solid	Medium 3	$59,228	$62,173	$62,086
Chicken	Layer: Dry	Midwest	Solid	Large 1	$162,199	$162,199	$162,199
Chicken	Layer: Dry	Midwest	Solid	Large 2	$477,076	$477,076	$477,076
Chicken	Layer: Dry	Midwest	Solid	Medium 1	$20,093	$20,093	$20,093
Chicken	Layer: Dry	Midwest	Solid	Medium 2	$34,392	$34,392	$34,392
Chicken	Layer: Dry	Midwest	Solid	Medium 3	$43,757	$43,757	$43,757
Chicken	Layer: Dry	South	Solid	Large 1	$162,199	$162,199	$162,199
Chicken	Layer: Dry	South	Solid	Large 2	$477,076	$477,076	$477,076
Chicken	Layer: Dry	South	Solid	Medium 1	$20,093	$20,093	$20,093
Chicken	Layer: Dry	South	Solid	Medium 2	$34,392	$34,392	$34,392
Chicken	Layer: Dry	South	Solid	Medium 3	$43,757	$43,757	$43,757
Turkey	Slaughter	Mid-Atlantic	Solid	Large 1	$144,607	$144,607	$144,607
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 1	$25,252	$25,252	$25,252

Table A-17c (Continued)

Animal	Farm Type	Region	Manure type	Size Class	Category 1	Category 2	Category 3
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 2	$39,320	$39,320	$39,320
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 3	$53,956	$53,956	$53,956
Turkey	Slaughter	Midwest	Solid	Large 1	$144,607	$144,607	$144,607
Turkey	Slaughter	Midwest	Solid	Medium 1	$25,252	$25,252	$25,252
Turkey	Slaughter	Midwest	Solid	Medium 2	$39,320	$39,320	$39,320
Turkey	Slaughter	Midwest	Solid	Medium 3	$53,956	$53,956	$53,956

Table A-17d

Costs for Storage for Poultry Operations Under Option 5, P-based Scenario

Animal	Farm Type	Region	Manure type	Size	Category 1	Category 2	Category 3
Chicken	Broiler	Mid-Atlantic	Solid	Large 1	$87,699	$93,098	$104,743
Chicken	Broiler	Mid-Atlantic	Solid	Large 2	$153,822	$228,892	$270,221
Chicken	Broiler	Mid-Atlantic	Solid	Medium 1	$27,813	$27,959	$27,789
Chicken	Broiler	Mid-Atlantic	Solid	Medium 2	$39,021	$40,769	$39,412
Chicken	Broiler	Mid-Atlantic	Solid	Medium 3	$59,884	$62,562	$60,577
Chicken	Broiler	South	Solid	Large 1	$87,699	$95,074	$93,645
Chicken	Broiler	South	Solid	Large 2	$153,822	$221,876	$237,290
Chicken	Broiler	South	Solid	Medium 1	$27,223	$27,663	$27,663
Chicken	Broiler	South	Solid	Medium 2	$37,846	$40,453	$40,394
Chicken	Broiler	South	Solid	Medium 3	$58,167	$62,177	$62,124
Chicken	Layer: Dry	Midwest	Solid	Large 1	$162,199	$162,199	$162,199
Chicken	Layer: Dry	Midwest	Solid	Large 2	$477,076	$477,076	$477,076
Chicken	Layer: Dry	Midwest	Solid	Medium 1	$20,093	$20,093	$20,093
Chicken	Layer: Dry	Midwest	Solid	Medium 2	$34,392	$34,392	$34,392
Chicken	Layer: Dry	Midwest	Solid	Medium 3	$43,757	$43,757	$43,757
Chicken	Layer: Dry	South	Solid	Large 1	$162,199	$162,199	$162,199
Chicken	Layer: Dry	South	Solid	Large 2	$477,076	$477,076	$477,076
Chicken	Layer: Dry	South	Solid	Medium 1	$20,093	$20,093	$20,093
Chicken	Layer: Dry	South	Solid	Medium 2	$34,392	$34,392	$34,392
Chicken	Layer: Dry	South	Solid	Medium 3	$43,757	$43,757	$43,757
Turkey	Slaughter	Mid-Atlantic	Solid	Large 1	$144,606	$144,607	$144,607

Table A-17d (Continued)

Animal	Farm Type	Region	Manure type	Size	Category 1	Category 2	Category 3
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 1	$25,252	$25,252	$25,252
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 2	$39,320	$39,320	$39,320
Turkey	Slaughter	Mid-Atlantic	Solid	Medium 3	$53,956	$53,956	$53,956
Turkey	Slaughter	Midwest	Solid	Large 1	$155,957	$144,607	$144,607
Turkey	Slaughter	Midwest	Solid	Medium 1	$25,252	$25,252	$25,252
Turkey	Slaughter	Midwest	Solid	Medium 2	$39,320	$39,320	$39,320
Turkey	Slaughter	Midwest	Solid	Medium 3	$53,956	$53,956	$53,956

Table A-17e

Capital Costs for Storage for Poultry Operations Under Option 5, N-based Scenario

Animal	Operation	Region	Manure Type	Size	Category 1	Category 2	Category 3
Chicken	Broiler	South	Solid	Large2	$176,217	$218,345	$222,311
Chicken	Broiler	South	Solid	Large1	$87,699	$94,436	$91,881
Chicken	Broiler	South	Solid	Medium3	$59,228	$62,173	$62,086
Chicken	Broiler	South	Solid	Medium2	$38,548	$40,460	$40,372
Chicken	Broiler	South	Solid	Medium1	$27,439	$27,651	$27,651
Chicken	Broiler	Mid-Atlantic	Solid	Large2	$192,172	$231,178	$267,927
Chicken	Broiler	Mid-Atlantic	Solid	Large1	$87,699	$93,613	$106,069
Chicken	Broiler	Mid-Atlantic	Solid	Medium3	$60,242	$62,844	$60,577
Chicken	Broiler	Mid-Atlantic	Solid	Medium2	$39,263	$40,945	$39,412
Chicken	Broiler	Mid-Atlantic	Solid	Medium1	$27,913	$27,953	$27,789
Chicken	Layer-Dry	Midwest	Solid	Medium1	$20,093	$20,093	$20,093
Chicken	Layer-Dry	Midwest	Solid	Medium2	$34,392	$34,392	$34,392
Chicken	Layer-Dry	Midwest	Solid	Medium3	$43,757	$43,757	$43,757
Chicken	Layer-Dry	Midwest	Solid	Large1	$162,199	$162,199	$162,199
Chicken	Layer-Dry	Midwest	Solid	Large2	$477,076	$477,076	$477,076
Chicken	Layer-Dry	South	Solid	Medium1	$20,093	$20,093	$20,093
Chicken	Layer-Dry	South	Solid	Medium2	$34,392	$34,392	$34,392
Chicken	Layer-Dry	South	Solid	Medium3	$43,757	$43,757	$43,757
Chicken	Layer-Dry	South	Solid	Large1	$162,199	$162,199	$162,199
Chicken	Layer-Dry	South	Solid	Large2	$477,076	$477,076	$477,076
Chicken	Layer-Wet	South	Liquid	Medium3	$0	$0	$0
Chicken	Layer-Wet	South	Liquid	Large1	$0	$0	$0

Table A-17e (Continued)

Animal	Operation	Region	Manure Type	Size	Category 1	Category 2	Category 3
Turkey	Slaughter	Mid-Atlantic	Solid	Medium1	$25,252	$25,252	$25,252
Turkey	Slaughter	Mid-Atlantic	Solid	Medium2	$39,320	$39,320	$39,320
Turkey	Slaughter	Mid-Atlantic	Solid	Medium3	$53,956	$53,956	$53,956
Turkey	Slaughter	Mid-Atlantic	Solid	Large1	$144,607	$144,607	$144,607
Turkey	Slaughter	Midwest	Solid	Medium1	$25,252	$25,252	$25,252
Turkey	Slaughter	Midwest	Solid	Medium2	$39,320	$39,320	$39,320
Turkey	Slaughter	Midwest	Solid	Medium3	$53,956	$53,956	$53,956
Turkey	Slaughter	Midwest	Solid	Large1	$144,607	$144,607	$144,607

Table A-18

Costs for Covered Lagoons at Veal Operations Under Option 5

Animal	Farm Type	Region	Size Class	Capital	Annual
Veal	Flush	Central	Medium 1	$65,959	$3,298
Veal	Flush	Mid-Atlantic	Medium 1	$79,984	$3,999
Veal	Flush	Midwest	Medium 1	$75,264	$3,763
Veal	Flush	Pacific	Medium 1	$79,366	$3,968
Veal	Flush	South	Medium 1	$68,049	$3,402
Veal	Flush	Central	Medium 2	$77,377	$3,869
Veal	Flush	Mid-Atlantic	Medium 2	$89,261	$4,463
Veal	Flush	Midwest	Medium 2	$83,167	$4,158
Veal	Flush	Pacific	Medium 2	$93,320	$4,666
Veal	Flush	South	Medium 2	$89,588	$4,479
Veal	Flush	Central	Medium 3	$100,765	$5,038
Veal	Flush	Mid-Atlantic	Medium 3	$114,140	$5,707
Veal	Flush	Midwest	Medium 3	$107,803	$5,390
Veal	Flush	Pacific	Medium 3	$118,625	$5,931
Veal	Flush	South	Medium 3	$114,198	$5,710

Table A-19

Costs for Sludge Removal at Dairies, Beef Feedlots, and Heifer Operations

Animal	Farm Type	Region	Size Class	Capital	Annual
Beef	Beef	Central	Large 1	$0	$2,377
Beef	Beef	Central	Large 2	$122,426	$6,121
Beef	Beef	Central	Medium 1	$0	$478
Beef	Beef	Central	Medium 2	$0	$714
Beef	Beef	Central	Medium 3	$0	$990
Beef	Beef	Mid-Atlantic	Large 1	$0	$7,693
Beef	Beef	Mid-Atlantic	Large 2	$122,426	$6,121
Beef	Beef	Mid-Atlantic	Medium 1	$0	$1,548
Beef	Beef	Mid-Atlantic	Medium 2	$0	$2,309
Beef	Beef	Mid-Atlantic	Medium 3	$0	$3,204
Beef	Beef	Midwest	Large 1	$0	$4,004
Beef	Beef	Midwest	Large 2	$122,426	$6,121
Beef	Beef	Midwest	Medium 1	$0	$806
Beef	Beef	Midwest	Medium 2	$0	$1,202
Beef	Beef	Midwest	Medium 3	$0	$1,668
Beef	Beef	Pacific	Large 1	$0	$8,312
Beef	Beef	Pacific	Large 2	$122,426	$6,121
Beef	Beef	Pacific	Medium 1	$0	$1,672
Beef	Beef	Pacific	Medium 2	$0	$2,495
Beef	Beef	Pacific	Medium 3	$0	$3,462
Beef	Beef	South	Large 1	$0	$9,148
Beef	Beef	South	Large 2	$122,426	$6,121
Beef	Beef	South	Medium 1	$0	$1,841
Beef	Beef	South	Medium 2	$0	$2,746
Beef	Beef	South	Medium 3	$0	$3,811
Dairy	Flush	Central	Large 1	$122,426	$6,121
Dairy	Flush	Central	Medium 1	$122,426	$6,121
Dairy	Flush	Central	Medium 2	$122,426	$6,121
Dairy	Flush	Central	Medium 3	$122,426	$6,121
Dairy	Flush	Mid-Atlantic	Large 1	$122,426	$6,121
Dairy	Flush	Mid-Atlantic	Medium 1	$122,426	$6,121
Dairy	Flush	Mid-Atlantic	Medium 2	$122,426	$6,121

Table A-19 (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Dairy	Flush	Mid-Atlantic	Medium 3	$122,426	$6,121
Dairy	Flush	Midwest	Large 1	$122,426	$6,121
Dairy	Flush	Midwest	Medium 1	$122,426	$6,121
Dairy	Flush	Midwest	Medium 2	$122,426	$6,121
Dairy	Flush	Midwest	Medium 3	$122,426	$6,121
Dairy	Flush	Pacific	Large 1	$122,426	$6,121
Dairy	Flush	Pacific	Medium 1	$122,426	$6,121
Dairy	Flush	Pacific	Medium 2	$122,426	$6,121
Dairy	Flush	Pacific	Medium 3	$122,426	$6,121
Dairy	Flush	South	Large 1	$122,426	$6,121
Dairy	Flush	South	Medium 1	$122,426	$6,121
Dairy	Flush	South	Medium 2	$122,426	$6,121
Dairy	Flush	South	Medium 3	$122,426	$6,121
Dairy	Hose	Central	Large 1	$122,426	$6,121
Dairy	Hose	Central	Medium 1	$0	$9,711
Dairy	Hose	Central	Medium 2	$0	$16,509
Dairy	Hose	Central	Medium 3	$0	$23,307
Dairy	Hose	Mid-Atlantic	Large 1	$122,426	$6,121
Dairy	Hose	Mid-Atlantic	Medium 1	$0	$13,614
Dairy	Hose	Mid-Atlantic	Medium 2	$0	$23,144
Dairy	Hose	Mid-Atlantic	Medium 3	$122,426	$6,121
Dairy	Hose	Midwest	Large 1	$122,426	$6,121
Dairy	Hose	Midwest	Medium 1	$0	$10,906
Dairy	Hose	Midwest	Medium 2	$0	$18,539
Dairy	Hose	Midwest	Medium 3	$122,426	$6,121
Dairy	Hose	Pacific	Large 1	$122,426	$6,121
Dairy	Hose	Pacific	Medium 1	$0	$14,068
Dairy	Hose	Pacific	Medium 2	$122,426	$6,121
Dairy	Hose	Pacific	Medium 3	$122,426	$6,121
Dairy	Hose	South	Large 1	$122,426	$6,121
Dairy	Hose	South	Medium 1	$0	$14,682
Dairy	Hose	South	Medium 2	$122,426	$6,121
Dairy	Hose	South	Medium 3	$122,426	$6,121
Heifers	Heifers	Central	Large 1	$0	$1,818

Table A-19 (Continued)

Animal	Farm Type	Region	Size Class	Capital	Annual
Heifers	Heifers	Central	Medium 1	$0	$485
Heifers	Heifers	Central	Medium 2	$0	$757
Heifers	Heifers	Central	Medium 3	$0	$1,060
Heifers	Heifers	Mid-Atlantic	Large 1	$0	$5,883
Heifers	Heifers	Mid-Atlantic	Medium 1	$0	$1,569
Heifers	Heifers	Mid-Atlantic	Medium 2	$0	$2,451
Heifers	Heifers	Mid-Atlantic	Medium 3	$0	$3,432
Heifers	Heifers	Midwest	Large 1	$0	$3,062
Heifers	Heifers	Midwest	Medium 1	$0	$816
Heifers	Heifers	Midwest	Medium 2	$0	$1,276
Heifers	Heifers	Midwest	Medium 3	$0	$1,786
Heifers	Heifers	Pacific	Large 1	$0	$6,356
Heifers	Heifers	Pacific	Medium 1	$0	$1,695
Heifers	Heifers	Pacific	Medium 2	$0	$2,648
Heifers	Heifers	Pacific	Medium 3	$0	$3,708
Heifers	Heifers	South	Large 1	$0	$6,996
Heifers	Heifers	South	Medium 1	$0	$1,865
Heifers	Heifers	South	Medium 2	$0	$2,915
Heifers	Heifers	South	Medium 3	$0	$4,081

Appendix B

Table B-1

Selected Transportation Option Under Option 1 for Beef Feedlots, Dairies, and Heifer Operations

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Beef	Beef	Large 1	CE	H	Contract Hauling	Purchase Truck
Beef	Beef	Large 1	CE	L	Contract Hauling	Purchase Truck
Beef	Beef	Large 1	CE	M	Contract Hauling	Purchase Truck
Beef	Beef	Large 1	MA	H	Contract Hauling	Purchase Truck
Beef	Beef	Large 1	MA	L	Contract Hauling	Purchase Truck
Beef	Beef	Large 1	MA	M	Contract Hauling	Purchase Truck
Beef	Beef	Large 1	MW	H	Contract Hauling	Purchase Truck
Beef	Beef	Large 1	MW	L	Contract Hauling	Purchase Truck
Beef	Beef	Large 1	MW	M	Contract Hauling	Purchase Truck
Beef	Beef	Large 1	PA	H	Purchase Truck	Purchase Truck
Beef	Beef	Large 1	PA	L	Purchase Truck	Purchase Truck
Beef	Beef	Large 1	PA	M	Purchase Truck	Purchase Truck
Beef	Beef	Large 1	SO	H	Purchase Truck	Purchase Truck
Beef	Beef	Large 1	SO	L	Purchase Truck	Purchase Truck
Beef	Beef	Large 1	SO	M	Purchase Truck	Purchase Truck
Beef	Beef	Large 2	CE	H	Contract Hauling	Purchase Truck
Beef	Beef	Large 2	CE	L	Contract Hauling	Purchase Truck
Beef	Beef	Large 2	CE	M	Contract Hauling	Purchase Truck
Beef	Beef	Large 2	MA	H	Purchase Truck	Purchase Truck
Beef	Beef	Large 2	MA	L	Purchase Truck	Purchase Truck
Beef	Beef	Large 2	MA	M	Purchase Truck	Purchase Truck
Beef	Beef	Large 2	MW	H	Contract Hauling	Purchase Truck
Beef	Beef	Large 2	MW	L	Contract Hauling	Purchase Truck
Beef	Beef	Large 2	MW	M	Contract Hauling	Purchase Truck

Table B-1 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Beef	Beef	Large 2	PA	H	Contract Hauling	Purchase Truck
Beef	Beef	Large 2	PA	L	Contract Hauling	Purchase Truck
Beef	Beef	Large 2	PA	M	Contract Hauling	Purchase Truck
Beef	Beef	Large 2	SO	H	Purchase Truck	Purchase Truck
Beef	Beef	Large 2	SO	L	Purchase Truck	Purchase Truck
Beef	Beef	Large 2	SO	M	Purchase Truck	Purchase Truck
Beef	Beef	Medium 1	CE	H	Contract Hauling	Purchase Truck
Beef	Beef	Medium 1	CE	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 1	CE	M	Contract Hauling	Purchase Truck
Beef	Beef	Medium 1	MA	H	Contract Hauling	Purchase Truck
Beef	Beef	Medium 1	MA	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 1	MA	M	Contract Hauling	Purchase Truck
Beef	Beef	Medium 1	MW	H	Contract Hauling	Purchase Truck
Beef	Beef	Medium 1	MW	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 1	MW	M	Contract Hauling	Purchase Truck
Beef	Beef	Medium 1	PA	H	Contract Hauling	Purchase Truck
Beef	Beef	Medium 1	PA	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 1	PA	M	Contract Hauling	Purchase Truck
Beef	Beef	Medium 1	SO	H	Contract Hauling	Purchase Truck
Beef	Beef	Medium 1	SO	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 1	SO	M	Contract Hauling	Purchase Truck
Beef	Beef	Medium 2	CE	H	Contract Hauling	Purchase Truck
Beef	Beef	Medium 2	CE	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 2	CE	M	Contract Hauling	Purchase Truck
Beef	Beef	Medium 2	MA	H	Contract Hauling	Purchase Truck
Beef	Beef	Medium 2	MA	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 2	MA	M	Contract Hauling	Purchase Truck
Beef	Beef	Medium 2	MW	H	Contract Hauling	Purchase Truck

Table B-1 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Beef	Beef	Medium 2	MW	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 2	MW	M	Contract Hauling	Purchase Truck
Beef	Beef	Medium 2	PA	H	Contract Hauling	Purchase Truck
Beef	Beef	Medium 2	PA	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 2	PA	M	Contract Hauling	Purchase Truck
Beef	Beef	Medium 2	SO	H	Contract Hauling	Purchase Truck
Beef	Beef	Medium 2	SO	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 2	SO	M	Contract Hauling	Purchase Truck
Beef	Beef	Medium 3	CE	H	Contract Hauling	Purchase Truck
Beef	Beef	Medium 3	CE	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 3	CE	M	Contract Hauling	Purchase Truck
Beef	Beef	Medium 3	MA	H	Contract Hauling	Purchase Truck
Beef	Beef	Medium 3	MA	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 3	MA	M	Contract Hauling	Purchase Truck
Beef	Beef	Medium 3	MW	H	Contract Hauling	Purchase Truck
Beef	Beef	Medium 3	MW	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 3	PA	H	Contract Hauling	Purchase Truck
Beef	Beef	Medium 3	PA	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 3	PA	M	Contract Hauling	Purchase Truck
Beef	Beef	Medium 3	SO	H	Contract Hauling	Purchase Truck
Beef	Beef	Medium 3	SO	L	Contract Hauling	Purchase Truck
Beef	Beef	Medium 3	SO	M	Contract Hauling	Purchase Truck
Dairy	Flush	Large 1	CE	H	Purchase Truck	Purchase Truck
Dairy	Flush	Large 1	CE	L	Purchase Truck	Purchase Truck
Dairy	Flush	Large 1	CE	M	Purchase Truck	Purchase Truck
Dairy	Flush	Large 1	MA	H	Purchase Truck	Purchase Truck
Dairy	Flush	Large 1	MA	L	Purchase Truck	Purchase Truck
Dairy	Flush	Large 1	MA	M	Purchase Truck	Purchase Truck

Table B-1 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Dairy	Flush	Large 1	MW	H	Contract Hauling	Purchase Truck
Dairy	Flush	Large 1	MW	L	Contract Hauling	Purchase Truck
Dairy	Flush	Large 1	MW	M	Contract Hauling	Purchase Truck
Dairy	Flush	Large 1	PA	H	Purchase Truck	Purchase Truck
Dairy	Flush	Large 1	PA	L	Purchase Truck	Purchase Truck
Dairy	Flush	Large 1	PA	M	Purchase Truck	Purchase Truck
Dairy	Flush	Large 1	SO	H	Purchase Truck	Purchase Truck
Dairy	Flush	Large 1	SO	L	Purchase Truck	Purchase Truck
Dairy	Flush	Large 1	SO	M	Purchase Truck	Purchase Truck
Dairy	Flush	Medium 1	CE	H	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	CE	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	CE	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	MA	H	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	MA	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	MA	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	MW	H	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	MW	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	MW	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	PA	H	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	PA	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	PA	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	SO	H	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	SO	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	SO	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 2	CE	H	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 2	CE	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 2	CE	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 2	MA	H	Contract Hauling	Purchase Truck

Table B-1 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Dairy	Flush	Medium 2	MA	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 2	MA	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 2	MW	H	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 2	MW	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 2	MW	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 2	PA	H	Purchase Truck	Purchase Truck
Dairy	Flush	Medium 2	PA	L	Purchase Truck	Purchase Truck
Dairy	Flush	Medium 2	PA	M	Purchase Truck	Purchase Truck
Dairy	Flush	Medium 2	SO	H	Purchase Truck	Purchase Truck
Dairy	Flush	Medium 2	SO	L	Purchase Truck	Purchase Truck
Dairy	Flush	Medium 2	SO	M	Purchase Truck	Purchase Truck
Dairy	Flush	Medium 3	CE	H	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	CE	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	CE	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	MA	H	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	MA	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	MA	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	MW	H	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	MW	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	MW	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	PA	H	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	PA	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	PA	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	SO	H	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	SO	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	SO	M	Contract Hauling	Purchase Truck
Dairy	Hose	Large 1	CE	H	Contract Hauling	Purchase Truck
Dairy	Hose	Large 1	CE	L	Contract Hauling	Purchase Truck

Table B-1 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Dairy	Hose	Large 1	CE	M	Contract Hauling	Purchase Truck
Dairy	Hose	Large 1	MA	H	Contract Hauling	Purchase Truck
Dairy	Hose	Large 1	MA	L	Contract Hauling	Purchase Truck
Dairy	Hose	Large 1	MA	M	Contract Hauling	Purchase Truck
Dairy	Hose	Large 1	MW	H	Contract Hauling	Purchase Truck
Dairy	Hose	Large 1	MW	L	Contract Hauling	Purchase Truck
Dairy	Hose	Large 1	MW	M	Contract Hauling	Purchase Truck
Dairy	Hose	Large 1	PA	H	Contract Hauling	Purchase Truck
Dairy	Hose	Large 1	PA	L	Contract Hauling	Purchase Truck
Dairy	Hose	Large 1	PA	M	Contract Hauling	Purchase Truck
Dairy	Hose	Large 1	SO	H	Contract Hauling	Purchase Truck
Dairy	Hose	Large 1	SO	L	Contract Hauling	Purchase Truck
Dairy	Hose	Large 1	SO	M	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	CE	H	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	CE	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	CE	M	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	MA	H	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	MA	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	MA	M	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	MW	H	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	MW	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	MW	M	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	PA	H	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	PA	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	PA	M	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	SO	H	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	SO	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 1	SO	M	Contract Hauling	Purchase Truck

Table B-1 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Dairy	Hose	Medium 2	CE	H	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 2	CE	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 2	CE	M	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 2	MA	H	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 2	MA	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 2	MA	M	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 2	MW	H	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 2	MW	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 2	MW	M	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 2	PA	H	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 2	PA	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 2	PA	M	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 2	SO	H	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 2	SO	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 2	SO	M	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 3	CE	H	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 3	CE	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 3	CE	M	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 3	MA	H	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 3	MA	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 3	MA	M	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 3	MW	H	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 3	MW	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 3	MW	M	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 3	PA	H	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 3	PA	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 3	PA	M	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 3	SO	H	Contract Hauling	Purchase Truck

Table B-1 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Dairy	Hose	Medium 3	SO	L	Contract Hauling	Purchase Truck
Dairy	Hose	Medium 3	SO	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	CE	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	CE	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	CE	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	MA	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	MA	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	MA	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	MW	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	MW	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	MW	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	PA	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	PA	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	PA	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	SO	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	SO	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	SO	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 1	CE	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 1	CE	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 1	CE	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 1	MA	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 1	MA	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 1	MA	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 1	MW	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 1	MW	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 1	MW	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 1	PA	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 1	PA	L	Contract Hauling	Purchase Truck

Table B-1 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Heifers	Heifers	Medium 1	PA	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 1	SO	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 1	SO	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 1	SO	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	CE	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	CE	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	CE	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	MA	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	MA	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	MA	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	MW	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	MW	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	MW	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	PA	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	PA	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	PA	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	SO	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	SO	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 2	SO	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 3	CE	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 3	CE	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 3	CE	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 3	MA	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 3	MA	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 3	MA	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 3	MW	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 3	MW	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 3	MW	M	Contract Hauling	Purchase Truck

Table B-1 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Heifers	Heifers	Medium 3	PA	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 3	PA	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 3	PA	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 3	SO	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 3	SO	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Medium 3	SO	M	Contract Hauling	Purchase Truck

Table B-2

Selected Transportation Option Under Option 2 for Beef Feedlots, Dairies, and Heifer Operations

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Beef	Beef	Large 1	CE	H	Contract Hauling	Contract Hauling
Beef	Beef	Large 1	CE	L	Contract Hauling	Contract Hauling
Beef	Beef	Large 1	CE	M	Contract Hauling	Contract Hauling
Beef	Beef	Large 1	MA	H	Contract Hauling	Purchase Truck
Beef	Beef	Large 1	MA	L	Contract Hauling	Purchase Truck
Beef	Beef	Large 1	MA	M	Contract Hauling	Purchase Truck
Beef	Beef	Large 1	MW	H	Contract Hauling	Contract Hauling
Beef	Beef	Large 1	MW	L	Contract Hauling	Contract Hauling
Beef	Beef	Large 1	MW	M	Contract Hauling	Contract Hauling
Beef	Beef	Large 1	PA	H	Contract Hauling	Contract Hauling
Beef	Beef	Large 1	PA	L	Contract Hauling	Contract Hauling
Beef	Beef	Large 1	PA	M	Contract Hauling	Contract Hauling
Beef	Beef	Large 1	SO	H	Contract Hauling	Contract Hauling
Beef	Beef	Large 1	SO	L	Contract Hauling	Contract Hauling
Beef	Beef	Large 1	SO	M	Contract Hauling	Contract Hauling
Beef	Beef	Large 2	CE	H	Contract Hauling	Contract Hauling
Beef	Beef	Large 2	CE	L	Contract Hauling	Contract Hauling
Beef	Beef	Large 2	CE	M	Contract Hauling	Contract Hauling
Beef	Beef	Large 2	MA	H	Contract Hauling	Purchase Truck
Beef	Beef	Large 2	MA	L	Contract Hauling	Purchase Truck
Beef	Beef	Large 2	MA	M	Contract Hauling	Purchase Truck
Beef	Beef	Large 2	MW	H	Contract Hauling	Contract Hauling
Beef	Beef	Large 2	MW	L	Contract Hauling	Contract Hauling
Beef	Beef	Large 2	MW	M	Contract Hauling	Contract Hauling

Table B-2 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Beef	Beef	Large 2	PA	H	Contract Hauling	Purchase Truck
Beef	Beef	Large 2	PA	L	Contract Hauling	Purchase Truck
Beef	Beef	Large 2	PA	M	Contract Hauling	Purchase Truck
Beef	Beef	Large 2	SO	H	Purchase Truck	Purchase Truck
Beef	Beef	Large 2	SO	L	Purchase Truck	Purchase Truck
Beef	Beef	Large 2	SO	M	Purchase Truck	Purchase Truck
Beef	Beef	Medium 1	CE	H	Contract Hauling	Contract Hauling
Beef	Beef	Medium 1	CE	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 1	CE	M	Contract Hauling	Contract Hauling
Beef	Beef	Medium 1	MA	H	Contract Hauling	Contract Hauling
Beef	Beef	Medium 1	MA	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 1	MA	M	Contract Hauling	Contract Hauling
Beef	Beef	Medium 1	MW	H	Contract Hauling	Contract Hauling
Beef	Beef	Medium 1	MW	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 1	MW	M	Contract Hauling	Contract Hauling
Beef	Beef	Medium 1	PA	H	Contract Hauling	Contract Hauling
Beef	Beef	Medium 1	PA	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 1	PA	M	Contract Hauling	Contract Hauling
Beef	Beef	Medium 1	SO	H	Contract Hauling	Contract Hauling
Beef	Beef	Medium 1	SO	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 1	SO	M	Contract Hauling	Contract Hauling
Beef	Beef	Medium 2	CE	H	Contract Hauling	Contract Hauling
Beef	Beef	Medium 2	CE	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 2	CE	M	Contract Hauling	Contract Hauling
Beef	Beef	Medium 2	MA	H	Contract Hauling	Contract Hauling
Beef	Beef	Medium 2	MA	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 2	MA	M	Contract Hauling	Contract Hauling
Beef	Beef	Medium 2	MW	H	Contract Hauling	Contract Hauling

Table B-2 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Beef	Beef	Medium 2	MW	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 2	MW	M	Contract Hauling	Contract Hauling
Beef	Beef	Medium 2	PA	H	Contract Hauling	Contract Hauling
Beef	Beef	Medium 2	PA	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 2	PA	M	Contract Hauling	Contract Hauling
Beef	Beef	Medium 2	SO	H	Contract Hauling	Contract Hauling
Beef	Beef	Medium 2	SO	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 2	SO	M	Contract Hauling	Contract Hauling
Beef	Beef	Medium 3	CE	H	Contract Hauling	Contract Hauling
Beef	Beef	Medium 3	CE	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 3	CE	M	Contract Hauling	Contract Hauling
Beef	Beef	Medium 3	MA	H	Contract Hauling	Contract Hauling
Beef	Beef	Medium 3	MA	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 3	MA	M	Contract Hauling	Contract Hauling
Beef	Beef	Medium 3	MW	H	Contract Hauling	Contract Hauling
Beef	Beef	Medium 3	MW	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 3	PA	H	Contract Hauling	Contract Hauling
Beef	Beef	Medium 3	PA	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 3	PA	M	Contract Hauling	Contract Hauling
Beef	Beef	Medium 3	SO	H	Contract Hauling	Contract Hauling
Beef	Beef	Medium 3	SO	L	Contract Hauling	Contract Hauling
Beef	Beef	Medium 3	SO	M	Contract Hauling	Contract Hauling
Dairy	Flush	Large 1	CE	H	Contract Hauling	Contract Hauling
Dairy	Flush	Large 1	CE	L	Contract Hauling	Contract Hauling
Dairy	Flush	Large 1	CE	M	Contract Hauling	Contract Hauling
Dairy	Flush	Large 1	MA	H	Contract Hauling	Purchase Truck
Dairy	Flush	Large 1	MA	L	Contract Hauling	Purchase Truck
Dairy	Flush	Large 1	MA	M	Contract Hauling	Purchase Truck

Table B-2 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Dairy	Flush	Large 1	MW	H	Contract Hauling	Contract Hauling
Dairy	Flush	Large 1	MW	L	Contract Hauling	Contract Hauling
Dairy	Flush	Large 1	MW	M	Contract Hauling	Contract Hauling
Dairy	Flush	Large 1	PA	H	Contract Hauling	Purchase Truck
Dairy	Flush	Large 1	PA	L	Contract Hauling	Purchase Truck
Dairy	Flush	Large 1	PA	M	Contract Hauling	Purchase Truck
Dairy	Flush	Large 1	SO	H	Contract Hauling	Purchase Truck
Dairy	Flush	Large 1	SO	L	Contract Hauling	Purchase Truck
Dairy	Flush	Large 1	SO	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	CE	H	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 1	CE	L	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 1	CE	M	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 1	MA	H	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	MA	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	MA	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 1	MW	H	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 1	MW	L	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 1	MW	M	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 1	PA	H	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 1	PA	L	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 1	PA	M	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 1	SO	H	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 1	SO	L	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 1	SO	M	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 2	CE	H	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 2	CE	L	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 2	CE	M	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 2	MA	H	Contract Hauling	Purchase Truck

Table B-2 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Dairy	Flush	Medium 2	MA	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 2	MA	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 2	MW	H	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 2	MW	L	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 2	MW	M	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 2	PA	H	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 2	PA	L	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 2	PA	M	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 2	SO	H	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 2	SO	L	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 2	SO	M	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 3	CE	H	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 3	CE	L	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 3	CE	M	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 3	MA	H	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	MA	L	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	MA	M	Contract Hauling	Purchase Truck
Dairy	Flush	Medium 3	MW	H	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 3	MW	L	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 3	MW	M	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 3	PA	H	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 3	PA	L	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 3	PA	M	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 3	SO	H	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 3	SO	L	Contract Hauling	Contract Hauling
Dairy	Flush	Medium 3	SO	M	Contract Hauling	Contract Hauling
Dairy	Hose	Large 1	CE	H	Contract Hauling	Contract Hauling
Dairy	Hose	Large 1	CE	L	Contract Hauling	Contract Hauling

Table B-2 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Dairy	Hose	Large 1	CE	M	Contract Hauling	Contract Hauling
Dairy	Hose	Large 1	MA	H	Contract Hauling	Contract Hauling
Dairy	Hose	Large 1	MA	L	Contract Hauling	Contract Hauling
Dairy	Hose	Large 1	MA	M	Contract Hauling	Contract Hauling
Dairy	Hose	Large 1	MW	H	Contract Hauling	Contract Hauling
Dairy	Hose	Large 1	MW	L	Contract Hauling	Contract Hauling
Dairy	Hose	Large 1	MW	M	Contract Hauling	Contract Hauling
Dairy	Hose	Large 1	PA	H	Contract Hauling	Contract Hauling
Dairy	Hose	Large 1	PA	L	Contract Hauling	Contract Hauling
Dairy	Hose	Large 1	PA	M	Contract Hauling	Contract Hauling
Dairy	Hose	Large 1	SO	H	Contract Hauling	Contract Hauling
Dairy	Hose	Large 1	SO	L	Contract Hauling	Contract Hauling
Dairy	Hose	Large 1	SO	M	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	CE	H	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	CE	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	CE	M	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	MA	H	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	MA	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	MA	M	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	MW	H	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	MW	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	MW	M	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	PA	H	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	PA	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	PA	M	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	SO	H	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	SO	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 1	SO	M	Contract Hauling	Contract Hauling

Table B-2 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Dairy	Hose	Medium 2	CE	H	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 2	CE	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 2	CE	M	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 2	MA	H	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 2	MA	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 2	MA	M	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 2	MW	H	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 2	MW	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 2	MW	M	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 2	PA	H	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 2	PA	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 2	PA	M	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 2	SO	H	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 2	SO	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 2	SO	M	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 3	CE	H	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 3	CE	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 3	CE	M	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 3	MA	H	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 3	MA	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 3	MA	M	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 3	MW	H	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 3	MW	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 3	MW	M	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 3	PA	H	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 3	PA	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 3	PA	M	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 3	SO	H	Contract Hauling	Contract Hauling

Table B-2 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Dairy	Hose	Medium 3	SO	L	Contract Hauling	Contract Hauling
Dairy	Hose	Medium 3	SO	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Large 1	CE	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Large 1	CE	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Large 1	CE	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Large 1	MA	H	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	MA	L	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	MA	M	Contract Hauling	Purchase Truck
Heifers	Heifers	Large 1	MW	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Large 1	MW	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Large 1	MW	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Large 1	PA	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Large 1	PA	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Large 1	PA	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Large 1	SO	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Large 1	SO	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Large 1	SO	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 1	CE	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 1	CE	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 1	CE	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 1	MA	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 1	MA	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 1	MA	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 1	MW	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 1	MW	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 1	MW	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 1	PA	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 1	PA	L	Contract Hauling	Contract Hauling

Table B-2 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Heifers	Heifers	Medium 1	PA	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 1	SO	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 1	SO	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 1	SO	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	CE	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	CE	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	CE	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	MA	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	MA	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	MA	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	MW	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	MW	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	MW	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	PA	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	PA	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	PA	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	SO	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	SO	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 2	SO	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 3	CE	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 3	CE	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 3	CE	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 3	MA	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 3	MA	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 3	MA	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 3	MW	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 3	MW	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 3	MW	M	Contract Hauling	Contract Hauling

Table B-2 (Continued)

Animal	Farm Type	Size Class	Region	Performance Needs	Category 2 Transportation Type	Category 3 Transportation Type
Heifers	Heifers	Medium 3	PA	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 3	PA	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 3	PA	M	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 3	SO	H	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 3	SO	L	Contract Hauling	Contract Hauling
Heifers	Heifers	Medium 3	SO	M	Contract Hauling	Contract Hauling

Appendix C

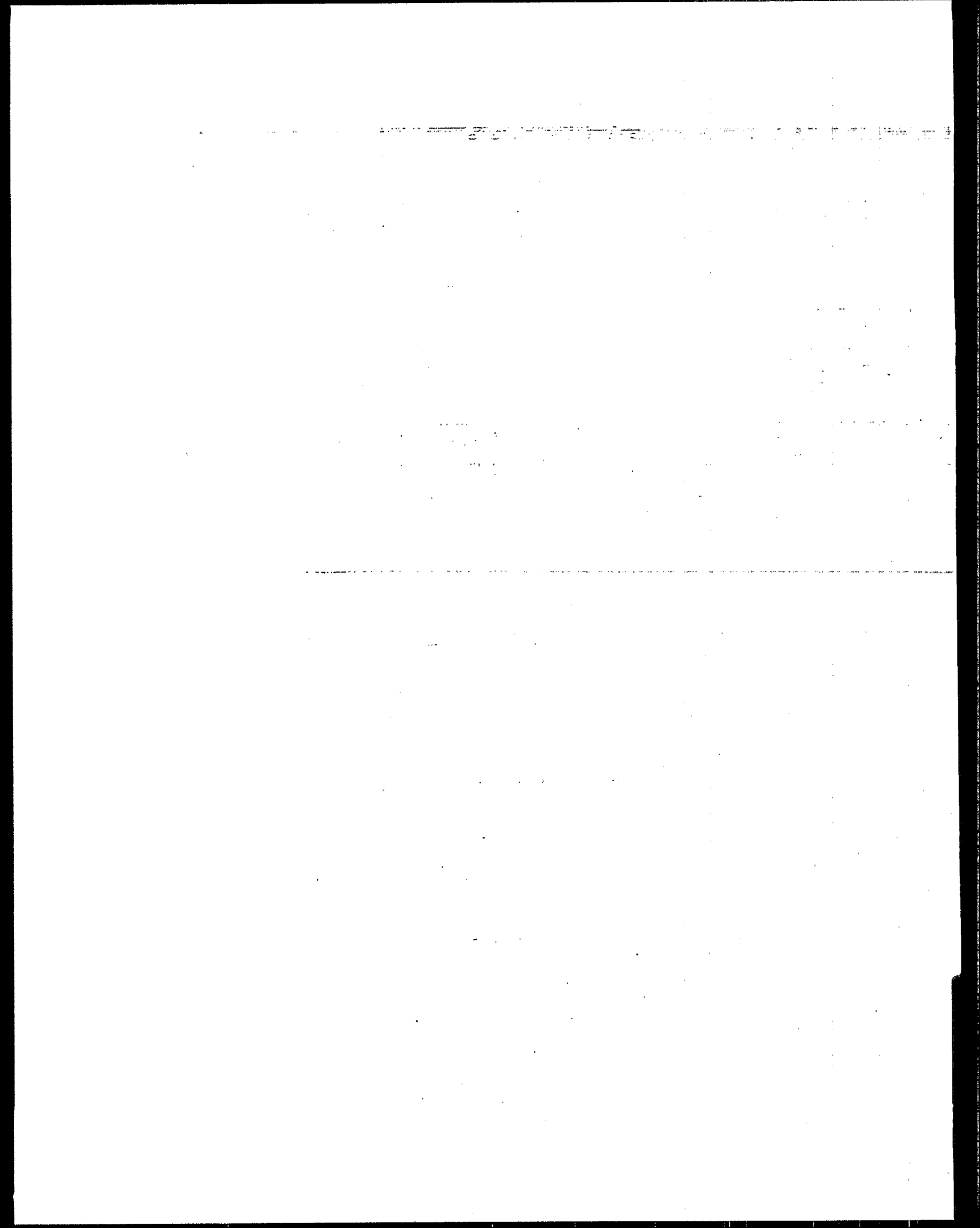

Table C-1a

Summary of Industry Costs for Option 1

Animal Type	Manure Type	Operation Type	Capital	Annual	Fixed	3-Year Recurring	5-Year Recurring
Beef	Solid/Liquid	Beef	$66,271,376	$8,689,062	$4,305,153	$592,050	$2,530,516
Dairy	Solid/Liquid	Flush	$262,639,714	$45,358,315	$2,626,098	$183,113	$894,258
Dairy	Solid/Liquid	Hose	$33,153,994	$4,072,126	$2,461,447	$2,798,726	$739,387
Heifers	Solid/Liquid	Heifers	$13,452,388	$1,319,976	$694,719	$204,401	$82,858
Veal	Liquid	Flush	$0	$30,553	$38,948	$2,422	$10,090
Chicken	Liquid	LW	$9,118,438	$1,296,980	$132,432	$19,525	$81,264
Chicken	Solid	BR	$93,407,347	$4,060,985	$2,184,684	$74,888	$1,009,264
Chicken	Solid	LA	$32,664,307	$1,746,196	$356,844	$51,695	$247,758
Swine	Evapor	FF	$108,469	$150,883	$84,495	$3,970	$35,289
Swine	Evapor	GF	$111,079	$154,573	$86,411	$4,054	$36,036
Swine	Liquid	FF	$5,308,843	$1,686,581	$844,688	$30,149	$241,083
Swine	Liquid	GF	$4,017,456	$1,135,603	$527,369	$22,505	$171,891
Swine	Pit	FF	$360,663	$1,497,912	$889,058	$30,374	$272,588
Swine	Pit	GF	$334,852	$1,720,540	$957,771	$38,814	$329,614
Turkey	Solid	SL	$31,170,087	$1,668,463	$701,880	$27,143	$450,698

Table C-1b

Model Farm Costs for Option 1

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Large 1	CE	1	H	72.1	$31,405	$2,727	$3,584	$340	$1,535
Beef	Beef	Liquid/Solid	Large 1	CE	1	L	72.1	$10,828	$2,182	$2,200	$272	$1,535
Beef	Beef	Liquid/Solid	Large 1	CE	1	M	144.2	$22,322	$2,454	$2,942	$306	$1,535
Beef	Beef	Liquid/Solid	Large 1	CE	2	H	22.3	$31,405	$1,711	$3,204	$60	$215
Beef	Beef	Liquid/Solid	Large 1	CE	2	L	22.3	$10,828	$1,368	$1,938	$48	$215
Beef	Beef	Liquid/Solid	Large 1	CE	2	M	44.5	$22,322	$1,540	$2,621	$54	$215
Beef	Beef	Liquid/Solid	Large 1	CE	3	H	11.7	$4,558	$1,045	$1,474	$20	$0
Beef	Beef	Liquid/Solid	Large 1	CE	3	L	11.7	$1,606	$836	$1,125	$16	$0
Beef	Beef	Liquid/Solid	Large 1	CE	3	M	23.3	$3,529	$941	$1,312	$18	$0
Beef	Beef	Liquid/Solid	Large 1	MA	1	H	1.4	$56,920	$2,176	$5,882	$180	$820
Beef	Beef	Liquid/Solid	Large 1	MA	1	L	1.4	$18,153	$1,709	$2,731	$141	$820
Beef	Beef	Liquid/Solid	Large 1	MA	1	M	2.7	$38,528	$2,074	$4,558	$172	$820
Beef	Beef	Liquid/Solid	Large 1	MA	2	H	0.4	$29,316	$1,591	$29,541	$40	$60
Beef	Beef	Liquid/Solid	Large 1	MA	2	L	0.4	$9,250	$1,249	$28,335	$31	$60
Beef	Beef	Liquid/Solid	Large 1	MA	2	M	0.8	$19,163	$1,516	$29,058	$38	$60
Beef	Beef	Liquid/Solid	Large 1	MA	3	H	0.2	$7,734	$1,045	$1,593	$20	$0
Beef	Beef	Liquid/Solid	Large 1	MA	3	L	0.2	$2,289	$821	$1,141	$16	$0
Beef	Beef	Liquid/Solid	Large 1	MA	3	M	0.4	$4,023	$996	$1,438	$19	$0
Beef	Beef	Liquid/Solid	Large 1	MW	1	H	145.5	$32,221	$2,246	$3,371	$200	$910
Beef	Beef	Liquid/Solid	Large 1	MW	1	L	145.5	$11,851	$1,797	$2,063	$160	$910
Beef	Beef	Liquid/Solid	Large 1	MW	1	M	291.0	$23,092	$2,021	$2,746	$180	$910
Beef	Beef	Liquid/Solid	Large 1	MW	2	H	44.9	$32,221	$1,599	$4,953	$40	$70
Beef	Beef	Liquid/Solid	Large 1	MW	2	L	44.9	$11,851	$1,279	$3,720	$32	$70
Beef	Beef	Liquid/Solid	Large 1	MW	2	M	89.9	$23,092	$1,439	$4,366	$36	$70
Beef	Beef	Liquid/Solid	Large 1	MW	3	H	23.5	$5,373	$1,045	$1,541	$20	$0
Beef	Beef	Liquid/Solid	Large 1	MW	3	L	23.5	$1,112	$836	$1,136	$16	$0

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Large 1	MW	3	M	47.1	$4,299	$941	$1,368	$18	$0
Beef	Beef	Liquid/Solid	Large 1	PA	1	H	9.5	$61,892	$2,142	$3,523	$180	$775
Beef	Beef	Liquid/Solid	Large 1	PA	1	L	9.5	$23,720	$1,713	$2,099	$144	$775
Beef	Beef	Liquid/Solid	Large 1	PA	1	M	19.7	$43,794	$1,928	$2,837	$162	$775
Beef	Beef	Liquid/Solid	Large 1	PA	2	H	2.9	$404,854	$1,641	$37,476	$40	$125
Beef	Beef	Liquid/Solid	Large 1	PA	2	L	2.9	$384,891	$1,313	$36,258	$32	$125
Beef	Beef	Liquid/Solid	Large 1	PA	2	M	6.1	$395,861	$1,477	$36,893	$36	$125
Beef	Beef	Liquid/Solid	Large 1	PA	3	H	1.5	$4,695	$1,045	$1,507	$20	$0
Beef	Beef	Liquid/Solid	Large 1	PA	3	L	1.5	$840	$836	$1,122	$16	$0
Beef	Beef	Liquid/Solid	Large 1	PA	3	M	3.2	$3,756	$941	$1,341	$18	$0
Beef	Beef	Liquid/Solid	Large 1	SO	1	H	0.0	$67,298	$2,515	$6,450	$280	$1,260
Beef	Beef	Liquid/Solid	Large 1	SO	1	L	0.0	$18,479	$2,012	$2,755	$224	$1,260
Beef	Beef	Liquid/Solid	Large 1	SO	1	M	0.0	$47,291	$2,339	$4,963	$260	$1,260
Beef	Beef	Liquid/Solid	Large 1	SO	2	H	0.0	$408,209	$1,618	$47,299	$40	$95
Beef	Beef	Liquid/Solid	Large 1	SO	2	L	0.0	$383,775	$1,295	$45,847	$32	$95
Beef	Beef	Liquid/Solid	Large 1	SO	2	M	0.0	$398,223	$1,505	$46,727	$37	$95
Beef	Beef	Liquid/Solid	Large 1	SO	3	H	0.0	$8,855	$1,045	$1,661	$20	$0
Beef	Beef	Liquid/Solid	Large 1	SO	3	L	0.0	$4,019	$836	$1,214	$16	$0
Beef	Beef	Liquid/Solid	Large 1	SO	3	M	0.0	$6,923	$972	$1,501	$19	$0
Beef	Beef	Liquid/Solid	Large 2	CE	1	H	2.6	$113,478	$18,189	$21,798	$4,500	$21,615
Beef	Beef	Liquid/Solid	Large 2	CE	1	L	2.6	$41,498	$14,552	$13,087	$3,600	$21,615
Beef	Beef	Liquid/Solid	Large 2	CE	1	M	5.4	$81,624	$16,370	$17,562	$4,050	$21,615
Beef	Beef	Liquid/Solid	Large 2	CE	2	H	17.5	$113,478	$6,481	$17,423	$1,340	$6,410
Beef	Beef	Liquid/Solid	Large 2	CE	2	L	17.5	$41,498	$5,185	$10,074	$1,072	$6,410
Beef	Beef	Liquid/Solid	Large 2	CE	2	M	35.5	$81,624	$5,833	$13,867	$1,206	$6,410
Beef	Beef	Liquid/Solid	Large 2	CE	3	H	12.9	$21,888	$1,045	$2,152	$20	$0
Beef	Beef	Liquid/Solid	Large 2	CE	3	L	12.9	$4,862	$836	$1,323	$16	$0
Beef	Beef	Liquid/Solid	Large 2	CE	3	M	26.1	$17,511	$941	$1,857	$18	$0

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Large 2	MA	1	H	0.1	$375,996	$10,420	$21,119	$2,400	$11,525
Beef	Beef	Liquid/Solid	Large 2	MA	1	L	0.1	$122,612	$8,182	$9,978	$1,885	$11,525
Beef	Beef	Liquid/Solid	Large 2	MA	1	M	0.1	$261,194	$9,928	$16,535	$2,287	$11,525
Beef	Beef	Liquid/Solid	Large 2	MA	2	H	0.5	$340,049	$3,690	$35,845	$600	$2,785
Beef	Beef	Liquid/Solid	Large 2	MA	2	L	0.5	$227,864	$2,897	$27,326	$471	$2,785
Beef	Beef	Liquid/Solid	Large 2	MA	2	M	0.5	$287,457	$3,516	$32,229	$572	$2,785
Beef	Beef	Liquid/Solid	Large 2	MA	3	H	0.4	$56,342	$1,045	$3,628	$20	$0
Beef	Beef	Liquid/Solid	Large 2	MA	3	L	0.4	$19,518	$821	$1,911	$16	$0
Beef	Beef	Liquid/Solid	Large 2	MA	3	M	0.4	$36,953	$996	$2,946	$19	$0
Beef	Beef	Liquid/Solid	Large 2	MW	1	H	5.4	$141,592	$11,409	$19,335	$2,660	$12,810
Beef	Beef	Liquid/Solid	Large 2	MW	1	L	5.4	$52,744	$9,127	$10,524	$2,128	$12,810
Beef	Beef	Liquid/Solid	Large 2	MW	1	M	10.7	$103,687	$10,268	$15,168	$2,394	$12,810
Beef	Beef	Liquid/Solid	Large 2	MW	2	H	35.5	$141,592	$3,928	$15,750	$660	$3,095
Beef	Beef	Liquid/Solid	Large 2	MW	2	L	35.5	$52,744	$3,143	$7,810	$528	$3,095
Beef	Beef	Liquid/Solid	Large 2	MW	2	M	71.0	$103,687	$3,535	$12,018	$594	$3,095
Beef	Beef	Liquid/Solid	Large 2	MW	3	H	26.1	$45,725	$1,045	$3,344	$20	$0
Beef	Beef	Liquid/Solid	Large 2	MW	3	L	26.1	$14,397	$836	$1,800	$16	$0
Beef	Beef	Liquid/Solid	Large 2	MW	3	M	52.3	$36,580	$941	$2,810	$18	$0
Beef	Beef	Liquid/Solid	Large 2	PA	1	H	0.3	$177,358	$9,973	$19,898	$2,280	$10,945
Beef	Beef	Liquid/Solid	Large 2	PA	1	L	0.3	$67,050	$7,978	$10,415	$1,824	$10,945
Beef	Beef	Liquid/Solid	Large 2	PA	1	M	0.7	$127,770	$8,976	$15,347	$2,052	$10,945
Beef	Beef	Liquid/Solid	Large 2	PA	2	H	2.1	$177,358	$4,182	$42,483	$720	$3,425
Beef	Beef	Liquid/Solid	Large 2	PA	2	L	2.1	$67,050	$3,346	$33,673	$576	$3,425
Beef	Beef	Liquid/Solid	Large 2	PA	2	M	4.8	$127,770	$3,764	$38,269	$648	$3,425
Beef	Beef	Liquid/Solid	Large 2	PA	3	H	1.6	$36,191	$1,045	$2,868	$20	$0
Beef	Beef	Liquid/Solid	Large 2	PA	3	L	1.6	$10,583	$836	$1,609	$16	$0
Beef	Beef	Liquid/Solid	Large 2	PA	3	M	3.5	$28,952	$941	$2,429	$18	$0
Beef	Beef	Liquid/Solid	Large 2	SO	1	H	0.0	$394,374	$15,221	$26,995	$3,700	$17,760

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Large 2	SO	1	L	0.0	$111,006	$12,177	$12,408	$2,960	$17,760
Beef	Beef	Liquid/Solid	Large 2	SO	1	M	0.0	$280,135	$14,155	$21,243	$3,441	$17,760
Beef	Beef	Liquid/Solid	Large 2	SO	2	H	0.0	$818,780	$4,848	$211,534	$900	$4,290
Beef	Beef	Liquid/Solid	Large 2	SO	2	L	0.0	$609,340	$3,879	$198,923	$720	$4,290
Beef	Beef	Liquid/Solid	Large 2	SO	2	M	0.0	$734,922	$4,509	$206,520	$837	$4,290
Beef	Beef	Liquid/Solid	Large 2	SO	3	H	0.0	$76,278	$1,045	$4,670	$20	$0
Beef	Beef	Liquid/Solid	Large 2	SO	3	L	0.0	$32,302	$836	$2,444	$16	$0
Beef	Beef	Liquid/Solid	Large 2	SO	3	M	0.0	$60,419	$972	$3,900	$19	$0
Beef	Beef	Liquid/Solid	Medium 1	CE	1	H	3.6	$34,623	$1,784	$3,108	$319	$310
Beef	Beef	Liquid/Solid	Medium 1	CE	1	L	3.6	$15,113	$1,427	$1,876	$303	$310
Beef	Beef	Liquid/Solid	Medium 1	CE	1	M	7.1	$26,064	$1,605	$2,550	$311	$310
Beef	Beef	Liquid/Solid	Medium 1	CE	2	H	0.4	$34,623	$1,599	$3,292	$279	$70
Beef	Beef	Liquid/Solid	Medium 1	CE	2	L	0.4	$15,113	$1,279	$2,082	$271	$70
Beef	Beef	Liquid/Solid	Medium 1	CE	2	M	0.8	$26,064	$1,439	$2,745	$275	$70
Beef	Beef	Liquid/Solid	Medium 1	CE	3	H	0.3	$7,775	$1,045	$1,547	$259	$0
Beef	Beef	Liquid/Solid	Medium 1	CE	3	L	0.3	$6,552	$836	$1,273	$255	$0
Beef	Beef	Liquid/Solid	Medium 1	CE	3	M	0.6	$7,271	$941	$1,413	$257	$0
Beef	Beef	Liquid/Solid	Medium 1	MA	1	H	0.5	$32,481	$1,672	$2,924	$834	$165
Beef	Beef	Liquid/Solid	Medium 1	MA	1	L	0.5	$15,740	$1,313	$1,843	$821	$165
Beef	Beef	Liquid/Solid	Medium 1	MA	1	M	0.9	$24,482	$1,593	$2,501	$831	$165
Beef	Beef	Liquid/Solid	Medium 1	MA	2	H	0.1	$32,481	$1,568	$9,080	$794	$30
Beef	Beef	Liquid/Solid	Medium 1	MA	2	L	0.1	$15,740	$1,231	$8,012	$790	$30
Beef	Beef	Liquid/Solid	Medium 1	MA	2	M	0.1	$24,482	$1,494	$8,661	$793	$30
Beef	Beef	Liquid/Solid	Medium 1	MA	3	H	0.0	$10,899	$1,045	$1,691	$794	$0
Beef	Beef	Liquid/Solid	Medium 1	MA	3	L	0.0	$8,779	$821	$1,374	$790	$0
Beef	Beef	Liquid/Solid	Medium 1	MA	3	M	0.1	$9,342	$996	$1,598	$793	$0
Beef	Beef	Liquid/Solid	Medium 1	MW	1	H	15.3	$35,538	$1,687	$3,109	$463	$185
Beef	Beef	Liquid/Solid	Medium 1	MW	1	L	15.3	$17,089	$1,350	$1,944	$451	$185

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Medium 1	MW	1	M	30.4	$27,032	$1,519	$2,555	$457	$185
Beef	Beef	Liquid/Solid	Medium 1	MW	2	H	1.6	$35,538	$1,568	$3,239	$423	$30
Beef	Beef	Liquid/Solid	Medium 1	MW	2	L	1.6	$17,089	$1,254	$2,088	$419	$30
Beef	Beef	Liquid/Solid	Medium 1	MW	2	M	3.3	$27,032	$1,411	$2,692	$421	$30
Beef	Beef	Liquid/Solid	Medium 1	MW	3	H	1.3	$8,690	$1,045	$1,603	$423	$0
Beef	Beef	Liquid/Solid	Medium 1	MW	3	L	1.3	$7,146	$836	$1,317	$419	$0
Beef	Beef	Liquid/Solid	Medium 1	MW	3	M	2.5	$8,239	$941	$1,469	$421	$0
Beef	Beef	Liquid/Solid	Medium 1	PA	1	H	0.4	$38,131	$1,664	$3,231	$896	$155
Beef	Beef	Liquid/Solid	Medium 1	PA	1	L	0.4	$20,490	$1,331	$2,112	$884	$155
Beef	Beef	Liquid/Solid	Medium 1	PA	1	M	0.9	$29,721	$1,498	$2,682	$890	$155
Beef	Beef	Liquid/Solid	Medium 1	PA	2	H	0.0	$38,131	$1,576	$5,423	$856	$40
Beef	Beef	Liquid/Solid	Medium 1	PA	2	L	0.0	$20,490	$1,261	$4,314	$852	$40
Beef	Beef	Liquid/Solid	Medium 1	PA	2	M	0.1	$29,721	$1,418	$4,879	$854	$40
Beef	Beef	Liquid/Solid	Medium 1	PA	3	H	0.0	$11,283	$1,045	$1,739	$856	$0
Beef	Beef	Liquid/Solid	Medium 1	PA	3	L	0.0	$9,751	$836	$1,456	$852	$0
Beef	Beef	Liquid/Solid	Medium 1	PA	3	M	0.1	$10,927	$941	$1,608	$854	$0
Beef	Beef	Liquid/Solid	Medium 1	SO	1	H	0.1	$38,031	$1,741	$3,247	$1,000	$255
Beef	Beef	Liquid/Solid	Medium 1	SO	1	L	0.1	$16,811	$1,393	$1,934	$984	$255
Beef	Beef	Liquid/Solid	Medium 1	SO	1	M	0.1	$29,292	$1,619	$2,726	$995	$255
Beef	Beef	Liquid/Solid	Medium 1	SO	2	H	0.0	$38,031	$1,580	$16,476	$940	$45
Beef	Beef	Liquid/Solid	Medium 1	SO	2	L	0.0	$16,811	$1,264	$15,182	$936	$45
Beef	Beef	Liquid/Solid	Medium 1	SO	2	M	0.0	$29,292	$1,469	$15,962	$939	$45
Beef	Beef	Liquid/Solid	Medium 1	SO	3	H	0.0	$11,988	$1,045	$1,750	$940	$0
Beef	Beef	Liquid/Solid	Medium 1	SO	3	L	0.0	$10,367	$836	$1,456	$936	$0
Beef	Beef	Liquid/Solid	Medium 1	SO	3	M	0.0	$11,304	$972	$1,645	$939	$0
Beef	Beef	Liquid/Solid	Medium 2	CE	1	H	1.9	$35,625	$1,899	$3,216	$477	$460
Beef	Beef	Liquid/Solid	Medium 2	CE	1	L	1.9	$16,085	$1,519	$1,977	$453	$460
Beef	Beef	Liquid/Solid	Medium 2	CE	1	M	3.9	$26,984	$1,709	$2,649	$465	$460

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Medium 2	CE	2	H	0.2	$35,625	$1,718	$3,403	$417	$225
Beef	Beef	Liquid/Solid	Medium 2	CE	2	L	0.2	$16,085	$1,375	$2,184	$405	$225
Beef	Beef	Liquid/Solid	Medium 2	CE	2	M	0.4	$26,984	$1,546	$2,847	$411	$225
Beef	Beef	Liquid/Solid	Medium 2	CE	3	H	0.2	$8,777	$1,045	$1,588	$377	$0
Beef	Beef	Liquid/Solid	Medium 2	CE	3	L	0.2	$7,261	$836	$1,307	$373	$0
Beef	Beef	Liquid/Solid	Medium 2	CE	3	M	0.3	$8,191	$941	$1,452	$375	$0
Beef	Beef	Liquid/Solid	Medium 2	MA	1	H	0.3	$34,648	$1,734	$4,304	$1,215	$245
Beef	Beef	Liquid/Solid	Medium 2	MA	1	L	0.3	$17,380	$1,361	$2,353	$1,202	$245
Beef	Beef	Liquid/Solid	Medium 2	MA	1	M	0.5	$26,285	$1,652	$3,498	$1,212	$245
Beef	Beef	Liquid/Solid	Medium 2	MA	2	H	0.0	$34,648	$1,630	$3,147	$1,195	$110
Beef	Beef	Liquid/Solid	Medium 2	MA	2	L	0.0	$17,380	$1,280	$2,057	$1,186	$110
Beef	Beef	Liquid/Solid	Medium 2	MA	2	M	0.1	$26,285	$1,553	$2,717	$1,193	$110
Beef	Beef	Liquid/Solid	Medium 2	MA	3	H	0.0	$13,066	$1,045	$1,785	$1,175	$0
Beef	Beef	Liquid/Solid	Medium 2	MA	3	L	0.0	$10,419	$821	$1,453	$1,170	$0
Beef	Beef	Liquid/Solid	Medium 2	MA	3	M	0.0	$11,145	$996	$1,683	$1,174	$0
Beef	Beef	Liquid/Solid	Medium 2	MW	1	H	8.3	$36,908	$1,757	$3,212	$681	$275
Beef	Beef	Liquid/Solid	Medium 2	MW	1	L	8.3	$18,388	$1,405	$2,044	$665	$275
Beef	Beef	Liquid/Solid	Medium 2	MW	1	M	16.7	$28,323	$1,581	$2,651	$673	$275
Beef	Beef	Liquid/Solid	Medium 2	MW	2	H	0.9	$36,908	$1,637	$3,342	$641	$120
Beef	Beef	Liquid/Solid	Medium 2	MW	2	L	0.9	$18,388	$1,310	$2,188	$633	$120
Beef	Beef	Liquid/Solid	Medium 2	MW	2	M	1.8	$28,323	$1,474	$2,788	$637	$120
Beef	Beef	Liquid/Solid	Medium 2	MW	3	H	0.7	$10,060	$1,045	$1,666	$621	$0
Beef	Beef	Liquid/Solid	Medium 2	MW	3	L	0.7	$8,084	$836	$1,367	$617	$0
Beef	Beef	Liquid/Solid	Medium 2	MW	3	M	1.4	$9,529	$941	$1,529	$619	$0
Beef	Beef	Liquid/Solid	Medium 2	PA	1	H	0.3	$40,490	$1,726	$3,377	$1,307	$235
Beef	Beef	Liquid/Solid	Medium 2	PA	1	L	0.3	$22,481	$1,381	$2,240	$1,295	$235
Beef	Beef	Liquid/Solid	Medium 2	PA	1	M	0.4	$31,992	$1,553	$2,821	$1,301	$235
Beef	Beef	Liquid/Solid	Medium 2	PA	2	H	0.0	$40,490	$1,634	$3,728	$1,287	$115

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Medium 2	PA	2	L	0.0	$22,481	$1,307	$2,602	$1,279	$115
Beef	Beef	Liquid/Solid	Medium 2	PA	2	M	0.0	$31,992	$1,470	$3,177	$1,283	$115
Beef	Beef	Liquid/Solid	Medium 2	PA	3	H	0.0	$13,642	$1,045	$1,849	$1,267	$0
Beef	Beef	Liquid/Solid	Medium 2	PA	3	L	0.0	$11,741	$836	$1,555	$1,263	$0
Beef	Beef	Liquid/Solid	Medium 2	PA	3	M	0.0	$13,198	$941	$1,715	$1,265	$0
Beef	Beef	Liquid/Solid	Medium 2	SO	1	H	0.0	$40,590	$1,838	$4,865	$1,473	$380
Beef	Beef	Liquid/Solid	Medium 2	SO	1	L	0.0	$18,906	$1,470	$2,435	$1,453	$380
Beef	Beef	Liquid/Solid	Medium 2	SO	1	M	0.1	$31,666	$1,709	$3,886	$1,466	$380
Beef	Beef	Liquid/Solid	Medium 2	SO	2	H	0.0	$40,590	$1,676	$3,555	$1,433	$170
Beef	Beef	Liquid/Solid	Medium 2	SO	2	L	0.0	$18,906	$1,341	$2,233	$1,421	$170
Beef	Beef	Liquid/Solid	Medium 2	SO	2	M	0.0	$31,666	$1,559	$3,031	$1,429	$170
Beef	Beef	Liquid/Solid	Medium 2	SO	3	H	0.0	$14,548	$1,045	$1,865	$1,393	$0
Beef	Beef	Liquid/Solid	Medium 2	SO	3	L	0.0	$12,463	$836	$1,555	$1,389	$0
Beef	Beef	Liquid/Solid	Medium 2	SO	3	M	0.0	$13,677	$972	$1,754	$1,392	$0
Beef	Beef	Liquid/Solid	Medium 3	CE	1	H	1.3	$36,821	$2,038	$2,001	$655	$640
Beef	Beef	Liquid/Solid	Medium 3	CE	1	L	1.3	$16,777	$1,630	$1,639	$623	$640
Beef	Beef	Liquid/Solid	Medium 3	CE	1	M	2.6	$28,042	$1,834	$1,825	$639	$640
Beef	Beef	Liquid/Solid	Medium 3	CE	2	H	0.1	$36,821	$1,853	$3,527	$595	$400
Beef	Beef	Liquid/Solid	Medium 3	CE	2	L	0.1	$16,777	$1,482	$2,273	$575	$400
Beef	Beef	Liquid/Solid	Medium 3	CE	2	M	0.3	$28,042	$1,668	$2,960	$585	$400
Beef	Beef	Liquid/Solid	Medium 3	CE	3	H	0.1	$9,973	$1,045	$1,634	$515	$0
Beef	Beef	Liquid/Solid	Medium 3	CE	3	L	0.1	$8,216	$836	$1,346	$511	$0
Beef	Beef	Liquid/Solid	Medium 3	CE	3	M	0.2	$9,249	$941	$1,495	$513	$0
Beef	Beef	Liquid/Solid	Medium 3	MA	1	H	0.1	$61,183	$1,807	$3,175	$1,682	$340
Beef	Beef	Liquid/Solid	Medium 3	MA	1	L	0.1	$26,942	$1,419	$2,060	$1,665	$340
Beef	Beef	Liquid/Solid	Medium 3	MA	1	M	0.2	$45,216	$1,722	$2,737	$1,678	$340
Beef	Beef	Liquid/Solid	Medium 3	MA	2	H	0.0	$36,939	$1,703	$3,291	$1,662	$205
Beef	Beef	Liquid/Solid	Medium 3	MA	2	L	0.0	$19,123	$1,337	$2,174	$1,649	$205

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Medium 3	MA	2	M	0.0	$28,209	$1,623	$2,849	$1,659	$205
Beef	Beef	Liquid/Solid	Medium 3	MA	3	H	0.0	$15,357	$1,045	$1,885	$1,622	$0
Beef	Beef	Liquid/Solid	Medium 3	MA	3	L	0.0	$12,163	$821	$1,537	$1,618	$0
Beef	Beef	Liquid/Solid	Medium 3	MA	3	M	0.0	$13,069	$996	$1,774	$1,621	$0
Beef	Beef	Liquid/Solid	Medium 3	MW	1	H	4.1	$38,608	$1,838	$3,331	$934	$380
Beef	Beef	Liquid/Solid	Medium 3	MW	1	L	4.1	$19,351	$1,470	$2,124	$914	$380
Beef	Beef	Liquid/Solid	Medium 3	MW	1	M	8.2	$29,861	$1,654	$2,761	$924	$380
Beef	Beef	Liquid/Solid	Medium 3	MW	2	H	0.4	$38,608	$1,722	$3,464	$894	$230
Beef	Beef	Liquid/Solid	Medium 3	MW	2	L	0.4	$19,351	$1,378	$2,269	$882	$230
Beef	Beef	Liquid/Solid	Medium 3	MW	2	M	0.9	$29,861	$1,550	$2,900	$888	$230
Beef	Beef	Liquid/Solid	Medium 3	MW	3	H	0.3	$11,761	$1,045	$1,739	$854	$0
Beef	Beef	Liquid/Solid	Medium 3	MW	3	L	0.3	$9,408	$836	$1,426	$850	$0
Beef	Beef	Liquid/Solid	Medium 3	MW	3	M	0.7	$11,067	$941	$1,596	$852	$0
Beef	Beef	Liquid/Solid	Medium 3	PA	1	H	0.3	$42,970	$1,795	$3,534	$1,811	$325
Beef	Beef	Liquid/Solid	Medium 3	PA	1	L	0.3	$24,578	$1,436	$2,377	$1,795	$325
Beef	Beef	Liquid/Solid	Medium 3	PA	1	M	0.4	$34,378	$1,616	$2,971	$1,803	$325
Beef	Beef	Liquid/Solid	Medium 3	PA	2	H	0.0	$42,970	$1,703	$3,884	$1,791	$205
Beef	Beef	Liquid/Solid	Medium 3	PA	2	L	0.0	$24,578	$1,362	$2,739	$1,779	$205
Beef	Beef	Liquid/Solid	Medium 3	PA	2	M	0.0	$34,378	$1,533	$3,327	$1,785	$205
Beef	Beef	Liquid/Solid	Medium 3	PA	3	H	0.0	$16,123	$1,045	$1,966	$1,751	$0
Beef	Beef	Liquid/Solid	Medium 3	PA	3	L	0.0	$13,839	$836	$1,660	$1,747	$0
Beef	Beef	Liquid/Solid	Medium 3	PA	3	M	0.0	$15,585	$941	$1,828	$1,749	$0
Beef	Beef	Liquid/Solid	Medium 3	SO	1	H	0.0	$72,243	$1,949	$3,088	$2,025	$525
Beef	Beef	Liquid/Solid	Medium 3	SO	1	L	0.0	$28,268	$1,559	$2,104	$2,001	$525
Beef	Beef	Liquid/Solid	Medium 3	SO	1	M	0.0	$54,166	$1,813	$2,705	$2,017	$525
Beef	Beef	Liquid/Solid	Medium 3	SO	2	H	0.0	$72,243	$1,788	$3,225	$1,985	$315
Beef	Beef	Liquid/Solid	Medium 3	SO	2	L	0.0	$28,268	$1,430	$2,261	$1,969	$315
Beef	Beef	Liquid/Solid	Medium 3	SO	2	M	0.0	$54,166	$1,662	$2,849	$1,980	$315

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Medium 3	SO	3	H	0.0	$17,253	$1,045	$1,988	$1,925	$0
Beef	Beef	Liquid/Solid	Medium 3	SO	3	L	0.0	$14,662	$836	$1,658	$1,921	$0
Beef	Beef	Liquid/Solid	Medium 3	SO	3	M	0.0	$16,183	$972	$1,870	$1,924	$0
Dairy	Flush	Liquid/Solid	Large 1	CE	1	H	20.3	$131,634	$3,543	$5,225	$560	$2,595
Dairy	Flush	Liquid/Solid	Large 1	CE	1	L	20.3	$0	$2,835	$2,074	$448	$2,595
Dairy	Flush	Liquid/Solid	Large 1	CE	1	M	40.8	$110,106	$3,189	$4,535	$504	$2,595
Dairy	Flush	Liquid/Solid	Large 1	CE	2	H	38.3	$303,357	$2,046	$26,286	$160	$650
Dairy	Flush	Liquid/Solid	Large 1	CE	2	L	38.3	$171,724	$1,636	$23,309	$128	$650
Dairy	Flush	Liquid/Solid	Large 1	CE	2	M	77.0	$281,830	$1,841	$25,683	$144	$650
Dairy	Flush	Liquid/Solid	Large 1	CE	3	H	16.5	$131,634	$1,045	$3,983	$20	$0
Dairy	Flush	Liquid/Solid	Large 1	CE	3	L	16.5	$0	$836	$1,080	$16	$0
Dairy	Flush	Liquid/Solid	Large 1	CE	3	M	33.2	$110,106	$941	$3,417	$18	$0
Dairy	Flush	Liquid/Solid	Large 1	MA	1	H	3.5	$131,724	$2,012	$4,140	$290	$2,140
Dairy	Flush	Liquid/Solid	Large 1	MA	1	L	3.5	$237	$1,610	$1,209	$232	$2,140
Dairy	Flush	Liquid/Solid	Large 1	MA	1	M	7.0	$110,423	$1,811	$3,563	$261	$2,140
Dairy	Flush	Liquid/Solid	Large 1	MA	2	H	6.6	$419,175	$1,180	$50,087	$63	$425
Dairy	Flush	Liquid/Solid	Large 1	MA	2	L	6.6	$287,688	$944	$47,253	$50	$425
Dairy	Flush	Liquid/Solid	Large 1	MA	2	M	13.3	$397,874	$1,062	$49,559	$57	$425
Dairy	Flush	Liquid/Solid	Large 1	MA	3	H	2.9	$131,724	$659	$3,485	$13	$0
Dairy	Flush	Liquid/Solid	Large 1	MA	3	L	2.9	$237	$527	$685	$10	$0
Dairy	Flush	Liquid/Solid	Large 1	MA	3	M	5.7	$110,423	$593	$2,974	$11	$0
Dairy	Flush	Liquid/Solid	Large 1	MW	1	H	3.2	$132,502	$3,351	$5,131	$500	$2,345
Dairy	Flush	Liquid/Solid	Large 1	MW	1	L	3.2	$561	$2,681	$1,996	$400	$2,345
Dairy	Flush	Liquid/Solid	Large 1	MW	1	M	6.2	$110,974	$3,016	$4,452	$450	$2,345
Dairy	Flush	Liquid/Solid	Large 1	MW	2	H	6.1	$132,502	$2,030	$29,862	$140	$630
Dairy	Flush	Liquid/Solid	Large 1	MW	2	L	6.1	$561	$1,624	$26,881	$112	$630
Dairy	Flush	Liquid/Solid	Large 1	MW	2	M	11.7	$110,974	$1,827	$29,260	$126	$630
Dairy	Flush	Liquid/Solid	Large 1	MW	3	H	2.6	$132,502	$1,045	$4,000	$20	$0

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Flush	Liquid/Solid	Large 1	MW	3	L	2.6	$561	$836	$1,091	$16	$0
Dairy	Flush	Liquid/Solid	Large 1	MW	3	M	5.1	$110,974	$941	$3,434	$18	$0
Dairy	Flush	Liquid/Solid	Large 1	PA	1	H	38.3	$131,634	$2,469	$4,600	$260	$1,200
Dairy	Flush	Liquid/Solid	Large 1	PA	1	L	38.3	$0	$1,975	$1,574	$208	$1,200
Dairy	Flush	Liquid/Solid	Large 1	PA	1	M	77.0	$110,106	$2,222	$3,973	$234	$1,200
Dairy	Flush	Liquid/Solid	Large 1	PA	2	H	72.4	$504,946	$1,730	$111,249	$60	$240
Dairy	Flush	Liquid/Solid	Large 1	PA	2	L	72.4	$373,312	$1,384	$108,309	$48	$240
Dairy	Flush	Liquid/Solid	Large 1	PA	2	M	145.4	$483,418	$1,557	$110,665	$54	$240
Dairy	Flush	Liquid/Solid	Large 1	PA	3	H	31.2	$131,634	$1,045	$3,983	$20	$0
Dairy	Flush	Liquid/Solid	Large 1	PA	3	L	31.2	$0	$836	$1,080	$16	$0
Dairy	Flush	Liquid/Solid	Large 1	PA	3	M	62.7	$110,106	$941	$3,417	$18	$0
Dairy	Flush	Liquid/Solid	Large 1	SO	1	H	4.6	$131,941	$2,977	$4,902	$400	$1,860
Dairy	Flush	Liquid/Solid	Large 1	SO	1	L	4.6	$0	$2,382	$1,811	$320	$1,860
Dairy	Flush	Liquid/Solid	Large 1	SO	1	M	9.2	$110,413	$2,680	$4,245	$360	$1,860
Dairy	Flush	Liquid/Solid	Large 1	SO	2	H	8.7	$333,529	$1,649	$62,194	$40	$135
Dairy	Flush	Liquid/Solid	Large 1	SO	2	L	8.7	$201,588	$1,319	$59,257	$32	$135
Dairy	Flush	Liquid/Solid	Large 1	SO	2	M	17.3	$312,001	$1,484	$61,614	$36	$135
Dairy	Flush	Liquid/Solid	Large 1	SO	3	H	3.7	$131,941	$1,045	$3,989	$20	$0
Dairy	Flush	Liquid/Solid	Large 1	SO	3	L	3.7	$0	$836	$1,080	$16	$0
Dairy	Flush	Liquid/Solid	Large 1	SO	3	M	7.5	$110,413	$941	$3,423	$18	$0
Dairy	Flush	Liquid/Solid	Medium 1	CE	1	H	8.3	$29,265	$1,895	$2,079	$120	$455
Dairy	Flush	Liquid/Solid	Medium 1	CE	1	L	8.3	$5,776	$1,516	$1,311	$96	$455
Dairy	Flush	Liquid/Solid	Medium 1	CE	1	M	16.8	$29,008	$1,706	$1,925	$108	$455
Dairy	Flush	Liquid/Solid	Medium 1	CE	2	H	6.0	$29,265	$1,818	$2,074	$100	$355
Dairy	Flush	Liquid/Solid	Medium 1	CE	2	L	6.0	$5,776	$1,455	$1,315	$80	$355
Dairy	Flush	Liquid/Solid	Medium 1	CE	2	M	12.1	$29,008	$1,637	$1,924	$90	$355
Dairy	Flush	Liquid/Solid	Medium 1	CE	3	H	2.3	$29,265	$1,045	$1,795	$20	$0
Dairy	Flush	Liquid/Solid	Medium 1	CE	3	L	2.3	$5,776	$836	$1,084	$16	$0

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Flush	Liquid/Solid	Medium 1	CE	3	M	4.7	$29,008	$941	$1,669	$18	$0
Dairy	Flush	Liquid/Solid	Medium 1	MA	1	H	16.8	$29,302	$1,156	$1,505	$63	$375
Dairy	Flush	Liquid/Solid	Medium 1	MA	1	L	16.8	$5,875	$924	$853	$50	$375
Dairy	Flush	Liquid/Solid	Medium 1	MA	1	M	33.6	$29,141	$1,040	$1,410	$57	$375
Dairy	Flush	Liquid/Solid	Medium 1	MA	2	H	12.1	$29,302	$1,112	$1,499	$50	$285
Dairy	Flush	Liquid/Solid	Medium 1	MA	2	L	12.1	$5,875	$890	$852	$40	$285
Dairy	Flush	Liquid/Solid	Medium 1	MA	2	M	24.2	$29,141	$1,001	$1,407	$45	$285
Dairy	Flush	Liquid/Solid	Medium 1	MA	3	H	4.7	$29,302	$659	$1,349	$13	$0
Dairy	Flush	Liquid/Solid	Medium 1	MA	3	L	4.7	$5,875	$527	$728	$10	$0
Dairy	Flush	Liquid/Solid	Medium 1	MA	3	M	9.4	$29,141	$593	$1,269	$11	$0
Dairy	Flush	Liquid/Solid	Medium 1	MW	1	H	14.9	$29,628	$1,861	$2,066	$100	$410
Dairy	Flush	Liquid/Solid	Medium 1	MW	1	L	14.9	$6,011	$1,489	$1,299	$80	$410
Dairy	Flush	Liquid/Solid	Medium 1	MW	1	M	30.2	$29,371	$1,675	$1,914	$90	$410
Dairy	Flush	Liquid/Solid	Medium 1	MW	2	H	10.7	$29,628	$1,791	$2,049	$80	$320
Dairy	Flush	Liquid/Solid	Medium 1	MW	2	L	10.7	$6,011	$1,433	$1,290	$64	$320
Dairy	Flush	Liquid/Solid	Medium 1	MW	2	M	21.7	$29,371	$1,612	$1,901	$72	$320
Dairy	Flush	Liquid/Solid	Medium 1	MW	3	H	4.2	$29,628	$1,045	$1,803	$20	$0
Dairy	Flush	Liquid/Solid	Medium 1	MW	3	L	4.2	$6,011	$836	$1,088	$16	$0
Dairy	Flush	Liquid/Solid	Medium 1	MW	3	M	8.4	$29,371	$941	$1,676	$18	$0
Dairy	Flush	Liquid/Solid	Medium 1	PA	1	H	5.1	$29,265	$1,707	$1,969	$60	$210
Dairy	Flush	Liquid/Solid	Medium 1	PA	1	L	5.1	$5,776	$1,365	$1,223	$48	$210
Dairy	Flush	Liquid/Solid	Medium 1	PA	1	M	10.2	$29,008	$1,536	$1,826	$54	$210
Dairy	Flush	Liquid/Solid	Medium 1	PA	2	H	3.6	$29,265	$1,668	$2,002	$60	$160
Dairy	Flush	Liquid/Solid	Medium 1	PA	2	L	3.6	$5,776	$1,335	$1,260	$48	$160
Dairy	Flush	Liquid/Solid	Medium 1	PA	2	M	7.3	$29,008	$1,501	$1,861	$54	$160
Dairy	Flush	Liquid/Solid	Medium 1	PA	3	H	1.4	$29,265	$1,045	$1,795	$20	$0
Dairy	Flush	Liquid/Solid	Medium 1	PA	3	L	1.4	$5,776	$836	$1,084	$16	$0
Dairy	Flush	Liquid/Solid	Medium 1	PA	3	M	2.8	$29,008	$941	$1,669	$18	$0

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Flush	Liquid/Solid	Medium 1	SO	1	H	6.3	$29,393	$1,795	$2,023	$80	$325
Dairy	Flush	Liquid/Solid	Medium 1	SO	1	L	6.3	$5,776	$1,436	$1,264	$64	$325
Dairy	Flush	Liquid/Solid	Medium 1	SO	1	M	12.4	$29,136	$1,616	$1,875	$72	$325
Dairy	Flush	Liquid/Solid	Medium 1	SO	2	H	4.5	$29,393	$1,726	$2,020	$60	$235
Dairy	Flush	Liquid/Solid	Medium 1	SO	2	L	4.5	$5,776	$1,381	$1,269	$48	$235
Dairy	Flush	Liquid/Solid	Medium 1	SO	2	M	8.9	$29,136	$1,553	$1,876	$54	$235
Dairy	Flush	Liquid/Solid	Medium 1	SO	3	H	1.8	$29,393	$1,045	$1,798	$20	$0
Dairy	Flush	Liquid/Solid	Medium 1	SO	3	L	1.8	$5,776	$836	$1,084	$16	$0
Dairy	Flush	Liquid/Solid	Medium 1	SO	3	M	3.5	$29,136	$941	$1,672	$18	$0
Dairy	Flush	Liquid/Solid	Medium 2	CE	1	H	3.0	$45,465	$2,138	$2,544	$180	$770
Dairy	Flush	Liquid/Solid	Medium 2	CE	1	L	3.0	$8,993	$1,710	$1,488	$144	$770
Dairy	Flush	Liquid/Solid	Medium 2	CE	1	M	6.1	$45,130	$1,924	$2,374	$162	$770
Dairy	Flush	Liquid/Solid	Medium 2	CE	2	H	2.2	$45,465	$1,707	$66,471	$60	$210
Dairy	Flush	Liquid/Solid	Medium 2	CE	2	L	2.2	$8,993	$1,365	$65,464	$48	$210
Dairy	Flush	Liquid/Solid	Medium 2	CE	2	M	4.4	$45,130	$1,536	$66,326	$54	$210
Dairy	Flush	Liquid/Solid	Medium 2	CE	3	H	0.8	$45,465	$1,045	$2,119	$20	$0
Dairy	Flush	Liquid/Solid	Medium 2	CE	3	L	0.8	$8,993	$836	$1,148	$16	$0
Dairy	Flush	Liquid/Solid	Medium 2	CE	3	M	1.7	$45,130	$941	$1,992	$18	$0
Dairy	Flush	Liquid/Solid	Medium 2	MA	1	H	6.1	$45,514	$1,282	$1,902	$88	$635
Dairy	Flush	Liquid/Solid	Medium 2	MA	1	L	6.1	$9,122	$1,025	$976	$71	$635
Dairy	Flush	Liquid/Solid	Medium 2	MA	1	M	12.1	$45,303	$1,154	$1,799	$79	$635
Dairy	Flush	Liquid/Solid	Medium 2	MA	2	H	4.4	$45,514	$1,044	$46,646	$25	$145
Dairy	Flush	Liquid/Solid	Medium 2	MA	2	L	4.4	$9,122	$835	$45,747	$20	$145
Dairy	Flush	Liquid/Solid	Medium 2	MA	2	M	8.7	$45,303	$940	$46,556	$23	$145
Dairy	Flush	Liquid/Solid	Medium 2	MA	3	H	1.7	$45,514	$659	$1,673	$13	$0
Dairy	Flush	Liquid/Solid	Medium 2	MA	3	L	1.7	$9,122	$527	$792	$10	$0
Dairy	Flush	Liquid/Solid	Medium 2	MA	3	M	3.4	$45,303	$593	$1,592	$11	$0
Dairy	Flush	Liquid/Solid	Medium 2	MW	1	H	5.4	$45,938	$2,080	$2,520	$160	$695

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Flush	Liquid/Solid	Medium 2	MW	1	L	5.4	$9,299	$1,664	$1,467	$128	$695
Dairy	Flush	Liquid/Solid	Medium 2	MW	1	M	10.8	$45,604	$1,872	$2,353	$144	$695
Dairy	Flush	Liquid/Solid	Medium 2	MW	2	H	3.9	$45,938	$1,703	$36,228	$60	$205
Dairy	Flush	Liquid/Solid	Medium 2	MW	2	L	3.9	$9,299	$1,362	$35,219	$48	$205
Dairy	Flush	Liquid/Solid	Medium 2	MW	2	M	7.8	$45,604	$1,533	$36,083	$54	$205
Dairy	Flush	Liquid/Solid	Medium 2	MW	3	H	1.5	$45,938	$1,045	$2,129	$20	$0
Dairy	Flush	Liquid/Solid	Medium 2	MW	3	L	1.5	$9,299	$836	$1,154	$16	$0
Dairy	Flush	Liquid/Solid	Medium 2	MW	3	M	3.0	$45,604	$941	$2,001	$18	$0
Dairy	Flush	Liquid/Solid	Medium 2	PA	1	H	1.9	$45,465	$1,818	$2,358	$100	$355
Dairy	Flush	Liquid/Solid	Medium 2	PA	1	L	1.9	$8,993	$1,455	$1,339	$80	$355
Dairy	Flush	Liquid/Solid	Medium 2	PA	1	M	3.7	$45,130	$1,637	$2,207	$90	$355
Dairy	Flush	Liquid/Solid	Medium 2	PA	2	H	1.3	$418,777	$1,607	$40,894	$40	$80
Dairy	Flush	Liquid/Solid	Medium 2	PA	2	L	1.3	$382,305	$1,285	$39,900	$32	$80
Dairy	Flush	Liquid/Solid	Medium 2	PA	2	M	2.6	$418,442	$1,446	$40,755	$36	$80
Dairy	Flush	Liquid/Solid	Medium 2	PA	3	H	0.5	$45,465	$1,045	$2,119	$20	$0
Dairy	Flush	Liquid/Solid	Medium 2	PA	3	L	0.5	$8,993	$836	$1,148	$16	$0
Dairy	Flush	Liquid/Solid	Medium 2	PA	3	M	1.0	$45,130	$941	$1,992	$18	$0
Dairy	Flush	Liquid/Solid	Medium 2	SO	1	H	2.3	$45,632	$1,969	$2,449	$140	$550
Dairy	Flush	Liquid/Solid	Medium 2	SO	1	L	2.3	$8,993	$1,575	$1,409	$112	$550
Dairy	Flush	Liquid/Solid	Medium 2	SO	1	M	4.6	$45,298	$1,772	$2,289	$126	$550
Dairy	Flush	Liquid/Solid	Medium 2	SO	2	H	1.6	$418,944	$1,587	$38,307	$20	$55
Dairy	Flush	Liquid/Solid	Medium 2	SO	2	L	1.6	$382,305	$1,270	$37,311	$16	$55
Dairy	Flush	Liquid/Solid	Medium 2	SO	2	M	3.3	$418,610	$1,429	$38,169	$18	$55
Dairy	Flush	Liquid/Solid	Medium 2	SO	3	H	0.6	$45,632	$1,045	$2,123	$20	$0
Dairy	Flush	Liquid/Solid	Medium 2	SO	3	L	0.6	$8,993	$836	$1,148	$16	$0
Dairy	Flush	Liquid/Solid	Medium 2	SO	3	M	1.3	$45,298	$941	$1,995	$18	$0
Dairy	Flush	Liquid/Solid	Medium 3	CE	1	H	1.6	$61,054	$2,384	$2,999	$240	$1,090
Dairy	Flush	Liquid/Solid	Medium 3	CE	1	L	1.6	$12,092	$1,907	$1,664	$192	$1,090

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Flush	Liquid/Solid	Medium 3	CE	1	M	3.2	$60,657	$2,146	$2,814	$216	$1,090
Dairy	Flush	Liquid/Solid	Medium 3	CE	2	H	1.2	$61,054	$1,953	$2,968	$120	$530
Dairy	Flush	Liquid/Solid	Medium 3	CE	2	L	1.2	$12,092	$1,562	$1,684	$96	$530
Dairy	Flush	Liquid/Solid	Medium 3	CE	2	M	2.3	$60,657	$1,758	$2,808	$108	$530
Dairy	Flush	Liquid/Solid	Medium 3	CE	3	H	0.4	$61,054	$1,045	$2,431	$20	$0
Dairy	Flush	Liquid/Solid	Medium 3	CE	3	L	0.4	$12,092	$836	$1,210	$16	$0
Dairy	Flush	Liquid/Solid	Medium 3	CE	3	M	0.9	$60,657	$941	$2,302	$18	$0
Dairy	Flush	Liquid/Solid	Medium 3	MA	1	H	1.4	$61,113	$1,410	$2,289	$126	$900
Dairy	Flush	Liquid/Solid	Medium 3	MA	1	L	1.4	$12,245	$1,128	$1,099	$101	$900
Dairy	Flush	Liquid/Solid	Medium 3	MA	1	M	2.5	$60,862	$1,269	$2,178	$113	$900
Dairy	Flush	Liquid/Solid	Medium 3	MA	2	H	1.0	$61,113	$1,170	$9,078	$63	$405
Dairy	Flush	Liquid/Solid	Medium 3	MA	2	L	1.0	$12,245	$936	$7,915	$50	$405
Dairy	Flush	Liquid/Solid	Medium 3	MA	2	M	1.8	$60,862	$1,053	$8,980	$57	$405
Dairy	Flush	Liquid/Solid	Medium 3	MA	3	H	0.4	$61,113	$659	$1,985	$13	$0
Dairy	Flush	Liquid/Solid	Medium 3	MA	3	L	0.4	$12,245	$527	$855	$10	$0
Dairy	Flush	Liquid/Solid	Medium 3	MA	3	M	0.7	$60,862	$593	$1,903	$11	$0
Dairy	Flush	Liquid/Solid	Medium 3	MW	1	H	0.9	$61,616	$2,303	$2,964	$220	$985
Dairy	Flush	Liquid/Solid	Medium 3	MW	1	L	0.9	$12,455	$1,843	$1,634	$176	$985
Dairy	Flush	Liquid/Solid	Medium 3	MW	1	M	1.6	$61,219	$2,073	$2,783	$198	$985
Dairy	Flush	Liquid/Solid	Medium 3	MW	2	H	0.6	$61,616	$1,922	$2,869	$120	$490
Dairy	Flush	Liquid/Solid	Medium 3	MW	2	L	0.6	$12,455	$1,538	$1,583	$96	$490
Dairy	Flush	Liquid/Solid	Medium 3	MW	2	M	1.1	$61,219	$1,730	$2,710	$108	$490
Dairy	Flush	Liquid/Solid	Medium 3	MW	3	H	0.3	$61,616	$1,045	$2,442	$20	$0
Dairy	Flush	Liquid/Solid	Medium 3	MW	3	L	0.3	$12,455	$836	$1,217	$16	$0
Dairy	Flush	Liquid/Solid	Medium 3	MW	3	M	0.4	$61,219	$941	$2,313	$18	$0
Dairy	Flush	Liquid/Solid	Medium 3	PA	1	H	1.9	$61,054	$1,934	$2,737	$120	$505
Dairy	Flush	Liquid/Solid	Medium 3	PA	1	L	1.9	$12,092	$1,547	$1,455	$96	$505
Dairy	Flush	Liquid/Solid	Medium 3	PA	1	M	3.8	$60,657	$1,740	$2,578	$108	$505

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Flush	Liquid/Solid	Medium 3	PA	2	H	1.4	$61,054	$1,718	$24,816	$60	$225
Dairy	Flush	Liquid/Solid	Medium 3	PA	2	L	1.4	$12,092	$1,375	$23,559	$48	$225
Dairy	Flush	Liquid/Solid	Medium 3	PA	2	M	2.7	$60,657	$1,546	$24,669	$54	$225
Dairy	Flush	Liquid/Solid	Medium 3	PA	3	H	0.5	$61,054	$1,045	$2,431	$20	$0
Dairy	Flush	Liquid/Solid	Medium 3	PA	3	L	0.5	$12,092	$836	$1,210	$16	$0
Dairy	Flush	Liquid/Solid	Medium 3	PA	3	M	1.1	$60,657	$941	$2,302	$18	$0
Dairy	Flush	Liquid/Solid	Medium 3	SO	1	H	0.9	$61,253	$2,146	$2,864	$180	$780
Dairy	Flush	Liquid/Solid	Medium 3	SO	1	L	0.9	$12,092	$1,717	$1,553	$144	$780
Dairy	Flush	Liquid/Solid	Medium 3	SO	1	M	2.1	$60,855	$1,931	$2,693	$162	$780
Dairy	Flush	Liquid/Solid	Medium 3	SO	2	H	0.6	$61,253	$1,764	$60,232	$80	$285
Dairy	Flush	Liquid/Solid	Medium 3	SO	2	L	0.6	$12,092	$1,412	$58,965	$64	$285
Dairy	Flush	Liquid/Solid	Medium 3	SO	2	M	1.5	$60,855	$1,588	$60,082	$72	$285
Dairy	Flush	Liquid/Solid	Medium 3	SO	3	H	0.2	$61,253	$1,045	$2,435	$20	$0
Dairy	Flush	Liquid/Solid	Medium 3	SO	3	L	0.2	$12,092	$836	$1,210	$16	$0
Dairy	Flush	Liquid/Solid	Medium 3	SO	3	M	0.6	$60,855	$941	$2,306	$18	$0
Dairy	Hose	Liquid/Solid	Large 1	CE	1	H	6.8	$19,927	$3,543	$3,394	$560	$2,595
Dairy	Hose	Liquid/Solid	Large 1	CE	1	L	6.8	$2,685	$2,835	$2,208	$448	$2,595
Dairy	Hose	Liquid/Solid	Large 1	CE	1	M	13.5	$13,050	$3,189	$2,836	$504	$2,595
Dairy	Hose	Liquid/Solid	Large 1	CE	2	H	12.8	$19,927	$2,046	$3,572	$160	$650
Dairy	Hose	Liquid/Solid	Large 1	CE	2	L	12.8	$2,685	$1,636	$2,561	$128	$650
Dairy	Hose	Liquid/Solid	Large 1	CE	2	M	25.5	$13,050	$1,841	$3,102	$144	$650
Dairy	Hose	Liquid/Solid	Large 1	CE	3	H	5.5	$6,503	$1,045	$1,480	$20	$0
Dairy	Hose	Liquid/Solid	Large 1	CE	3	L	5.5	$0	$836	$1,080	$16	$0
Dairy	Hose	Liquid/Solid	Large 1	CE	3	M	11.0	$4,996	$941	$1,315	$18	$0
Dairy	Hose	Liquid/Solid	Large 1	MA	1	H	3.5	$38,086	$2,012	$2,292	$290	$2,140
Dairy	Hose	Liquid/Solid	Large 1	MA	1	L	3.5	$12,253	$1,610	$1,459	$232	$2,140
Dairy	Hose	Liquid/Solid	Large 1	MA	1	M	7.0	$27,921	$1,811	$1,931	$261	$2,140
Dairy	Hose	Liquid/Solid	Large 1	MA	2	H	6.6	$21,448	$1,180	$2,874	$63	$425

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Hose	Liquid/Solid	Large 1	MA	2	L	6.6	$5,905	$944	$2,083	$50	$425
Dairy	Hose	Liquid/Solid	Large 1	MA	2	M	13.3	$15,977	$1,062	$2,537	$57	$425
Dairy	Hose	Liquid/Solid	Large 1	MA	3	H	2.9	$6,593	$659	$983	$13	$0
Dairy	Hose	Liquid/Solid	Large 1	MA	3	L	2.9	$237	$527	$685	$10	$0
Dairy	Hose	Liquid/Solid	Large 1	MA	3	M	5.7	$5,313	$593	$872	$11	$0
Dairy	Hose	Liquid/Solid	Large 1	MW	1	H	3.2	$31,992	$3,351	$3,859	$500	$2,345
Dairy	Hose	Liquid/Solid	Large 1	MW	1	L	3.2	$4,228	$2,681	$2,179	$400	$2,345
Dairy	Hose	Liquid/Solid	Large 1	MW	1	M	6.5	$21,121	$3,016	$3,113	$450	$2,345
Dairy	Hose	Liquid/Solid	Large 1	MW	2	H	6.1	$31,992	$2,030	$3,542	$140	$630
Dairy	Hose	Liquid/Solid	Large 1	MW	2	L	6.1	$4,228	$1,624	$2,016	$112	$630
Dairy	Hose	Liquid/Solid	Large 1	MW	2	M	12.2	$21,121	$1,827	$2,873	$126	$630
Dairy	Hose	Liquid/Solid	Large 1	MW	3	H	2.6	$7,371	$1,045	$1,497	$20	$0
Dairy	Hose	Liquid/Solid	Large 1	MW	3	L	2.6	$561	$836	$1,091	$16	$0
Dairy	Hose	Liquid/Solid	Large 1	MW	3	M	5.3	$5,864	$941	$1,332	$18	$0
Dairy	Hose	Liquid/Solid	Large 1	PA	1	H	12.7	$19,927	$2,469	$2,769	$260	$1,200
Dairy	Hose	Liquid/Solid	Large 1	PA	1	L	12.7	$2,685	$1,975	$1,708	$208	$1,200
Dairy	Hose	Liquid/Solid	Large 1	PA	1	M	25.9	$13,050	$2,222	$2,273	$234	$1,200
Dairy	Hose	Liquid/Solid	Large 1	PA	2	H	24.0	$19,927	$1,730	$5,240	$60	$240
Dairy	Hose	Liquid/Solid	Large 1	PA	2	L	24.0	$2,685	$1,384	$4,265	$48	$240
Dairy	Hose	Liquid/Solid	Large 1	PA	2	M	49.0	$13,050	$1,557	$4,787	$54	$240
Dairy	Hose	Liquid/Solid	Large 1	PA	3	H	10.3	$6,503	$1,045	$1,480	$20	$0
Dairy	Hose	Liquid/Solid	Large 1	PA	3	L	10.3	$0	$836	$1,080	$16	$0
Dairy	Hose	Liquid/Solid	Large 1	PA	3	M	21.1	$4,996	$941	$1,315	$18	$0
Dairy	Hose	Liquid/Solid	Large 1	SO	1	H	1.6	$43,568	$2,977	$2,763	$400	$1,860
Dairy	Hose	Liquid/Solid	Large 1	SO	1	L	1.6	$20,924	$2,382	$2,018	$320	$1,860
Dairy	Hose	Liquid/Solid	Large 1	SO	1	M	3.0	$34,144	$2,680	$2,428	$360	$1,860
Dairy	Hose	Liquid/Solid	Large 1	SO	2	H	3.1	$24,261	$1,649	$7,766	$40	$135
Dairy	Hose	Liquid/Solid	Large 1	SO	2	L	3.1	$9,934	$1,319	$6,956	$32	$135

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Hose	Liquid/Solid	Large 1	SO	2	M	5.6	$18,995	$1,484	$7,399	$36	$135
Dairy	Hose	Liquid/Solid	Large 1	SO	3	H	1.3	$6,809	$1,045	$1,486	$20	$0
Dairy	Hose	Liquid/Solid	Large 1	SO	3	L	1.3	$0	$836	$1,080	$16	$0
Dairy	Hose	Liquid/Solid	Large 1	SO	3	M	2.4	$5,303	$941	$1,321	$18	$0
Dairy	Hose	Liquid/Solid	Medium 1	CE	1	H	8.3	$22,903	$1,895	$2,519	$2,062	$455
Dairy	Hose	Liquid/Solid	Medium 1	CE	1	L	8.3	$8,895	$1,516	$1,618	$2,038	$455
Dairy	Hose	Liquid/Solid	Medium 1	CE	1	M	16.7	$17,277	$1,706	$2,096	$2,050	$455
Dairy	Hose	Liquid/Solid	Medium 1	CE	2	H	6.0	$22,903	$1,818	$2,594	$2,042	$355
Dairy	Hose	Liquid/Solid	Medium 1	CE	2	L	6.0	$8,895	$1,455	$1,702	$2,022	$355
Dairy	Hose	Liquid/Solid	Medium 1	CE	2	M	12.0	$17,277	$1,637	$2,176	$2,032	$355
Dairy	Hose	Liquid/Solid	Medium 1	CE	3	H	2.3	$9,479	$1,045	$1,564	$1,962	$0
Dairy	Hose	Liquid/Solid	Medium 1	CE	3	L	2.3	$6,210	$836	$1,257	$1,958	$0
Dairy	Hose	Liquid/Solid	Medium 1	CE	3	M	4.7	$9,223	$941	$1,438	$1,960	$0
Dairy	Hose	Liquid/Solid	Medium 1	MA	1	H	50.6	$24,210	$1,180	$2,028	$1,875	$375
Dairy	Hose	Liquid/Solid	Medium 1	MA	1	L	50.6	$10,951	$944	$1,274	$1,862	$375
Dairy	Hose	Liquid/Solid	Medium 1	MA	1	M	100.9	$19,374	$1,062	$1,697	$1,869	$375
Dairy	Hose	Liquid/Solid	Medium 1	MA	2	H	36.4	$24,210	$1,136	$2,056	$1,862	$285
Dairy	Hose	Liquid/Solid	Medium 1	MA	2	L	36.4	$10,951	$908	$1,308	$1,852	$285
Dairy	Hose	Liquid/Solid	Medium 1	MA	2	M	72.7	$19,374	$1,022	$1,729	$1,857	$285
Dairy	Hose	Liquid/Solid	Medium 1	MA	3	H	14.2	$8,984	$673	$1,107	$1,824	$0
Dairy	Hose	Liquid/Solid	Medium 1	MA	3	L	14.2	$5,746	$538	$886	$1,821	$0
Dairy	Hose	Liquid/Solid	Medium 1	MA	3	M	28.3	$8,807	$605	$1,025	$1,822	$0
Dairy	Hose	Liquid/Solid	Medium 1	MW	1	H	44.8	$33,370	$1,861	$3,011	$1,550	$410
Dairy	Hose	Liquid/Solid	Medium 1	MW	1	L	44.8	$8,842	$1,489	$1,594	$1,530	$410
Dairy	Hose	Liquid/Solid	Medium 1	MW	1	M	89.6	$23,409	$1,675	$2,375	$1,540	$410
Dairy	Hose	Liquid/Solid	Medium 1	MW	2	H	32.2	$33,370	$1,791	$3,041	$1,530	$320
Dairy	Hose	Liquid/Solid	Medium 1	MW	2	L	32.2	$8,842	$1,433	$1,632	$1,514	$320
Dairy	Hose	Liquid/Solid	Medium 1	MW	2	M	64.5	$23,409	$1,612	$2,408	$1,522	$320

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Hose	Liquid/Solid	Medium 1	MW	3	H	12.5	$8,852	$1,045	$1,522	$1,470	$0
Dairy	Hose	Liquid/Solid	Medium 1	MW	3	L	12.5	$5,397	$836	$1,211	$1,466	$0
Dairy	Hose	Liquid/Solid	Medium 1	MW	3	M	25.1	$8,567	$941	$1,395	$1,468	$0
Dairy	Hose	Liquid/Solid	Medium 1	PA	1	H	5.1	$25,328	$1,707	$2,531	$2,874	$210
Dairy	Hose	Liquid/Solid	Medium 1	PA	1	L	5.1	$11,320	$1,365	$1,652	$2,862	$210
Dairy	Hose	Liquid/Solid	Medium 1	PA	1	M	10.2	$19,702	$1,536	$2,119	$2,868	$210
Dairy	Hose	Liquid/Solid	Medium 1	PA	2	H	3.7	$25,328	$1,668	$2,661	$2,874	$160
Dairy	Hose	Liquid/Solid	Medium 1	PA	2	L	3.7	$11,320	$1,335	$1,786	$2,862	$160
Dairy	Hose	Liquid/Solid	Medium 1	PA	2	M	7.3	$19,702	$1,501	$2,251	$2,868	$160
Dairy	Hose	Liquid/Solid	Medium 1	PA	3	H	1.4	$11,904	$1,045	$1,686	$2,834	$0
Dairy	Hose	Liquid/Solid	Medium 1	PA	3	L	1.4	$8,636	$836	$1,378	$2,830	$0
Dairy	Hose	Liquid/Solid	Medium 1	PA	3	M	2.8	$11,648	$941	$1,559	$2,832	$0
Dairy	Hose	Liquid/Solid	Medium 1	SO	1	H	6.3	$28,639	$1,795	$2,744	$3,016	$325
Dairy	Hose	Liquid/Solid	Medium 1	SO	1	L	6.3	$17,725	$1,436	$2,013	$3,000	$325
Dairy	Hose	Liquid/Solid	Medium 1	SO	1	M	12.3	$24,624	$1,616	$2,407	$3,008	$325
Dairy	Hose	Liquid/Solid	Medium 1	SO	2	H	4.5	$28,639	$1,726	$2,791	$2,996	$235
Dairy	Hose	Liquid/Solid	Medium 1	SO	2	L	4.5	$17,725	$1,381	$2,068	$2,984	$235
Dairy	Hose	Liquid/Solid	Medium 1	SO	2	M	8.8	$24,624	$1,553	$2,458	$2,990	$235
Dairy	Hose	Liquid/Solid	Medium 1	SO	3	H	1.8	$11,188	$1,045	$1,646	$2,956	$0
Dairy	Hose	Liquid/Solid	Medium 1	SO	3	L	1.8	$7,791	$836	$1,336	$2,952	$0
Dairy	Hose	Liquid/Solid	Medium 1	SO	3	M	3.4	$10,932	$941	$1,520	$2,954	$0
Dairy	Hose	Liquid/Solid	Medium 2	CE	1	H	3.0	$25,653	$2,138	$2,779	$3,482	$770
Dairy	Hose	Liquid/Solid	Medium 2	CE	1	L	3.0	$11,120	$1,710	$1,839	$3,446	$770
Dairy	Hose	Liquid/Solid	Medium 2	CE	1	M	6.0	$19,949	$1,924	$2,340	$3,464	$770
Dairy	Hose	Liquid/Solid	Medium 2	CE	2	H	2.2	$25,653	$1,707	$3,190	$3,362	$210
Dairy	Hose	Liquid/Solid	Medium 2	CE	2	L	2.2	$11,120	$1,365	$2,301	$3,350	$210
Dairy	Hose	Liquid/Solid	Medium 2	CE	2	M	4.3	$19,949	$1,536	$2,777	$3,356	$210
Dairy	Hose	Liquid/Solid	Medium 2	CE	3	H	0.8	$12,229	$1,045	$1,683	$3,322	$0

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Hose	Liquid/Solid	Medium 2	CE	3	L	0.8	$8,436	$836	$1,365	$3,318	$0
Dairy	Hose	Liquid/Solid	Medium 2	CE	3	M	1.7	$11,895	$941	$1,555	$3,320	$0
Dairy	Hose	Liquid/Solid	Medium 2	MA	1	H	18.2	$26,900	$1,309	$2,218	$3,168	$635
Dairy	Hose	Liquid/Solid	Medium 2	MA	1	L	18.2	$13,125	$1,047	$1,439	$3,150	$635
Dairy	Hose	Liquid/Solid	Medium 2	MA	1	M	36.6	$22,010	$1,178	$1,879	$3,159	$635
Dairy	Hose	Liquid/Solid	Medium 2	MA	2	H	13.1	$26,900	$1,066	$2,379	$3,104	$145
Dairy	Hose	Liquid/Solid	Medium 2	MA	2	L	13.1	$13,125	$853	$1,628	$3,099	$145
Dairy	Hose	Liquid/Solid	Medium 2	MA	2	M	26.3	$22,010	$960	$2,054	$3,101	$145
Dairy	Hose	Liquid/Solid	Medium 2	MA	3	H	5.1	$11,674	$673	$1,222	$3,091	$0
Dairy	Hose	Liquid/Solid	Medium 2	MA	3	L	5.1	$7,921	$538	$991	$3,088	$0
Dairy	Hose	Liquid/Solid	Medium 2	MA	3	M	10.2	$11,443	$605	$1,139	$3,090	$0
Dairy	Hose	Liquid/Solid	Medium 2	MW	1	H	16.2	$36,034	$2,080	$6,402	$2,626	$695
Dairy	Hose	Liquid/Solid	Medium 2	MW	1	L	16.2	$10,924	$1,664	$2,238	$2,594	$695
Dairy	Hose	Liquid/Solid	Medium 2	MW	1	M	32.2	$25,986	$1,872	$4,507	$2,610	$695
Dairy	Hose	Liquid/Solid	Medium 2	MW	2	H	11.7	$36,034	$1,703	$3,416	$2,526	$205
Dairy	Hose	Liquid/Solid	Medium 2	MW	2	L	11.7	$10,924	$1,362	$2,005	$2,514	$205
Dairy	Hose	Liquid/Solid	Medium 2	MW	2	M	23.2	$25,986	$1,533	$2,787	$2,520	$205
Dairy	Hose	Liquid/Solid	Medium 2	MW	3	H	4.5	$11,516	$1,045	$1,633	$2,486	$0
Dairy	Hose	Liquid/Solid	Medium 2	MW	3	L	4.5	$7,479	$836	$1,310	$2,482	$0
Dairy	Hose	Liquid/Solid	Medium 2	MW	3	M	9.0	$11,144	$941	$1,504	$2,484	$0
Dairy	Hose	Liquid/Solid	Medium 2	PA	1	H	1.9	$53,519	$1,818	$2,762	$1,324	$355
Dairy	Hose	Liquid/Solid	Medium 2	PA	1	L	1.9	$38,986	$1,455	$1,860	$1,304	$355
Dairy	Hose	Liquid/Solid	Medium 2	PA	1	M	3.6	$47,815	$1,637	$2,342	$1,314	$355
Dairy	Hose	Liquid/Solid	Medium 2	PA	2	H	1.3	$53,519	$1,607	$3,481	$1,264	$80
Dairy	Hose	Liquid/Solid	Medium 2	PA	2	L	1.3	$38,986	$1,285	$2,603	$1,256	$80
Dairy	Hose	Liquid/Solid	Medium 2	PA	2	M	2.6	$47,815	$1,446	$3,074	$1,260	$80
Dairy	Hose	Liquid/Solid	Medium 2	PA	3	H	0.5	$40,095	$1,045	$1,852	$1,244	$0
Dairy	Hose	Liquid/Solid	Medium 2	PA	3	L	0.5	$36,301	$836	$1,534	$1,240	$0

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Hose	Liquid/Solid	Medium 2	PA	3	M	1.0	$39,761	$941	$1,724	$1,242	$0
Dairy	Hose	Liquid/Solid	Medium 2	SO	1	H	2.1	$56,407	$1,969	$2,989	$1,364	$550
Dairy	Hose	Liquid/Solid	Medium 2	SO	1	L	2.1	$44,929	$1,575	$2,227	$1,336	$550
Dairy	Hose	Liquid/Solid	Medium 2	SO	1	M	4.6	$52,314	$1,772	$2,641	$1,350	$550
Dairy	Hose	Liquid/Solid	Medium 2	SO	2	H	1.5	$56,407	$1,587	$3,246	$1,244	$55
Dairy	Hose	Liquid/Solid	Medium 2	SO	2	L	1.5	$44,929	$1,270	$2,528	$1,240	$55
Dairy	Hose	Liquid/Solid	Medium 2	SO	2	M	3.3	$52,314	$1,429	$2,919	$1,242	$55
Dairy	Hose	Liquid/Solid	Medium 2	SO	3	H	0.6	$38,956	$1,045	$1,790	$1,244	$0
Dairy	Hose	Liquid/Solid	Medium 2	SO	3	L	0.6	$34,995	$836	$1,469	$1,240	$0
Dairy	Hose	Liquid/Solid	Medium 2	SO	3	M	1.3	$38,622	$941	$1,662	$1,242	$0
Dairy	Hose	Liquid/Solid	Medium 3	CE	1	H	1.5	$28,306	$2,384	$4,656	$4,901	$1,090
Dairy	Hose	Liquid/Solid	Medium 3	CE	1	L	1.5	$13,290	$1,907	$2,383	$4,853	$1,090
Dairy	Hose	Liquid/Solid	Medium 3	CE	1	M	3.2	$22,539	$2,146	$3,555	$4,877	$1,090
Dairy	Hose	Liquid/Solid	Medium 3	CE	2	H	1.1	$28,306	$1,953	$3,447	$4,781	$530
Dairy	Hose	Liquid/Solid	Medium 3	CE	2	L	1.1	$13,290	$1,562	$2,519	$4,757	$530
Dairy	Hose	Liquid/Solid	Medium 3	CE	2	M	2.3	$22,539	$1,758	$3,018	$4,769	$530
Dairy	Hose	Liquid/Solid	Medium 3	CE	3	H	0.4	$14,882	$1,045	$1,798	$4,681	$0
Dairy	Hose	Liquid/Solid	Medium 3	CE	3	L	0.4	$10,605	$836	$1,471	$4,677	$0
Dairy	Hose	Liquid/Solid	Medium 3	CE	3	M	0.9	$14,484	$941	$1,669	$4,679	$0
Dairy	Hose	Liquid/Solid	Medium 3	MA	1	H	3.9	$45,700	$1,440	$2,402	$943	$900
Dairy	Hose	Liquid/Solid	Medium 3	MA	1	L	3.9	$31,450	$1,152	$1,599	$917	$900
Dairy	Hose	Liquid/Solid	Medium 3	MA	1	M	7.7	$40,767	$1,296	$2,055	$930	$900
Dairy	Hose	Liquid/Solid	Medium 3	MA	2	H	2.8	$45,700	$1,195	$2,561	$878	$405
Dairy	Hose	Liquid/Solid	Medium 3	MA	2	L	2.8	$31,450	$956	$1,786	$866	$405
Dairy	Hose	Liquid/Solid	Medium 3	MA	2	M	5.5	$40,767	$1,076	$2,228	$872	$405
Dairy	Hose	Liquid/Solid	Medium 3	MA	3	H	1.1	$30,474	$673	$1,330	$827	$0
Dairy	Hose	Liquid/Solid	Medium 3	MA	3	L	1.1	$26,245	$538	$1,089	$824	$0
Dairy	Hose	Liquid/Solid	Medium 3	MA	3	M	2.2	$30,200	$605	$1,246	$826	$0

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Hose	Liquid/Solid	Medium 3	MW	1	H	2.5	$54,861	$2,303	$3,487	$1,034	$985
Dairy	Hose	Liquid/Solid	Medium 3	MW	1	L	2.5	$29,223	$1,843	$1,996	$990	$985
Dairy	Hose	Liquid/Solid	Medium 3	MW	1	M	4.7	$44,743	$2,073	$2,821	$1,012	$985
Dairy	Hose	Liquid/Solid	Medium 3	MW	2	H	1.8	$54,861	$1,922	$3,650	$934	$490
Dairy	Hose	Liquid/Solid	Medium 3	MW	2	L	1.8	$29,223	$1,538	$2,203	$910	$490
Dairy	Hose	Liquid/Solid	Medium 3	MW	2	M	3.4	$44,743	$1,730	$3,006	$922	$490
Dairy	Hose	Liquid/Solid	Medium 3	MW	3	H	0.7	$30,344	$1,045	$1,740	$834	$0
Dairy	Hose	Liquid/Solid	Medium 3	MW	3	L	0.7	$25,778	$836	$1,407	$830	$0
Dairy	Hose	Liquid/Solid	Medium 3	MW	3	M	1.3	$29,901	$941	$1,610	$832	$0
Dairy	Hose	Liquid/Solid	Medium 3	PA	1	H	1.9	$57,051	$1,934	$2,989	$1,344	$505
Dairy	Hose	Liquid/Solid	Medium 3	PA	1	L	1.9	$42,035	$1,547	$2,063	$1,320	$505
Dairy	Hose	Liquid/Solid	Medium 3	PA	1	M	3.7	$51,284	$1,740	$2,561	$1,332	$505
Dairy	Hose	Liquid/Solid	Medium 3	PA	2	H	1.4	$57,051	$1,718	$3,703	$1,284	$225
Dairy	Hose	Liquid/Solid	Medium 3	PA	2	L	1.4	$42,035	$1,375	$2,802	$1,272	$225
Dairy	Hose	Liquid/Solid	Medium 3	PA	2	M	2.7	$51,284	$1,546	$3,287	$1,278	$225
Dairy	Hose	Liquid/Solid	Medium 3	PA	3	H	0.5	$43,627	$1,045	$2,011	$1,244	$0
Dairy	Hose	Liquid/Solid	Medium 3	PA	3	L	0.5	$39,350	$836	$1,684	$1,240	$0
Dairy	Hose	Liquid/Solid	Medium 3	PA	3	M	1.0	$43,229	$941	$1,882	$1,242	$0
Dairy	Hose	Liquid/Solid	Medium 3	SO	1	H	0.9	$59,522	$2,146	$9,723	$1,404	$780
Dairy	Hose	Liquid/Solid	Medium 3	SO	1	L	0.9	$47,529	$1,717	$6,133	$1,368	$780
Dairy	Hose	Liquid/Solid	Medium 3	SO	1	M	1.9	$55,365	$1,931	$7,965	$1,386	$780
Dairy	Hose	Liquid/Solid	Medium 3	SO	2	H	0.6	$59,522	$1,764	$3,484	$1,304	$285
Dairy	Hose	Liquid/Solid	Medium 3	SO	2	L	0.6	$47,529	$1,412	$2,735	$1,288	$285
Dairy	Hose	Liquid/Solid	Medium 3	SO	2	M	1.4	$55,365	$1,588	$3,146	$1,296	$285
Dairy	Hose	Liquid/Solid	Medium 3	SO	3	H	0.2	$42,070	$1,045	$1,927	$1,244	$0
Dairy	Hose	Liquid/Solid	Medium 3	SO	3	L	0.2	$37,595	$836	$1,596	$1,240	$0
Dairy	Hose	Liquid/Solid	Medium 3	SO	3	M	0.5	$41,673	$941	$1,798	$1,242	$0
Heifers	Heifers	Liquid/Solid	Large 1	CE	1	H	24.5	$30,772	$1,830	$3,043	$100	$370

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Heifers	Heifers	Liquid/Solid	Large 1	CE	1	L	24.5	$10,602	$1,464	$1,776	$80	$370
Heifers	Heifers	Liquid/Solid	Large 1	CE	1	M	49.6	$21,830	$1,647	$2,458	$90	$370
Heifers	Heifers	Liquid/Solid	Large 1	CE	2	H	7.6	$30,772	$1,795	$3,187	$80	$325
Heifers	Heifers	Liquid/Solid	Large 1	CE	2	L	7.6	$10,602	$1,436	$1,924	$64	$325
Heifers	Heifers	Liquid/Solid	Large 1	CE	2	M	15.3	$21,830	$1,616	$2,604	$72	$325
Heifers	Heifers	Liquid/Solid	Large 1	CE	3	H	4.0	$3,924	$1,045	$1,455	$20	$0
Heifers	Heifers	Liquid/Solid	Large 1	CE	3	L	4.0	$1,380	$836	$1,118	$16	$0
Heifers	Heifers	Liquid/Solid	Large 1	CE	3	M	8.0	$3,037	$941	$1,297	$18	$0
Heifers	Heifers	Liquid/Solid	Large 1	MA	1	H	0.0	$54,237	$1,780	$4,754	$80	$305
Heifers	Heifers	Liquid/Solid	Large 1	MA	1	L	0.0	$17,292	$1,398	$2,260	$63	$305
Heifers	Heifers	Liquid/Solid	Large 1	MA	1	M	0.0	$36,795	$1,696	$3,711	$76	$305
Heifers	Heifers	Liquid/Solid	Large 1	MA	2	H	0.0	$53,094	$1,749	$4,107	$80	$265
Heifers	Heifers	Liquid/Solid	Large 1	MA	2	L	0.0	$16,924	$1,373	$2,277	$63	$265
Heifers	Heifers	Liquid/Solid	Large 1	MA	2	M	0.0	$35,994	$1,667	$3,355	$76	$265
Heifers	Heifers	Liquid/Solid	Large 1	MA	3	H	0.0	$6,496	$1,045	$1,549	$20	$0
Heifers	Heifers	Liquid/Solid	Large 1	MA	3	L	0.0	$1,895	$821	$1,126	$16	$0
Heifers	Heifers	Liquid/Solid	Large 1	MA	3	M	0.0	$3,304	$996	$1,408	$19	$0
Heifers	Heifers	Liquid/Solid	Large 1	MW	1	H	0.0	$31,296	$1,780	$3,063	$80	$305
Heifers	Heifers	Liquid/Solid	Large 1	MW	1	L	0.0	$11,611	$1,424	$1,834	$64	$305
Heifers	Heifers	Liquid/Solid	Large 1	MW	1	M	0.0	$22,352	$1,602	$2,473	$72	$305
Heifers	Heifers	Liquid/Solid	Large 1	MW	2	H	0.0	$31,296	$1,749	$3,186	$80	$265
Heifers	Heifers	Liquid/Solid	Large 1	MW	2	L	0.0	$11,611	$1,399	$1,961	$64	$265
Heifers	Heifers	Liquid/Solid	Large 1	MW	2	M	0.0	$22,352	$1,574	$2,598	$72	$265
Heifers	Heifers	Liquid/Solid	Large 1	MW	3	H	0.0	$4,449	$1,045	$1,504	$20	$0
Heifers	Heifers	Liquid/Solid	Large 1	MW	3	L	0.0	$872	$836	$1,124	$16	$0
Heifers	Heifers	Liquid/Solid	Large 1	MW	3	M	0.0	$3,559	$941	$1,339	$18	$0
Heifers	Heifers	Liquid/Solid	Large 1	PA	1	H	16.3	$30,781	$1,691	$2,986	$60	$190
Heifers	Heifers	Liquid/Solid	Large 1	PA	1	L	16.3	$11,405	$1,353	$1,782	$48	$190

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Heifers	Heifers	Liquid/Solid	Large 1	PA	1	M	33.3	$21,940	$1,522	$2,406	$54	$190
Heifers	Heifers	Liquid/Solid	Large 1	PA	2	H	5.0	$30,781	$1,672	$3,754	$60	$165
Heifers	Heifers	Liquid/Solid	Large 1	PA	2	L	5.0	$11,405	$1,338	$2,553	$48	$165
Heifers	Heifers	Liquid/Solid	Large 1	PA	2	M	10.3	$21,940	$1,505	$3,175	$54	$165
Heifers	Heifers	Liquid/Solid	Large 1	PA	3	H	2.6	$3,933	$1,045	$1,479	$20	$0
Heifers	Heifers	Liquid/Solid	Large 1	PA	3	L	2.6	$666	$836	$1,113	$16	$0
Heifers	Heifers	Liquid/Solid	Large 1	PA	3	M	5.4	$3,146	$941	$1,318	$18	$0
Heifers	Heifers	Liquid/Solid	Large 1	SO	1	H	0.0	$64,274	$1,780	$4,932	$80	$305
Heifers	Heifers	Liquid/Solid	Large 1	SO	1	L	0.0	$17,435	$1,424	$2,132	$64	$305
Heifers	Heifers	Liquid/Solid	Large 1	SO	1	M	0.0	$45,053	$1,655	$3,806	$74	$305
Heifers	Heifers	Liquid/Solid	Large 1	SO	2	H	0.0	$63,695	$1,749	$19,068	$80	$265
Heifers	Heifers	Liquid/Solid	Large 1	SO	2	L	0.0	$17,292	$1,399	$16,666	$64	$265
Heifers	Heifers	Liquid/Solid	Large 1	SO	2	M	0.0	$44,654	$1,627	$18,105	$74	$265
Heifers	Heifers	Liquid/Solid	Large 1	SO	3	H	0.0	$7,307	$1,045	$1,600	$20	$0
Heifers	Heifers	Liquid/Solid	Large 1	SO	3	L	0.0	$3,340	$836	$1,188	$16	$0
Heifers	Heifers	Liquid/Solid	Large 1	SO	3	M	0.0	$5,705	$972	$1,453	$19	$0
Heifers	Heifers	Liquid/Solid	Medium 1	CE	1	H	1.8	$61,508	$1,622	$4,358	$525	$100
Heifers	Heifers	Liquid/Solid	Medium 1	CE	1	L	1.8	$23,704	$1,298	$2,230	$517	$100
Heifers	Heifers	Liquid/Solid	Medium 1	CE	1	M	3.4	$44,892	$1,460	$3,407	$521	$100
Heifers	Heifers	Liquid/Solid	Medium 1	CE	2	H	0.2	$61,508	$1,587	$4,502	$505	$55
Heifers	Heifers	Liquid/Solid	Medium 1	CE	2	L	0.2	$23,704	$1,270	$2,378	$501	$55
Heifers	Heifers	Liquid/Solid	Medium 1	CE	2	M	0.4	$44,892	$1,429	$3,552	$503	$55
Heifers	Heifers	Liquid/Solid	Medium 1	CE	3	H	0.2	$7,812	$1,045	$1,548	$505	$0
Heifers	Heifers	Liquid/Solid	Medium 1	CE	3	L	0.2	$6,583	$836	$1,274	$501	$0
Heifers	Heifers	Liquid/Solid	Medium 1	CE	3	M	0.3	$7,305	$941	$1,415	$503	$0
Heifers	Heifers	Liquid/Solid	Medium 1	MA	1	H	0.0	$54,143	$1,607	$3,968	$1,609	$80
Heifers	Heifers	Liquid/Solid	Medium 1	MA	1	L	0.0	$22,765	$1,262	$2,164	$1,600	$80
Heifers	Heifers	Liquid/Solid	Medium 1	MA	1	M	0.0	$39,691	$1,531	$3,225	$1,607	$80

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Heifers	Heifers	Liquid/Solid	Medium 1	MA	2	H	0.0	$54,143	$1,576	$11,163	$1,589	$40
Heifers	Heifers	Liquid/Solid	Medium 1	MA	2	L	0.0	$22,765	$1,237	$9,363	$1,584	$40
Heifers	Heifers	Liquid/Solid	Medium 1	MA	2	M	0.0	$39,691	$1,502	$10,421	$1,588	$40
Heifers	Heifers	Liquid/Solid	Medium 1	MA	3	H	0.0	$10,979	$1,045	$1,694	$1,589	$0
Heifers	Heifers	Liquid/Solid	Medium 1	MA	3	L	0.0	$8,843	$821	$1,377	$1,584	$0
Heifers	Heifers	Liquid/Solid	Medium 1	MA	3	M	0.0	$9,411	$996	$1,601	$1,588	$0
Heifers	Heifers	Liquid/Solid	Medium 1	MW	1	H	31.4	$62,441	$1,607	$4,407	$856	$80
Heifers	Heifers	Liquid/Solid	Medium 1	MW	1	L	31.4	$27,075	$1,285	$2,406	$848	$80
Heifers	Heifers	Liquid/Solid	Medium 1	MW	1	M	63.1	$45,877	$1,446	$3,455	$852	$80
Heifers	Heifers	Liquid/Solid	Medium 1	MW	2	H	3.4	$62,441	$1,576	$4,530	$836	$40
Heifers	Heifers	Liquid/Solid	Medium 1	MW	2	L	3.4	$27,075	$1,261	$2,533	$832	$40
Heifers	Heifers	Liquid/Solid	Medium 1	MW	2	M	6.8	$45,877	$1,418	$3,580	$834	$40
Heifers	Heifers	Liquid/Solid	Medium 1	MW	3	H	2.6	$8,745	$1,045	$1,606	$836	$0
Heifers	Heifers	Liquid/Solid	Medium 1	MW	3	L	2.6	$7,189	$836	$1,319	$832	$0
Heifers	Heifers	Liquid/Solid	Medium 1	MW	3	M	5.3	$8,290	$941	$1,471	$834	$0
Heifers	Heifers	Liquid/Solid	Medium 1	PA	1	H	0.9	$65,075	$1,584	$4,531	$1,715	$50
Heifers	Heifers	Liquid/Solid	Medium 1	PA	1	L	0.9	$31,313	$1,267	$2,616	$1,711	$50
Heifers	Heifers	Liquid/Solid	Medium 1	PA	1	M	1.7	$48,607	$1,425	$3,584	$1,713	$50
Heifers	Heifers	Liquid/Solid	Medium 1	PA	2	H	0.1	$65,075	$1,568	$22,282	$1,715	$30
Heifers	Heifers	Liquid/Solid	Medium 1	PA	2	L	0.1	$31,313	$1,254	$20,368	$1,711	$30
Heifers	Heifers	Liquid/Solid	Medium 1	PA	2	M	0.2	$48,607	$1,411	$21,335	$1,713	$30
Heifers	Heifers	Liquid/Solid	Medium 1	PA	3	H	0.1	$11,379	$1,045	$1,744	$1,715	$0
Heifers	Heifers	Liquid/Solid	Medium 1	PA	3	L	0.1	$9,835	$836	$1,460	$1,711	$0
Heifers	Heifers	Liquid/Solid	Medium 1	PA	3	M	0.1	$11,020	$941	$1,612	$1,713	$0
Heifers	Heifers	Liquid/Solid	Medium 1	SO	1	H	0.0	$64,170	$1,607	$4,475	$1,905	$80
Heifers	Heifers	Liquid/Solid	Medium 1	SO	1	L	0.0	$23,338	$1,285	$2,197	$1,897	$80
Heifers	Heifers	Liquid/Solid	Medium 1	SO	1	M	0.0	$47,372	$1,494	$3,556	$1,903	$80
Heifers	Heifers	Liquid/Solid	Medium 1	SO	2	H	0.0	$64,170	$1,576	$18,744	$1,885	$40

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Heifers	Heifers	Liquid/Solid	Medium 1	SO	2	L	0.0	$23,338	$1,261	$16,470	$1,881	$40
Heifers	Heifers	Liquid/Solid	Medium 1	SO	2	M	0.0	$47,372	$1,465	$17,827	$1,884	$40
Heifers	Heifers	Liquid/Solid	Medium 1	SO	3	H	0.0	$12,085	$1,045	$1,755	$1,885	$0
Heifers	Heifers	Liquid/Solid	Medium 1	SO	3	L	0.0	$10,451	$836	$1,460	$1,881	$0
Heifers	Heifers	Liquid/Solid	Medium 1	SO	3	M	0.0	$11,396	$972	$1,650	$1,884	$0
Heifers	Heifers	Liquid/Solid	Medium 2	CE	1	H	4.5	$35,802	$1,664	$3,087	$439	$155
Heifers	Heifers	Liquid/Solid	Medium 2	CE	1	L	4.5	$16,216	$1,331	$1,873	$427	$155
Heifers	Heifers	Liquid/Solid	Medium 2	CE	1	M	9.2	$27,144	$1,498	$2,533	$433	$155
Heifers	Heifers	Liquid/Solid	Medium 2	CE	2	H	0.5	$35,802	$1,630	$3,231	$419	$110
Heifers	Heifers	Liquid/Solid	Medium 2	CE	2	L	0.5	$16,216	$1,304	$2,021	$411	$110
Heifers	Heifers	Liquid/Solid	Medium 2	CE	2	M	1.0	$27,144	$1,467	$2,679	$415	$110
Heifers	Heifers	Liquid/Solid	Medium 2	CE	3	H	0.4	$8,954	$1,045	$1,595	$399	$0
Heifers	Heifers	Liquid/Solid	Medium 2	CE	3	L	0.4	$7,392	$836	$1,312	$395	$0
Heifers	Heifers	Liquid/Solid	Medium 2	CE	3	M	0.8	$8,350	$941	$1,459	$397	$0
Heifers	Heifers	Liquid/Solid	Medium 2	MA	1	H	0.0	$35,029	$1,641	$3,016	$1,266	$125
Heifers	Heifers	Liquid/Solid	Medium 2	MA	1	L	0.0	$17,670	$1,289	$1,922	$1,257	$125
Heifers	Heifers	Liquid/Solid	Medium 2	MA	1	M	0.0	$26,604	$1,564	$2,584	$1,264	$125
Heifers	Heifers	Liquid/Solid	Medium 2	MA	2	H	0.0	$35,029	$1,610	$8,288	$1,266	$85
Heifers	Heifers	Liquid/Solid	Medium 2	MA	2	L	0.0	$17,670	$1,265	$7,197	$1,257	$85
Heifers	Heifers	Liquid/Solid	Medium 2	MA	2	M	0.0	$26,604	$1,535	$7,857	$1,264	$85
Heifers	Heifers	Liquid/Solid	Medium 2	MA	3	H	0.0	$13,447	$1,045	$1,801	$1,246	$0
Heifers	Heifers	Liquid/Solid	Medium 2	MA	3	L	0.0	$10,710	$821	$1,467	$1,241	$0
Heifers	Heifers	Liquid/Solid	Medium 2	MA	3	M	0.0	$11,464	$996	$1,698	$1,245	$0
Heifers	Heifers	Liquid/Solid	Medium 2	MW	1	H	4.2	$37,160	$1,641	$3,156	$678	$125
Heifers	Heifers	Liquid/Solid	Medium 2	MW	1	L	4.2	$18,571	$1,313	$2,000	$670	$125
Heifers	Heifers	Liquid/Solid	Medium 2	MW	1	M	8.3	$28,556	$1,477	$2,601	$674	$125
Heifers	Heifers	Liquid/Solid	Medium 2	MW	2	H	0.4	$37,160	$1,610	$3,279	$678	$85
Heifers	Heifers	Liquid/Solid	Medium 2	MW	2	L	0.4	$18,571	$1,288	$2,126	$670	$85

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Heifers	Heifers	Liquid/Solid	Medium 2	MW	2	M	0.9	$28,556	$1,449	$2,726	$674	$85
Heifers	Heifers	Liquid/Solid	Medium 2	MW	3	H	0.3	$10,312	$1,045	$1,677	$658	$0
Heifers	Heifers	Liquid/Solid	Medium 2	MW	3	L	0.3	$8,268	$836	$1,376	$654	$0
Heifers	Heifers	Liquid/Solid	Medium 2	MW	3	M	0.7	$9,762	$941	$1,539	$656	$0
Heifers	Heifers	Liquid/Solid	Medium 2	PA	1	H	1.3	$40,940	$1,607	$9,045	$1,364	$80
Heifers	Heifers	Liquid/Solid	Medium 2	PA	1	L	1.3	$22,867	$1,285	$4,490	$1,356	$80
Heifers	Heifers	Liquid/Solid	Medium 2	PA	1	M	2.8	$32,427	$1,446	$6,780	$1,360	$80
Heifers	Heifers	Liquid/Solid	Medium 2	PA	2	H	0.1	$40,940	$1,587	$14,489	$1,344	$55
Heifers	Heifers	Liquid/Solid	Medium 2	PA	2	L	0.1	$22,867	$1,270	$13,367	$1,340	$55
Heifers	Heifers	Liquid/Solid	Medium 2	PA	2	M	0.3	$32,427	$1,429	$13,941	$1,342	$55
Heifers	Heifers	Liquid/Solid	Medium 2	PA	3	H	0.1	$14,093	$1,045	$1,870	$1,344	$0
Heifers	Heifers	Liquid/Solid	Medium 2	PA	3	L	0.1	$12,128	$836	$1,574	$1,340	$0
Heifers	Heifers	Liquid/Solid	Medium 2	PA	3	M	0.2	$13,633	$941	$1,735	$1,342	$0
Heifers	Heifers	Liquid/Solid	Medium 2	SO	1	H	0.0	$40,981	$1,641	$3,321	$1,497	$125
Heifers	Heifers	Liquid/Solid	Medium 2	SO	1	L	0.0	$19,214	$1,313	$2,000	$1,489	$125
Heifers	Heifers	Liquid/Solid	Medium 2	SO	1	M	0.0	$32,023	$1,526	$2,797	$1,495	$125
Heifers	Heifers	Liquid/Solid	Medium 2	SO	2	H	0.0	$40,981	$1,614	$17,672	$1,497	$90
Heifers	Heifers	Liquid/Solid	Medium 2	SO	2	L	0.0	$19,214	$1,291	$16,355	$1,489	$90
Heifers	Heifers	Liquid/Solid	Medium 2	SO	2	M	0.0	$32,023	$1,501	$17,149	$1,495	$90
Heifers	Heifers	Liquid/Solid	Medium 2	SO	3	H	0.0	$14,939	$1,045	$1,883	$1,477	$0
Heifers	Heifers	Liquid/Solid	Medium 2	SO	3	L	0.0	$12,770	$836	$1,569	$1,473	$0
Heifers	Heifers	Liquid/Solid	Medium 2	SO	3	M	0.0	$14,035	$972	$1,771	$1,476	$0
Heifers	Heifers	Liquid/Solid	Medium 3	CE	1	H	1.8	$37,144	$1,711	$3,166	$590	$215
Heifers	Heifers	Liquid/Solid	Medium 3	CE	1	L	1.8	$17,034	$1,368	$1,927	$578	$215
Heifers	Heifers	Liquid/Solid	Medium 3	CE	1	M	3.7	$28,338	$1,540	$2,606	$584	$215
Heifers	Heifers	Liquid/Solid	Medium 3	CE	2	H	0.2	$37,144	$1,676	$3,221	$590	$170
Heifers	Heifers	Liquid/Solid	Medium 3	CE	2	L	0.2	$17,034	$1,341	$1,986	$578	$170
Heifers	Heifers	Liquid/Solid	Medium 3	CE	2	M	0.4	$28,338	$1,508	$2,663	$584	$170

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Heifers	Heifers	Liquid/Solid	Medium 3	CE	3	H	0.2	$10,296	$1,045	$1,647	$550	$0
Heifers	Heifers	Liquid/Solid	Medium 3	CE	3	L	0.2	$8,474	$836	$1,358	$546	$0
Heifers	Heifers	Liquid/Solid	Medium 3	CE	3	M	0.3	$9,544	$941	$1,508	$548	$0
Heifers	Heifers	Liquid/Solid	Medium 3	MA	1	H	0.0	$61,844	$1,680	$3,341	$1,776	$175
Heifers	Heifers	Liquid/Solid	Medium 3	MA	1	L	0.0	$27,370	$1,319	$2,091	$1,763	$175
Heifers	Heifers	Liquid/Solid	Medium 3	MA	1	M	0.0	$45,745	$1,601	$2,840	$1,773	$175
Heifers	Heifers	Liquid/Solid	Medium 3	MA	2	H	0.0	$37,448	$1,653	$6,089	$1,756	$140
Heifers	Heifers	Liquid/Solid	Medium 3	MA	2	L	0.0	$19,502	$1,298	$4,975	$1,747	$140
Heifers	Heifers	Liquid/Solid	Medium 3	MA	2	M	0.0	$28,631	$1,575	$5,647	$1,754	$140
Heifers	Heifers	Liquid/Solid	Medium 3	MA	3	H	0.0	$15,866	$1,045	$1,907	$1,736	$0
Heifers	Heifers	Liquid/Solid	Medium 3	MA	3	L	0.0	$12,541	$821	$1,555	$1,732	$0
Heifers	Heifers	Liquid/Solid	Medium 3	MA	3	M	0.0	$13,491	$996	$1,794	$1,735	$0
Heifers	Heifers	Liquid/Solid	Medium 3	MW	1	H	1.9	$38,977	$1,680	$3,256	$953	$175
Heifers	Heifers	Liquid/Solid	Medium 3	MW	1	L	1.9	$19,620	$1,344	$2,064	$941	$175
Heifers	Heifers	Liquid/Solid	Medium 3	MW	1	M	3.0	$30,199	$1,512	$2,694	$947	$175
Heifers	Heifers	Liquid/Solid	Medium 3	MW	2	H	0.2	$38,977	$1,653	$3,288	$933	$140
Heifers	Heifers	Liquid/Solid	Medium 3	MW	2	L	0.2	$19,620	$1,322	$2,099	$925	$140
Heifers	Heifers	Liquid/Solid	Medium 3	MW	2	M	0.3	$30,199	$1,488	$2,728	$929	$140
Heifers	Heifers	Liquid/Solid	Medium 3	MW	3	H	0.2	$12,130	$1,045	$1,755	$913	$0
Heifers	Heifers	Liquid/Solid	Medium 3	MW	3	L	0.2	$9,676	$836	$1,440	$909	$0
Heifers	Heifers	Liquid/Solid	Medium 3	MW	3	M	0.3	$11,406	$941	$1,612	$911	$0
Heifers	Heifers	Liquid/Solid	Medium 3	PA	1	H	0.6	$43,544	$1,630	$3,464	$1,894	$110
Heifers	Heifers	Liquid/Solid	Medium 3	PA	1	L	0.6	$25,062	$1,304	$2,324	$1,886	$110
Heifers	Heifers	Liquid/Solid	Medium 3	PA	1	M	1.1	$34,930	$1,467	$2,910	$1,890	$110
Heifers	Heifers	Liquid/Solid	Medium 3	PA	2	H	0.1	$43,544	$1,614	$7,308	$1,894	$90
Heifers	Heifers	Liquid/Solid	Medium 3	PA	2	L	0.1	$25,062	$1,291	$6,169	$1,886	$90
Heifers	Heifers	Liquid/Solid	Medium 3	PA	2	M	0.1	$34,930	$1,453	$6,754	$1,890	$90
Heifers	Heifers	Liquid/Solid	Medium 3	PA	3	H	0.0	$16,697	$1,045	$1,993	$1,874	$0

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Heifers	Heifers	Liquid/Solid	Medium 3	PA	3	L	0.0	$14,323	$836	$1,684	$1,870	$0
Heifers	Heifers	Liquid/Solid	Medium 3	PA	3	M	0.1	$16,136	$941	$1,854	$1,872	$0
Heifers	Heifers	Liquid/Solid	Medium 3	SO	1	H	0.0	$73,033	$1,684	$3,225	$2,100	$180
Heifers	Heifers	Liquid/Solid	Medium 3	SO	1	L	0.0	$28,816	$1,347	$2,070	$2,088	$180
Heifers	Heifers	Liquid/Solid	Medium 3	SO	1	M	0.0	$54,859	$1,566	$2,770	$2,096	$180
Heifers	Heifers	Liquid/Solid	Medium 3	SO	2	H	0.0	$43,927	$1,653	$11,267	$2,080	$140
Heifers	Heifers	Liquid/Solid	Medium 3	SO	2	L	0.0	$21,614	$1,322	$9,924	$2,072	$140
Heifers	Heifers	Liquid/Solid	Medium 3	SO	2	M	0.0	$34,755	$1,537	$10,735	$2,078	$140
Heifers	Heifers	Liquid/Solid	Medium 3	SO	3	H	0.0	$17,885	$1,045	$2,016	$2,060	$0
Heifers	Heifers	Liquid/Solid	Medium 3	SO	3	L	0.0	$15,171	$836	$1,682	$2,056	$0
Heifers	Heifers	Liquid/Solid	Medium 3	SO	3	M	0.0	$16,767	$972	$1,897	$2,059	$0
Veal	Flush	Liquid	Medium 1	CE	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	CE	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	CE	1	M	0.1	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	CE	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	CE	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	CE	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	CE	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	CE	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	CE	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	MA	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	MA	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	MA	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	MA	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	MA	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	MA	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	MA	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	MA	3	L	0.0	$0	$1,045	$1,210	$20	$500

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 1	MA	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	MW	1	H	0.5	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	MW	1	L	0.5	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	MW	1	M	1.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	MW	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	MW	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	MW	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	MW	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	MW	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	MW	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	PA	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	PA	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	PA	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	PA	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	PA	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	PA	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	PA	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	PA	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	PA	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	SO	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	SO	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	SO	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	SO	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	SO	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	SO	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	SO	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	SO	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	SO	3	M	0.0	$0	$1,045	$1,210	$20	$500

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 2	CE	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	CE	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	CE	1	M	0.1	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	CE	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	CE	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	CE	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	CE	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	CE	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	CE	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	MA	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	MA	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	MA	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	MA	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	MA	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	MA	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	MA	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	MA	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	MA	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	MW	1	H	0.2	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	MW	1	L	0.2	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	MW	1	M	0.5	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	MW	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	MW	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	MW	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	MW	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	MW	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	MW	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	PA	1	H	0.0	$0	$1,930	$1,514	$120	$500

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 2	PA	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	PA	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	PA	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	PA	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	PA	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	PA	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	PA	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	PA	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	SO	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	SO	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	SO	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	SO	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	SO	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	SO	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	SO	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	SO	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	SO	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	CE	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	CE	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	CE	1	M	1.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	CE	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	CE	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	CE	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	CE	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	CE	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	CE	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	MA	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	MA	1	L	0.0	$0	$1,930	$1,514	$120	$500

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 3	MA	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	MA	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	MA	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	MA	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	MA	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	MA	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	MA	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	MW	1	H	4.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	MW	1	L	4.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	MW	1	M	8.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	MW	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	MW	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	MW	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	MW	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	MW	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	MW	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	PA	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	PA	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	PA	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	PA	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	PA	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	PA	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	PA	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	PA	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	PA	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	SO	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	SO	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	SO	1	M	0.0	$0	$1,930	$1,514	$120	$500

Table C-1b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 3	SO	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	SO	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	SO	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	SO	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	SO	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	SO	3	M	0.0	$0	$1,045	$1,210	$20	$500

Table C-2a

Summary of Industry Costs for Option 2

Animal Type	Manure Type	Operation Type	Capital	Annual	Fixed	3-Year Recurring	5-Year Recurring
Beef	Solid/Liquid	Beef	$96,942,128	$38,651,376	$7,672,585	$1,496,851	$9,179,452
Dairy	Solid/Liquid	Flush	$147,690,591	$115,353,998	$3,188,393	$334,556	$2,017,898
Dairy	Solid/Liquid	Hose	$35,758,320	$8,280,186	$3,066,584	$2,961,250	$1,916,937
Heifers	Solid/Liquid	Heifers	$16,559,995	$2,305,508	$842,928	$243,437	$312,186
Veal	Liquid	Flush	$0	$30,553	$38,948	$2,422	$10,090
Chicken	Liquid	LW	$14,047,475	$1,491,472	$144,601	$22,435	$93,337
Chicken	Solid	BR	$93,515,959	$4,120,237	$2,303,023	$83,562	$1,127,487
Chicken	Solid	LA	$32,642,246	$1,929,765	$333,911	$47,230	$224,575
Swine	Evapor	FF	$109,151	$151,249	$128,484	$8,945	$79,289
Swine	Evapor	GF	$112,054	$155,285	$131,852	$9,178	$81,337
Swine	Liquid	FF	$6,645,012	$1,803,879	$1,358,438	$86,947	$6,894,239
Swine	Liquid	GF	$4,934,234	$1,196,853	$855,210	$61,344	$5,231,336
Swine	Pit	FF	$505,620	$13,907,671	$1,398,631	$82,198	$781,926
Swine	Pit	GF	$454,228	$19,817,425	$1,538,482	$101,262	$910,429
Turkey	Solid	SL	$31,276,907	$2,864,728	$835,304	$35,254	$584,319

Table C-2b

Model Farm Costs for Option 2

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Large 1	CE	1	H	48.7	$40,527	$4,498	$5,213	$816	$5,998
Beef	Beef	Liquid/Solid	Large 1	CE	1	L	48.7	$13,961	$3,598	$3,230	$653	$5,998
Beef	Beef	Liquid/Solid	Large 1	CE	1	M	97.4	$28,707	$4,048	$4,289	$734	$5,998
Beef	Beef	Liquid/Solid	Large 1	CE	2	H	45.7	$57,024	$3,353	$6,955	$506	$1,689
Beef	Beef	Liquid/Solid	Large 1	CE	2	L	45.7	$19,628	$2,682	$4,394	$405	$1,689
Beef	Beef	Liquid/Solid	Large 1	CE	2	M	91.3	$40,255	$3,018	$5,772	$455	$1,689
Beef	Beef	Liquid/Solid	Large 1	CE	3	H	11.7	$4,558	$1,045	$10,931	$20	$0
Beef	Beef	Liquid/Solid	Large 1	CE	3	L	11.7	$1,606	$836	$10,582	$16	$0
Beef	Beef	Liquid/Solid	Large 1	CE	3	M	23.3	$3,529	$941	$10,769	$18	$0
Beef	Beef	Liquid/Solid	Large 1	MA	1	H	1.0	$58,218	$3,304	$6,971	$487	$3,786
Beef	Beef	Liquid/Solid	Large 1	MA	1	L	1.0	$18,571	$2,595	$3,386	$383	$3,786
Beef	Beef	Liquid/Solid	Large 1	MA	1	M	2.1	$39,438	$3,149	$5,488	$464	$3,786
Beef	Beef	Liquid/Solid	Large 1	MA	2	H	0.7	$54,491	$2,520	$15,272	$286	$861
Beef	Beef	Liquid/Solid	Large 1	MA	2	L	0.7	$17,369	$1,979	$11,617	$225	$861
Beef	Beef	Liquid/Solid	Large 1	MA	2	M	1.5	$36,823	$2,402	$13,736	$272	$861
Beef	Beef	Liquid/Solid	Large 1	MA	3	H	0.2	$198,123	$1,045	$73,248	$20	$0
Beef	Beef	Liquid/Solid	Large 1	MA	3	L	0.2	$192,678	$821	$72,796	$16	$0
Beef	Beef	Liquid/Solid	Large 1	MA	3	M	0.4	$194,412	$996	$73,093	$19	$0
Beef	Beef	Liquid/Solid	Large 1	MW	1	H	138.6	$38,144	$3,132	$7,353	$440	$3,529
Beef	Beef	Liquid/Solid	Large 1	MW	1	L	138.6	$14,220	$2,506	$3,862	$352	$3,529
Beef	Beef	Liquid/Solid	Large 1	MW	1	M	277.3	$27,238	$2,819	$5,637	$396	$3,529
Beef	Beef	Liquid/Solid	Large 1	MW	2	H	51.8	$55,411	$2,529	$7,217	$282	$772
Beef	Beef	Liquid/Solid	Large 1	MW	2	L	51.8	$21,127	$2,023	$4,450	$225	$772
Beef	Beef	Liquid/Solid	Large 1	MW	2	M	103.7	$39,325	$2,276	$5,863	$253	$772

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Large 1	MW	3	H	23.5	$5,373	$1,045	$8,679	$20	$0
Beef	Beef	Liquid/Solid	Large 1	MW	3	L	23.5	$1,112	$836	$8,274	$16	$0
Beef	Beef	Liquid/Solid	Large 1	MW	3	M	47.1	$4,299	$941	$8,506	$18	$0
Beef	Beef	Liquid/Solid	Large 1	PA	1	H	5.7	$65,130	$3,604	$6,076	$572	$4,261
Beef	Beef	Liquid/Solid	Large 1	PA	1	L	5.7	$25,015	$2,883	$3,461	$458	$4,261
Beef	Beef	Liquid/Solid	Large 1	PA	1	M	11.7	$46,061	$3,243	$4,795	$515	$4,261
Beef	Beef	Liquid/Solid	Large 1	PA	2	H	6.8	$64,843	$2,890	$28,199	$371	$1,301
Beef	Beef	Liquid/Solid	Large 1	PA	2	L	6.8	$24,900	$2,312	$24,127	$297	$1,301
Beef	Beef	Liquid/Solid	Large 1	PA	2	M	14.1	$45,860	$2,601	$26,189	$334	$1,301
Beef	Beef	Liquid/Solid	Large 1	PA	3	H	1.5	$4,695	$1,045	$59,818	$20	$0
Beef	Beef	Liquid/Solid	Large 1	PA	3	L	1.5	$840	$836	$59,433	$16	$0
Beef	Beef	Liquid/Solid	Large 1	PA	3	M	3.2	$3,756	$941	$59,652	$18	$0
Beef	Beef	Liquid/Solid	Large 1	SO	1	H	0.0	$67,898	$3,008	$7,023	$412	$5,140
Beef	Beef	Liquid/Solid	Large 1	SO	1	L	0.0	$18,628	$2,407	$3,055	$330	$5,140
Beef	Beef	Liquid/Solid	Large 1	SO	1	M	0.0	$47,706	$2,798	$5,428	$383	$5,140
Beef	Beef	Liquid/Solid	Large 1	SO	2	H	0.0	$61,436	$2,119	$34,129	$177	$1,045
Beef	Beef	Liquid/Solid	Large 1	SO	2	L	0.0	$17,029	$1,696	$30,319	$142	$1,045
Beef	Beef	Liquid/Solid	Large 1	SO	2	M	0.0	$43,242	$1,971	$32,592	$165	$1,045
Beef	Beef	Liquid/Solid	Large 1	SO	3	H	0.0	$8,855	$1,045	$52,151	$20	$0
Beef	Beef	Liquid/Solid	Large 1	SO	3	L	0.0	$4,019	$836	$51,703	$16	$0
Beef	Beef	Liquid/Solid	Large 1	SO	3	M	0.0	$6,923	$972	$51,991	$19	$0
Beef	Beef	Liquid/Solid	Large 2	CE	1	H	1.5	$133,164	$29,448	$28,864	$7,525	$83,315
Beef	Beef	Liquid/Solid	Large 2	CE	1	L	1.5	$49,372	$23,559	$18,533	$6,020	$83,315
Beef	Beef	Liquid/Solid	Large 2	CE	1	M	3.1	$95,403	$26,503	$23,818	$6,773	$83,315
Beef	Beef	Liquid/Solid	Large 2	CE	2	H	18.6	$201,261	$21,087	$39,775	$5,266	$24,360
Beef	Beef	Liquid/Solid	Large 2	CE	2	L	18.6	$76,611	$16,869	$29,346	$4,213	$24,360

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Large 2	CE	2	M	37.8	$143,072	$18,978	$34,679	$4,739	$24,360
Beef	Beef	Liquid/Solid	Large 2	CE	3	H	12.9	$21,888	$1,045	$132,910	$20	$0
Beef	Beef	Liquid/Solid	Large 2	CE	3	L	12.9	$4,862	$836	$132,081	$16	$0
Beef	Beef	Liquid/Solid	Large 2	CE	3	M	26.1	$17,511	$941	$132,614	$18	$0
Beef	Beef	Liquid/Solid	Large 2	MA	1	H	0.1	$411,735	$15,272	$24,075	$3,705	$44,295
Beef	Beef	Liquid/Solid	Large 2	MA	1	L	0.1	$134,139	$11,993	$12,238	$2,909	$44,295
Beef	Beef	Liquid/Solid	Large 2	MA	1	M	0.1	$286,265	$14,552	$19,318	$3,530	$44,295
Beef	Beef	Liquid/Solid	Large 2	MA	2	H	0.6	$457,053	$10,092	$67,008	$2,320	$10,517
Beef	Beef	Liquid/Solid	Large 2	MA	2	L	0.6	$148,754	$7,924	$56,422	$1,822	$10,517
Beef	Beef	Liquid/Solid	Large 2	MA	2	M	0.6	$318,056	$9,616	$62,659	$2,211	$10,517
Beef	Beef	Liquid/Solid	Large 2	MA	3	H	0.4	$305,761	$1,045	$776,124	$20	$0
Beef	Beef	Liquid/Solid	Large 2	MA	3	L	0.4	$268,937	$821	$774,406	$16	$0
Beef	Beef	Liquid/Solid	Large 2	MA	3	M	0.4	$286,372	$996	$775,442	$19	$0
Beef	Beef	Liquid/Solid	Large 2	MW	1	H	5.0	$165,176	$16,799	$22,853	$4,109	$49,698
Beef	Beef	Liquid/Solid	Large 2	MW	1	L	5.0	$62,177	$13,439	$13,185	$3,287	$49,698
Beef	Beef	Liquid/Solid	Large 2	MW	1	M	10.1	$120,196	$15,119	$18,258	$3,698	$49,698
Beef	Beef	Liquid/Solid	Large 2	MW	2	H	35.8	$275,401	$11,145	$27,616	$2,600	$11,800
Beef	Beef	Liquid/Solid	Large 2	MW	2	L	35.8	$106,267	$8,916	$17,533	$2,080	$11,800
Beef	Beef	Liquid/Solid	Large 2	MW	2	M	71.7	$197,353	$10,030	$22,813	$2,340	$11,800
Beef	Beef	Liquid/Solid	Large 2	MW	3	H	26.1	$45,725	$1,045	$103,861	$20	$0
Beef	Beef	Liquid/Solid	Large 2	MW	3	L	26.1	$14,397	$836	$102,317	$16	$0
Beef	Beef	Liquid/Solid	Large 2	MW	3	M	52.3	$36,580	$941	$103,327	$18	$0
Beef	Beef	Liquid/Solid	Large 2	PA	1	H	0.2	$301,386	$19,916	$26,505	$4,955	$60,010
Beef	Beef	Liquid/Solid	Large 2	PA	1	L	0.2	$116,661	$15,933	$15,371	$3,964	$60,010
Beef	Beef	Liquid/Solid	Large 2	PA	1	M	0.3	$214,590	$17,924	$21,129	$4,459	$60,010
Beef	Beef	Liquid/Solid	Large 2	PA	2	H	2.3	$671,736	$16,386	$55,286	$4,005	$18,533

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Large 2	PA	2	L	2.3	$264,801	$13,109	$43,089	$3,204	$18,533
Beef	Beef	Liquid/Solid	Large 2	PA	2	M	5.1	$473,834	$14,747	$49,378	$3,605	$18,533
Beef	Beef	Liquid/Solid	Large 2	PA	3	H	1.6	$349,773	$1,045	$562,250	$20	$0
Beef	Beef	Liquid/Solid	Large 2	PA	3	L	1.6	$324,166	$836	$560,992	$16	$0
Beef	Beef	Liquid/Solid	Large 2	PA	3	M	3.5	$342,535	$941	$561,812	$18	$0
Beef	Beef	Liquid/Solid	Large 2	SO	1	H	0.0	$415,794	$18,376	$28,961	$4,547	$72,400
Beef	Beef	Liquid/Solid	Large 2	SO	1	L	0.0	$116,306	$14,701	$13,909	$3,637	$72,400
Beef	Beef	Liquid/Solid	Large 2	SO	1	M	0.0	$294,930	$17,090	$23,040	$4,228	$72,400
Beef	Beef	Liquid/Solid	Large 2	SO	2	H	0.0	$890,614	$8,381	$127,583	$1,856	$17,220
Beef	Beef	Liquid/Solid	Large 2	SO	2	L	0.0	$564,886	$6,705	$113,685	$1,485	$17,220
Beef	Beef	Liquid/Solid	Large 2	SO	2	M	0.0	$758,966	$7,794	$122,065	$1,726	$17,220
Beef	Beef	Liquid/Solid	Large 2	SO	3	H	0.0	$337,597	$1,045	$497,323	$20	$0
Beef	Beef	Liquid/Solid	Large 2	SO	3	L	0.0	$293,621	$836	$495,097	$16	$0
Beef	Beef	Liquid/Solid	Large 2	SO	3	M	0.0	$321,738	$972	$496,552	$19	$0
Beef	Beef	Liquid/Solid	Medium 1	CE	1	H	3.3	$34,623	$2,280	$3,397	$454	$1,076
Beef	Beef	Liquid/Solid	Medium 1	CE	1	L	3.3	$15,113	$1,824	$2,107	$411	$1,076
Beef	Beef	Liquid/Solid	Medium 1	CE	1	M	6.4	$26,064	$2,052	$2,810	$432	$1,076
Beef	Beef	Liquid/Solid	Medium 1	CE	2	H	0.7	$34,623	$2,034	$3,566	$385	$423
Beef	Beef	Liquid/Solid	Medium 1	CE	2	L	0.7	$15,113	$1,627	$2,305	$356	$423
Beef	Beef	Liquid/Solid	Medium 1	CE	2	M	1.4	$26,064	$1,831	$2,994	$370	$423
Beef	Beef	Liquid/Solid	Medium 1	CE	3	H	0.3	$7,775	$1,045	$3,173	$259	$0
Beef	Beef	Liquid/Solid	Medium 1	CE	3	L	0.3	$6,552	$836	$2,899	$255	$0
Beef	Beef	Liquid/Solid	Medium 1	CE	3	M	0.6	$7,271	$941	$3,039	$257	$0
Beef	Beef	Liquid/Solid	Medium 1	MA	1	H	0.5	$42,392	$2,046	$2,886	$934	$738
Beef	Beef	Liquid/Solid	Medium 1	MA	1	L	0.5	$18,936	$1,607	$1,932	$899	$738
Beef	Beef	Liquid/Solid	Medium 1	MA	1	M	0.9	$31,434	$1,949	$2,530	$926	$738

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Medium 1	MA	2	H	0.1	$50,824	$1,849	$4,458	$871	$263
Beef	Beef	Liquid/Solid	Medium 1	MA	2	L	0.1	$21,656	$1,452	$3,675	$850	$263
Beef	Beef	Liquid/Solid	Medium 1	MA	2	M	0.2	$37,350	$1,762	$4,172	$866	$263
Beef	Beef	Liquid/Solid	Medium 1	MA	3	H	0.0	$10,899	$1,045	$26,334	$794	$0
Beef	Beef	Liquid/Solid	Medium 1	MA	3	L	0.0	$8,779	$821	$26,018	$790	$0
Beef	Beef	Liquid/Solid	Medium 1	MA	3	M	0.1	$9,342	$996	$26,241	$793	$0
Beef	Beef	Liquid/Solid	Medium 1	MW	1	H	14.8	$35,538	$2,030	$3,308	$555	$725
Beef	Beef	Liquid/Solid	Medium 1	MW	1	L	14.8	$17,089	$1,624	$2,104	$525	$725
Beef	Beef	Liquid/Solid	Medium 1	MW	1	M	29.5	$27,032	$1,827	$2,735	$540	$725
Beef	Beef	Liquid/Solid	Medium 1	MW	2	H	2.1	$35,538	$1,863	$3,408	$506	$250
Beef	Beef	Liquid/Solid	Medium 1	MW	2	L	2.1	$17,089	$1,491	$2,223	$486	$250
Beef	Beef	Liquid/Solid	Medium 1	MW	2	M	4.2	$27,032	$1,677	$2,844	$496	$250
Beef	Beef	Liquid/Solid	Medium 1	MW	3	H	1.3	$8,690	$1,045	$3,076	$423	$0
Beef	Beef	Liquid/Solid	Medium 1	MW	3	L	1.3	$7,146	$836	$2,790	$419	$0
Beef	Beef	Liquid/Solid	Medium 1	MW	3	M	2.5	$8,239	$941	$2,942	$421	$0
Beef	Beef	Liquid/Solid	Medium 1	PA	1	H	0.4	$38,131	$2,138	$3,507	$1,022	$857
Beef	Beef	Liquid/Solid	Medium 1	PA	1	L	0.4	$20,490	$1,710	$2,333	$985	$857
Beef	Beef	Liquid/Solid	Medium 1	PA	1	M	0.8	$29,721	$1,924	$2,930	$1,004	$857
Beef	Beef	Liquid/Solid	Medium 1	PA	2	H	0.1	$38,131	$1,924	$4,100	$957	$364
Beef	Beef	Liquid/Solid	Medium 1	PA	2	L	0.1	$20,490	$1,539	$2,951	$933	$364
Beef	Beef	Liquid/Solid	Medium 1	PA	2	M	0.2	$29,721	$1,732	$3,535	$945	$364
Beef	Beef	Liquid/Solid	Medium 1	PA	3	H	0.0	$11,283	$1,045	$13,471	$856	$0
Beef	Beef	Liquid/Solid	Medium 1	PA	3	L	0.0	$9,751	$836	$13,188	$852	$0
Beef	Beef	Liquid/Solid	Medium 1	PA	3	M	0.1	$10,927	$941	$13,340	$854	$0
Beef	Beef	Liquid/Solid	Medium 1	SO	1	H	0.1	$38,031	$1,917	$4,168	$1,044	$523
Beef	Beef	Liquid/Solid	Medium 1	SO	1	L	0.1	$16,811	$1,534	$2,218	$1,019	$523

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Medium 1	SO	1	M	0.1	$29,292	$1,783	$3,386	$1,035	$523
Beef	Beef	Liquid/Solid	Medium 1	SO	2	H	0.0	$38,031	$1,730	$6,371	$987	$172
Beef	Beef	Liquid/Solid	Medium 1	SO	2	L	0.0	$16,811	$1,384	$5,059	$974	$172
Beef	Beef	Liquid/Solid	Medium 1	SO	2	M	0.0	$29,292	$1,609	$5,850	$983	$172
Beef	Beef	Liquid/Solid	Medium 1	SO	3	H	0.0	$11,988	$1,045	$12,112	$940	$0
Beef	Beef	Liquid/Solid	Medium 1	SO	3	L	0.0	$10,367	$836	$11,818	$936	$0
Beef	Beef	Liquid/Solid	Medium 1	SO	3	M	0.0	$11,304	$972	$12,007	$939	$0
Beef	Beef	Liquid/Solid	Medium 2	CE	1	H	1.7	$35,625	$2,623	$9,772	$670	$1,580
Beef	Beef	Liquid/Solid	Medium 2	CE	1	L	1.7	$16,085	$2,098	$4,330	$607	$1,580
Beef	Beef	Liquid/Solid	Medium 2	CE	1	M	3.6	$26,984	$2,361	$7,322	$639	$1,580
Beef	Beef	Liquid/Solid	Medium 2	CE	2	H	0.4	$35,625	$2,608	$4,046	$655	$938
Beef	Beef	Liquid/Solid	Medium 2	CE	2	L	0.4	$16,085	$2,087	$2,723	$596	$938
Beef	Beef	Liquid/Solid	Medium 2	CE	2	M	0.8	$26,984	$2,348	$3,437	$626	$938
Beef	Beef	Liquid/Solid	Medium 2	CE	3	H	0.2	$8,777	$1,045	$3,962	$377	$0
Beef	Beef	Liquid/Solid	Medium 2	CE	3	L	0.2	$7,261	$836	$3,681	$373	$0
Beef	Beef	Liquid/Solid	Medium 2	CE	3	M	0.3	$8,191	$941	$3,826	$375	$0
Beef	Beef	Liquid/Solid	Medium 2	MA	1	H	0.2	$44,922	$2,291	$6,339	$1,364	$1,100
Beef	Beef	Liquid/Solid	Medium 2	MA	1	L	0.2	$20,693	$1,799	$3,160	$1,319	$1,100
Beef	Beef	Liquid/Solid	Medium 2	MA	1	M	0.5	$33,492	$2,183	$5,007	$1,354	$1,100
Beef	Beef	Liquid/Solid	Medium 2	MA	2	H	0.0	$53,664	$2,251	$4,566	$1,364	$625
Beef	Beef	Liquid/Solid	Medium 2	MA	2	L	0.0	$23,512	$1,767	$3,056	$1,319	$625
Beef	Beef	Liquid/Solid	Medium 2	MA	2	M	0.1	$39,625	$2,145	$3,968	$1,354	$625
Beef	Beef	Liquid/Solid	Medium 2	MA	3	H	0.0	$13,066	$1,045	$38,550	$1,175	$0
Beef	Beef	Liquid/Solid	Medium 2	MA	3	L	0.0	$10,419	$821	$38,219	$1,170	$0
Beef	Beef	Liquid/Solid	Medium 2	MA	3	M	0.0	$11,145	$996	$38,449	$1,174	$0
Beef	Beef	Liquid/Solid	Medium 2	MW	1	H	8.1	$36,908	$2,268	$3,510	$819	$1,081

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Medium 2	MW	1	L	8.1	$18,388	$1,815	$2,283	$776	$1,081
Beef	Beef	Liquid/Solid	Medium 2	MW	1	M	16.2	$28,323	$2,042	$2,919	$798	$1,081
Beef	Beef	Liquid/Solid	Medium 2	MW	2	H	1.2	$36,908	$2,289	$3,780	$822	$606
Beef	Beef	Liquid/Solid	Medium 2	MW	2	L	1.2	$18,388	$1,831	$2,550	$778	$606
Beef	Beef	Liquid/Solid	Medium 2	MW	2	M	2.3	$28,323	$2,060	$3,188	$800	$606
Beef	Beef	Liquid/Solid	Medium 2	MW	3	H	0.7	$10,060	$1,045	$3,864	$621	$0
Beef	Beef	Liquid/Solid	Medium 2	MW	3	L	0.7	$8,084	$836	$3,564	$617	$0
Beef	Beef	Liquid/Solid	Medium 2	MW	3	M	1.4	$9,529	$941	$3,726	$619	$0
Beef	Beef	Liquid/Solid	Medium 2	PA	1	H	0.2	$56,623	$2,430	$4,155	$1,497	$1,279
Beef	Beef	Liquid/Solid	Medium 2	PA	1	L	0.2	$28,934	$1,944	$2,715	$1,447	$1,279
Beef	Beef	Liquid/Solid	Medium 2	PA	1	M	0.4	$43,285	$2,187	$3,447	$1,472	$1,279
Beef	Beef	Liquid/Solid	Medium 2	PA	2	H	0.1	$66,216	$2,353	$4,909	$1,489	$784
Beef	Beef	Liquid/Solid	Medium 2	PA	2	L	0.1	$32,771	$1,882	$3,347	$1,440	$784
Beef	Beef	Liquid/Solid	Medium 2	PA	2	M	0.1	$50,000	$2,118	$4,141	$1,464	$784
Beef	Beef	Liquid/Solid	Medium 2	PA	3	H	0.0	$13,642	$1,045	$19,352	$1,267	$0
Beef	Beef	Liquid/Solid	Medium 2	PA	3	L	0.0	$11,741	$836	$19,058	$1,263	$0
Beef	Beef	Liquid/Solid	Medium 2	PA	3	M	0.0	$13,198	$941	$19,218	$1,265	$0
Beef	Beef	Liquid/Solid	Medium 2	SO	1	H	0.0	$51,471	$2,065	$3,324	$1,533	$733
Beef	Beef	Liquid/Solid	Medium 2	SO	1	L	0.0	$21,598	$1,652	$2,127	$1,501	$733
Beef	Beef	Liquid/Solid	Medium 2	SO	1	M	0.1	$39,181	$1,921	$2,853	$1,522	$733
Beef	Beef	Liquid/Solid	Medium 2	SO	2	H	0.0	$61,921	$1,966	$3,421	$1,507	$400
Beef	Beef	Liquid/Solid	Medium 2	SO	2	L	0.0	$24,184	$1,573	$2,400	$1,480	$400
Beef	Beef	Liquid/Solid	Medium 2	SO	2	M	0.0	$46,399	$1,828	$3,022	$1,497	$400
Beef	Beef	Liquid/Solid	Medium 2	SO	3	H	0.0	$14,548	$1,045	$15,505	$1,393	$0
Beef	Beef	Liquid/Solid	Medium 2	SO	3	L	0.0	$12,463	$836	$15,194	$1,389	$0
Beef	Beef	Liquid/Solid	Medium 2	SO	3	M	0.0	$13,677	$972	$15,394	$1,392	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Medium 3	CE	1	H	1.2	$36,821	$3,194	$4,016	$966	$2,398
Beef	Beef	Liquid/Solid	Medium 3	CE	1	L	1.2	$16,777	$2,555	$2,606	$872	$2,398
Beef	Beef	Liquid/Solid	Medium 3	CE	1	M	2.4	$28,042	$2,875	$3,370	$919	$2,398
Beef	Beef	Liquid/Solid	Medium 3	CE	2	H	0.3	$36,821	$3,371	$4,662	$1,005	$1,700
Beef	Beef	Liquid/Solid	Medium 3	CE	2	L	0.3	$16,777	$2,697	$3,231	$903	$1,700
Beef	Beef	Liquid/Solid	Medium 3	CE	2	M	0.5	$28,042	$3,034	$4,006	$954	$1,700
Beef	Beef	Liquid/Solid	Medium 3	CE	3	H	0.1	$9,973	$1,045	$5,358	$515	$0
Beef	Beef	Liquid/Solid	Medium 3	CE	3	L	0.1	$8,216	$836	$5,070	$511	$0
Beef	Beef	Liquid/Solid	Medium 3	CE	3	M	0.2	$9,249	$941	$5,219	$513	$0
Beef	Beef	Liquid/Solid	Medium 3	MA	1	H	0.1	$61,890	$2,618	$4,394	$1,908	$1,577
Beef	Beef	Liquid/Solid	Medium 3	MA	1	L	0.1	$27,171	$2,056	$2,672	$1,842	$1,577
Beef	Beef	Liquid/Solid	Medium 3	MA	1	M	0.2	$45,712	$2,495	$3,711	$1,894	$1,577
Beef	Beef	Liquid/Solid	Medium 3	MA	2	H	0.0	$57,169	$2,744	$6,027	$1,944	$1,087
Beef	Beef	Liquid/Solid	Medium 3	MA	2	L	0.0	$25,648	$2,155	$3,881	$1,870	$1,087
Beef	Beef	Liquid/Solid	Medium 3	MA	2	M	0.0	$42,400	$2,615	$5,161	$1,928	$1,087
Beef	Beef	Liquid/Solid	Medium 3	MA	3	H	0.0	$15,357	$1,045	$54,987	$1,622	$0
Beef	Beef	Liquid/Solid	Medium 3	MA	3	L	0.0	$12,163	$821	$54,638	$1,618	$0
Beef	Beef	Liquid/Solid	Medium 3	MA	3	M	0.0	$13,069	$996	$54,876	$1,621	$0
Beef	Beef	Liquid/Solid	Medium 3	MW	1	H	4.0	$48,578	$2,547	$3,771	$1,125	$1,498
Beef	Beef	Liquid/Solid	Medium 3	MW	1	L	4.0	$23,043	$2,038	$2,464	$1,067	$1,498
Beef	Beef	Liquid/Solid	Medium 3	MW	1	M	8.0	$36,840	$2,293	$3,151	$1,096	$1,498
Beef	Beef	Liquid/Solid	Medium 3	MW	2	H	0.6	$59,669	$2,792	$4,268	$1,186	$1,028
Beef	Beef	Liquid/Solid	Medium 3	MW	2	L	0.6	$27,151	$2,234	$2,914	$1,116	$1,028
Beef	Beef	Liquid/Solid	Medium 3	MW	2	M	1.1	$44,603	$2,513	$3,625	$1,151	$1,028
Beef	Beef	Liquid/Solid	Medium 3	MW	3	H	0.3	$11,761	$1,045	$4,788	$854	$0
Beef	Beef	Liquid/Solid	Medium 3	MW	3	L	0.3	$9,408	$836	$4,476	$850	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Beef	Beef	Liquid/Solid	Medium 3	MW	3	M	0.7	$11,067	$941	$4,646	$852	$0
Beef	Beef	Liquid/Solid	Medium 3	PA	1	H	0.2	$59,803	$2,774	$5,152	$2,074	$1,777
Beef	Beef	Liquid/Solid	Medium 3	PA	1	L	0.2	$31,311	$2,220	$3,252	$2,005	$1,777
Beef	Beef	Liquid/Solid	Medium 3	PA	1	M	0.4	$46,161	$2,497	$4,217	$2,039	$1,777
Beef	Beef	Liquid/Solid	Medium 3	PA	2	H	0.1	$69,812	$2,858	$6,585	$2,109	$1,279
Beef	Beef	Liquid/Solid	Medium 3	PA	2	L	0.1	$35,315	$2,286	$4,302	$2,034	$1,279
Beef	Beef	Liquid/Solid	Medium 3	PA	2	M	0.1	$53,167	$2,572	$5,458	$2,072	$1,279
Beef	Beef	Liquid/Solid	Medium 3	PA	3	H	0.0	$16,123	$1,045	$26,254	$1,751	$0
Beef	Beef	Liquid/Solid	Medium 3	PA	3	L	0.0	$13,839	$836	$25,948	$1,747	$0
Beef	Beef	Liquid/Solid	Medium 3	PA	3	M	0.0	$15,585	$941	$26,116	$1,749	$0
Beef	Beef	Liquid/Solid	Medium 3	SO	1	H	0.0	$72,589	$2,306	$3,793	$2,127	$1,070
Beef	Beef	Liquid/Solid	Medium 3	SO	1	L	0.0	$28,353	$1,845	$2,393	$2,083	$1,070
Beef	Beef	Liquid/Solid	Medium 3	SO	1	M	0.0	$54,405	$2,144	$3,241	$2,112	$1,070
Beef	Beef	Liquid/Solid	Medium 3	SO	2	H	0.0	$72,875	$2,274	$4,685	$2,125	$723
Beef	Beef	Liquid/Solid	Medium 3	SO	2	L	0.0	$28,424	$1,819	$2,980	$2,081	$723
Beef	Beef	Liquid/Solid	Medium 3	SO	2	M	0.0	$54,602	$2,115	$4,008	$2,109	$723
Beef	Beef	Liquid/Solid	Medium 3	SO	3	H	0.0	$17,253	$1,045	$23,018	$1,925	$0
Beef	Beef	Liquid/Solid	Medium 3	SO	3	L	0.0	$14,662	$836	$22,688	$1,921	$0
Beef	Beef	Liquid/Solid	Medium 3	SO	3	M	0.0	$16,183	$972	$22,900	$1,924	$0
Dairy	Flush	Liquid/Solid	Large 1	CE	1	H	16.3	$131,634	$4,821	$5,968	$903	$5,833
Dairy	Flush	Liquid/Solid	Large 1	CE	1	L	16.3	$0	$3,857	$2,669	$722	$5,833
Dairy	Flush	Liquid/Solid	Large 1	CE	1	M	32.8	$110,106	$4,339	$5,204	$812	$5,833
Dairy	Flush	Liquid/Solid	Large 1	CE	2	H	42.2	$131,634	$2,579	$53,842	$303	$1,246
Dairy	Flush	Liquid/Solid	Large 1	CE	2	L	42.2	$0	$2,063	$50,803	$243	$1,246
Dairy	Flush	Liquid/Solid	Large 1	CE	2	M	85.0	$110,106	$2,321	$53,209	$273	$1,246
Dairy	Flush	Liquid/Solid	Large 1	CE	3	H	16.5	$131,634	$1,045	$61,516	$20	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Flush	Liquid/Solid	Large 1	CE	3	L	16.5	$0	$836	$58,614	$16	$0
Dairy	Flush	Liquid/Solid	Large 1	CE	3	M	33.2	$110,106	$941	$60,951	$18	$0
Dairy	Flush	Liquid/Solid	Large 1	MA	1	H	2.3	$131,724	$3,337	$4,910	$645	$6,911
Dairy	Flush	Liquid/Solid	Large 1	MA	1	L	2.3	$237	$2,669	$1,825	$516	$6,911
Dairy	Flush	Liquid/Solid	Large 1	MA	1	M	4.7	$110,423	$3,003	$4,257	$581	$6,911
Dairy	Flush	Liquid/Solid	Large 1	MA	2	H	7.8	$131,724	$1,528	$144,896	$158	$1,063
Dairy	Flush	Liquid/Solid	Large 1	MA	2	L	7.8	$237	$1,222	$142,022	$127	$1,063
Dairy	Flush	Liquid/Solid	Large 1	MA	2	M	15.6	$110,423	$1,375	$144,348	$142	$1,063
Dairy	Flush	Liquid/Solid	Large 1	MA	3	H	2.9	$340,779	$659	$203,569	$13	$0
Dairy	Flush	Liquid/Solid	Large 1	MA	3	L	2.9	$209,292	$527	$200,769	$10	$0
Dairy	Flush	Liquid/Solid	Large 1	MA	3	M	5.7	$319,478	$593	$203,058	$11	$0
Dairy	Flush	Liquid/Solid	Large 1	MW	1	H	2.4	$132,502	$5,295	$6,261	$1,024	$7,015
Dairy	Flush	Liquid/Solid	Large 1	MW	1	L	2.4	$561	$4,236	$2,900	$819	$7,015
Dairy	Flush	Liquid/Solid	Large 1	MW	1	M	4.7	$110,974	$4,765	$5,470	$922	$7,015
Dairy	Flush	Liquid/Solid	Large 1	MW	2	H	6.9	$132,502	$2,893	$22,615	$380	$1,610
Dairy	Flush	Liquid/Solid	Large 1	MW	2	L	6.9	$561	$2,314	$19,533	$304	$1,610
Dairy	Flush	Liquid/Solid	Large 1	MW	2	M	13.3	$110,974	$2,603	$21,963	$342	$1,610
Dairy	Flush	Liquid/Solid	Large 1	MW	3	H	2.6	$132,502	$1,045	$46,897	$20	$0
Dairy	Flush	Liquid/Solid	Large 1	MW	3	L	2.6	$561	$836	$43,988	$16	$0
Dairy	Flush	Liquid/Solid	Large 1	MW	3	M	5.1	$110,974	$941	$46,332	$18	$0
Dairy	Flush	Liquid/Solid	Large 1	PA	1	H	23.9	$131,634	$3,847	$5,402	$631	$4,206
Dairy	Flush	Liquid/Solid	Large 1	PA	1	L	23.9	$0	$3,077	$2,215	$505	$4,206
Dairy	Flush	Liquid/Solid	Large 1	PA	1	M	47.9	$110,106	$3,462	$4,694	$568	$4,206
Dairy	Flush	Liquid/Solid	Large 1	PA	2	H	86.9	$131,634	$2,074	$195,854	$153	$642
Dairy	Flush	Liquid/Solid	Large 1	PA	2	L	86.9	$0	$1,659	$192,874	$123	$642
Dairy	Flush	Liquid/Solid	Large 1	PA	2	M	174.4	$110,106	$1,866	$195,249	$138	$642

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Flush	Liquid/Solid	Large 1	PA	3	H	31.2	$355,621	$1,045	$100,968	$20	$0
Dairy	Flush	Liquid/Solid	Large 1	PA	3	L	31.2	$223,987	$836	$98,065	$16	$0
Dairy	Flush	Liquid/Solid	Large 1	PA	3	M	62.7	$334,093	$941	$100,403	$18	$0
Dairy	Flush	Liquid/Solid	Large 1	SO	1	H	3.3	$131,941	$3,346	$5,117	$500	$2,721
Dairy	Flush	Liquid/Solid	Large 1	SO	1	L	3.3	$0	$2,677	$1,982	$400	$2,721
Dairy	Flush	Liquid/Solid	Large 1	SO	1	M	6.7	$110,413	$3,011	$4,438	$450	$2,721
Dairy	Flush	Liquid/Solid	Large 1	SO	2	H	9.9	$131,941	$1,605	$151,760	$28	$85
Dairy	Flush	Liquid/Solid	Large 1	SO	2	L	9.9	$0	$1,284	$148,829	$22	$85
Dairy	Flush	Liquid/Solid	Large 1	SO	2	M	19.8	$110,413	$1,445	$151,183	$25	$85
Dairy	Flush	Liquid/Solid	Large 1	SO	3	H	3.7	$329,796	$1,045	$87,529	$20	$0
Dairy	Flush	Liquid/Solid	Large 1	SO	3	L	3.7	$197,855	$836	$84,620	$16	$0
Dairy	Flush	Liquid/Solid	Large 1	SO	3	M	7.5	$308,268	$941	$86,964	$18	$0
Dairy	Flush	Liquid/Solid	Medium 1	CE	1	H	6.4	$29,265	$2,261	$2,292	$216	$1,149
Dairy	Flush	Liquid/Solid	Medium 1	CE	1	L	6.4	$5,776	$1,809	$1,481	$173	$1,149
Dairy	Flush	Liquid/Solid	Medium 1	CE	1	M	13.0	$29,008	$2,035	$2,116	$195	$1,149
Dairy	Flush	Liquid/Solid	Medium 1	CE	2	H	7.8	$29,265	$2,374	$2,428	$246	$941
Dairy	Flush	Liquid/Solid	Medium 1	CE	2	L	7.8	$5,776	$1,899	$1,604	$197	$941
Dairy	Flush	Liquid/Solid	Medium 1	CE	2	M	15.9	$29,008	$2,137	$2,246	$222	$941
Dairy	Flush	Liquid/Solid	Medium 1	CE	3	H	2.3	$29,265	$1,045	$16,754	$20	$0
Dairy	Flush	Liquid/Solid	Medium 1	CE	3	L	2.3	$5,776	$836	$16,042	$16	$0
Dairy	Flush	Liquid/Solid	Medium 1	CE	3	M	4.7	$29,008	$941	$16,628	$18	$0
Dairy	Flush	Liquid/Solid	Medium 1	MA	1	H	12.8	$29,302	$1,416	$1,656	$131	$1,165
Dairy	Flush	Liquid/Solid	Medium 1	MA	1	L	12.8	$5,875	$1,133	$974	$105	$1,165
Dairy	Flush	Liquid/Solid	Medium 1	MA	1	M	25.7	$29,141	$1,275	$1,546	$118	$1,165
Dairy	Flush	Liquid/Solid	Medium 1	MA	2	H	16.0	$29,302	$1,507	$1,821	$158	$942
Dairy	Flush	Liquid/Solid	Medium 1	MA	2	L	16.0	$5,875	$1,206	$1,128	$126	$942

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Flush	Liquid/Solid	Medium 1	MA	2	M	32.0	$29,141	$1,356	$1,705	$142	$942
Dairy	Flush	Liquid/Solid	Medium 1	MA	3	H	4.7	$227,158	$659	$40,802	$13	$0
Dairy	Flush	Liquid/Solid	Medium 1	MA	3	L	4.7	$203,731	$527	$40,181	$10	$0
Dairy	Flush	Liquid/Solid	Medium 1	MA	3	M	9.4	$226,996	$593	$40,723	$11	$0
Dairy	Flush	Liquid/Solid	Medium 1	MW	1	H	11.7	$29,628	$2,315	$2,330	$223	$1,277
Dairy	Flush	Liquid/Solid	Medium 1	MW	1	L	11.7	$6,011	$1,852	$1,510	$178	$1,277
Dairy	Flush	Liquid/Solid	Medium 1	MW	1	M	23.8	$29,371	$2,083	$2,151	$200	$1,277
Dairy	Flush	Liquid/Solid	Medium 1	MW	2	H	13.8	$29,628	$2,489	$2,473	$264	$1,051
Dairy	Flush	Liquid/Solid	Medium 1	MW	2	L	13.8	$6,011	$1,991	$1,633	$211	$1,051
Dairy	Flush	Liquid/Solid	Medium 1	MW	2	M	28.0	$29,371	$2,240	$2,284	$237	$1,051
Dairy	Flush	Liquid/Solid	Medium 1	MW	3	H	4.2	$29,628	$1,045	$11,385	$20	$0
Dairy	Flush	Liquid/Solid	Medium 1	MW	3	L	4.2	$6,011	$836	$10,671	$16	$0
Dairy	Flush	Liquid/Solid	Medium 1	MW	3	M	8.4	$29,371	$941	$11,259	$18	$0
Dairy	Flush	Liquid/Solid	Medium 1	PA	1	H	3.5	$29,265	$1,995	$2,137	$137	$735
Dairy	Flush	Liquid/Solid	Medium 1	PA	1	L	3.5	$5,776	$1,596	$1,357	$110	$735
Dairy	Flush	Liquid/Solid	Medium 1	PA	1	M	7.1	$29,008	$1,796	$1,977	$123	$735
Dairy	Flush	Liquid/Solid	Medium 1	PA	2	H	5.2	$29,265	$2,069	$2,281	$160	$595
Dairy	Flush	Liquid/Solid	Medium 1	PA	2	L	5.2	$5,776	$1,655	$1,492	$128	$595
Dairy	Flush	Liquid/Solid	Medium 1	PA	2	M	10.4	$29,008	$1,862	$2,116	$144	$595
Dairy	Flush	Liquid/Solid	Medium 1	PA	3	H	1.4	$29,265	$1,045	$31,537	$20	$0
Dairy	Flush	Liquid/Solid	Medium 1	PA	3	L	1.4	$5,776	$836	$30,825	$16	$0
Dairy	Flush	Liquid/Solid	Medium 1	PA	3	M	2.8	$29,008	$941	$31,411	$18	$0
Dairy	Flush	Liquid/Solid	Medium 1	SO	1	H	5.5	$29,393	$1,857	$2,059	$97	$450
Dairy	Flush	Liquid/Solid	Medium 1	SO	1	L	5.5	$5,776	$1,486	$1,293	$78	$450
Dairy	Flush	Liquid/Solid	Medium 1	SO	1	M	10.9	$29,136	$1,671	$1,907	$87	$450
Dairy	Flush	Liquid/Solid	Medium 1	SO	2	H	5.3	$29,393	$1,834	$2,109	$94	$343

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Flush	Liquid/Solid	Medium 1	SO	2	L	5.3	$5,776	$1,467	$1,345	$75	$343
Dairy	Flush	Liquid/Solid	Medium 1	SO	2	M	10.5	$29,136	$1,650	$1,958	$85	$343
Dairy	Flush	Liquid/Solid	Medium 1	SO	3	H	1.8	$29,393	$1,045	$22,645	$20	$0
Dairy	Flush	Liquid/Solid	Medium 1	SO	3	L	1.8	$5,776	$836	$21,931	$16	$0
Dairy	Flush	Liquid/Solid	Medium 1	SO	3	M	3.5	$29,136	$941	$22,519	$18	$0
Dairy	Flush	Liquid/Solid	Medium 2	CE	1	H	2.3	$45,465	$2,746	$2,898	$346	$1,931
Dairy	Flush	Liquid/Solid	Medium 2	CE	1	L	2.3	$8,993	$2,197	$1,771	$277	$1,931
Dairy	Flush	Liquid/Solid	Medium 2	CE	1	M	4.7	$45,130	$2,471	$2,692	$311	$1,931
Dairy	Flush	Liquid/Solid	Medium 2	CE	2	H	2.8	$45,465	$2,053	$24,653	$152	$573
Dairy	Flush	Liquid/Solid	Medium 2	CE	2	L	2.8	$8,993	$1,642	$23,606	$122	$573
Dairy	Flush	Liquid/Solid	Medium 2	CE	2	M	5.8	$45,130	$1,848	$24,487	$137	$573
Dairy	Flush	Liquid/Solid	Medium 2	CE	3	H	0.8	$45,465	$1,045	$26,729	$20	$0
Dairy	Flush	Liquid/Solid	Medium 2	CE	3	L	0.8	$8,993	$836	$25,758	$16	$0
Dairy	Flush	Liquid/Solid	Medium 2	CE	3	M	1.7	$45,130	$941	$26,602	$18	$0
Dairy	Flush	Liquid/Solid	Medium 2	MA	1	H	4.6	$45,514	$1,737	$2,167	$214	$2,004
Dairy	Flush	Liquid/Solid	Medium 2	MA	1	L	4.6	$9,122	$1,389	$1,188	$171	$2,004
Dairy	Flush	Liquid/Solid	Medium 2	MA	1	M	9.3	$45,303	$1,563	$2,037	$193	$2,004
Dairy	Flush	Liquid/Solid	Medium 2	MA	2	H	5.8	$45,514	$1,257	$36,322	$84	$501
Dairy	Flush	Liquid/Solid	Medium 2	MA	2	L	5.8	$9,122	$1,006	$35,398	$67	$501
Dairy	Flush	Liquid/Solid	Medium 2	MA	2	M	11.6	$45,303	$1,131	$36,220	$76	$501
Dairy	Flush	Liquid/Solid	Medium 2	MA	3	H	1.7	$247,103	$659	$69,121	$13	$0
Dairy	Flush	Liquid/Solid	Medium 2	MA	3	L	1.7	$210,711	$527	$68,240	$10	$0
Dairy	Flush	Liquid/Solid	Medium 2	MA	3	M	3.4	$246,892	$593	$69,040	$11	$0
Dairy	Flush	Liquid/Solid	Medium 2	MW	1	H	4.3	$45,938	$2,852	$2,969	$369	$2,168
Dairy	Flush	Liquid/Solid	Medium 2	MW	1	L	4.3	$9,299	$2,282	$1,826	$295	$2,168
Dairy	Flush	Liquid/Solid	Medium 2	MW	1	M	8.5	$45,604	$2,567	$2,757	$332	$2,168

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Flush	Liquid/Solid	Medium 2	MW	2	H	5.0	$45,938	$2,160	$14,289	$178	$685
Dairy	Flush	Liquid/Solid	Medium 2	MW	2	L	5.0	$9,299	$1,728	$13,227	$143	$685
Dairy	Flush	Liquid/Solid	Medium 2	MW	2	M	10.0	$45,604	$1,944	$14,117	$160	$685
Dairy	Flush	Liquid/Solid	Medium 2	MW	3	H	1.5	$45,938	$1,045	$18,197	$20	$0
Dairy	Flush	Liquid/Solid	Medium 2	MW	3	L	1.5	$9,299	$836	$17,222	$16	$0
Dairy	Flush	Liquid/Solid	Medium 2	MW	3	M	3.0	$45,604	$941	$18,069	$18	$0
Dairy	Flush	Liquid/Solid	Medium 2	PA	1	H	1.3	$45,465	$2,310	$2,644	$229	$1,249
Dairy	Flush	Liquid/Solid	Medium 2	PA	1	L	1.3	$8,993	$1,848	$1,568	$183	$1,249
Dairy	Flush	Liquid/Solid	Medium 2	PA	1	M	2.6	$45,130	$2,079	$2,464	$206	$1,249
Dairy	Flush	Liquid/Solid	Medium 2	PA	2	H	1.9	$45,465	$1,822	$53,342	$97	$314
Dairy	Flush	Liquid/Solid	Medium 2	PA	2	L	1.9	$8,993	$1,458	$52,322	$78	$314
Dairy	Flush	Liquid/Solid	Medium 2	PA	2	M	3.7	$45,130	$1,640	$53,190	$88	$314
Dairy	Flush	Liquid/Solid	Medium 2	PA	3	H	0.5	$45,465	$1,045	$52,033	$20	$0
Dairy	Flush	Liquid/Solid	Medium 2	PA	3	L	0.5	$8,993	$836	$51,061	$16	$0
Dairy	Flush	Liquid/Solid	Medium 2	PA	3	M	1.0	$45,130	$941	$51,905	$18	$0
Dairy	Flush	Liquid/Solid	Medium 2	SO	1	H	2.0	$45,632	$2,071	$2,509	$167	$759
Dairy	Flush	Liquid/Solid	Medium 2	SO	1	L	2.0	$8,993	$1,657	$1,457	$134	$759
Dairy	Flush	Liquid/Solid	Medium 2	SO	1	M	4.0	$45,298	$1,864	$2,342	$151	$759
Dairy	Flush	Liquid/Solid	Medium 2	SO	2	H	1.9	$45,632	$1,624	$63,169	$31	$92
Dairy	Flush	Liquid/Solid	Medium 2	SO	2	L	1.9	$8,993	$1,299	$62,169	$25	$92
Dairy	Flush	Liquid/Solid	Medium 2	SO	2	M	3.8	$45,298	$1,462	$63,029	$28	$92
Dairy	Flush	Liquid/Solid	Medium 2	SO	3	H	0.6	$45,632	$1,045	$36,319	$20	$0
Dairy	Flush	Liquid/Solid	Medium 2	SO	3	L	0.6	$8,993	$836	$35,345	$16	$0
Dairy	Flush	Liquid/Solid	Medium 2	SO	3	M	1.3	$45,298	$941	$36,192	$18	$0
Dairy	Flush	Liquid/Solid	Medium 3	CE	1	H	1.2	$61,054	$3,197	$3,472	$459	$2,663
Dairy	Flush	Liquid/Solid	Medium 3	CE	1	L	1.2	$12,092	$2,558	$2,043	$367	$2,663

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Flush	Liquid/Solid	Medium 3	CE	1	M	2.5	$60,657	$2,878	$3,239	$413	$2,663
Dairy	Flush	Liquid/Solid	Medium 3	CE	2	H	1.5	$61,054	$2,730	$3,427	$337	$1,336
Dairy	Flush	Liquid/Solid	Medium 3	CE	2	L	1.5	$12,092	$2,184	$2,052	$270	$1,336
Dairy	Flush	Liquid/Solid	Medium 3	CE	2	M	3.0	$60,657	$2,457	$3,221	$303	$1,336
Dairy	Flush	Liquid/Solid	Medium 3	CE	3	H	0.4	$61,054	$1,045	$35,666	$20	$0
Dairy	Flush	Liquid/Solid	Medium 3	CE	3	L	0.4	$12,092	$836	$34,444	$16	$0
Dairy	Flush	Liquid/Solid	Medium 3	CE	3	M	0.9	$60,657	$941	$35,537	$18	$0
Dairy	Flush	Liquid/Solid	Medium 3	MA	1	H	1.1	$61,113	$2,085	$2,682	$307	$2,902
Dairy	Flush	Liquid/Solid	Medium 3	MA	1	L	1.1	$12,245	$1,668	$1,413	$246	$2,902
Dairy	Flush	Liquid/Solid	Medium 3	MA	1	M	1.9	$60,862	$1,876	$2,531	$277	$2,902
Dairy	Flush	Liquid/Solid	Medium 3	MA	2	H	1.3	$61,113	$1,734	$4,966	$218	$1,357
Dairy	Flush	Liquid/Solid	Medium 3	MA	2	L	1.3	$12,245	$1,387	$3,738	$174	$1,357
Dairy	Flush	Liquid/Solid	Medium 3	MA	2	M	2.4	$60,862	$1,560	$4,835	$196	$1,357
Dairy	Flush	Liquid/Solid	Medium 3	MA	3	H	0.4	$270,167	$659	$100,255	$13	$0
Dairy	Flush	Liquid/Solid	Medium 3	MA	3	L	0.4	$221,300	$527	$99,125	$10	$0
Dairy	Flush	Liquid/Solid	Medium 3	MA	3	M	0.7	$269,917	$593	$100,174	$11	$0
Dairy	Flush	Liquid/Solid	Medium 3	MW	1	H	0.7	$61,616	$3,337	$3,565	$501	$2,984
Dairy	Flush	Liquid/Solid	Medium 3	MW	1	L	0.7	$12,455	$2,669	$2,115	$401	$2,984
Dairy	Flush	Liquid/Solid	Medium 3	MW	1	M	1.2	$61,219	$3,003	$3,324	$451	$2,984
Dairy	Flush	Liquid/Solid	Medium 3	MW	2	H	0.8	$61,616	$2,927	$3,461	$388	$1,533
Dairy	Flush	Liquid/Solid	Medium 3	MW	2	L	0.8	$12,455	$2,342	$2,059	$310	$1,533
Dairy	Flush	Liquid/Solid	Medium 3	MW	2	M	1.5	$61,219	$2,635	$3,244	$349	$1,533
Dairy	Flush	Liquid/Solid	Medium 3	MW	3	H	0.3	$61,616	$1,045	$24,145	$20	$0
Dairy	Flush	Liquid/Solid	Medium 3	MW	3	L	0.3	$12,455	$836	$22,920	$16	$0
Dairy	Flush	Liquid/Solid	Medium 3	MW	3	M	0.4	$61,219	$941	$24,016	$18	$0
Dairy	Flush	Liquid/Solid	Medium 3	PA	1	H	1.3	$61,054	$2,627	$3,141	$309	$1,765

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Flush	Liquid/Solid	Medium 3	PA	1	L	1.3	$12,092	$2,102	$1,777	$247	$1,765
Dairy	Flush	Liquid/Solid	Medium 3	PA	1	M	2.6	$60,657	$2,364	$2,941	$278	$1,765
Dairy	Flush	Liquid/Solid	Medium 3	PA	2	H	1.9	$61,054	$2,271	$9,421	$218	$825
Dairy	Flush	Liquid/Solid	Medium 3	PA	2	L	1.9	$12,092	$1,817	$8,100	$174	$825
Dairy	Flush	Liquid/Solid	Medium 3	PA	2	M	3.8	$60,657	$2,044	$9,242	$196	$825
Dairy	Flush	Liquid/Solid	Medium 3	PA	3	H	0.5	$61,054	$1,045	$72,517	$20	$0
Dairy	Flush	Liquid/Solid	Medium 3	PA	3	L	0.5	$12,092	$836	$71,295	$16	$0
Dairy	Flush	Liquid/Solid	Medium 3	PA	3	M	1.1	$60,657	$941	$72,388	$18	$0
Dairy	Flush	Liquid/Solid	Medium 3	SO	1	H	0.8	$61,253	$2,331	$2,972	$229	$1,136
Dairy	Flush	Liquid/Solid	Medium 3	SO	1	L	0.8	$12,092	$1,865	$1,640	$183	$1,136
Dairy	Flush	Liquid/Solid	Medium 3	SO	1	M	1.8	$60,855	$2,098	$2,790	$206	$1,136
Dairy	Flush	Liquid/Solid	Medium 3	SO	2	H	0.7	$61,253	$1,904	$25,808	$119	$431
Dairy	Flush	Liquid/Solid	Medium 3	SO	2	L	0.7	$12,092	$1,523	$24,525	$95	$431
Dairy	Flush	Liquid/Solid	Medium 3	SO	2	M	1.8	$60,855	$1,714	$25,650	$107	$431
Dairy	Flush	Liquid/Solid	Medium 3	SO	3	H	0.2	$61,253	$1,045	$60,506	$20	$0
Dairy	Flush	Liquid/Solid	Medium 3	SO	3	L	0.2	$12,092	$836	$59,281	$16	$0
Dairy	Flush	Liquid/Solid	Medium 3	SO	3	M	0.6	$60,855	$941	$60,377	$18	$0
Dairy	Hose	Liquid/Solid	Large 1	CE	1	H	5.4	$23,286	$4,821	$4,070	$903	$5,833
Dairy	Hose	Liquid/Solid	Large 1	CE	1	L	5.4	$3,357	$3,857	$2,790	$722	$5,833
Dairy	Hose	Liquid/Solid	Large 1	CE	1	M	10.9	$15,066	$4,339	$3,465	$812	$5,833
Dairy	Hose	Liquid/Solid	Large 1	CE	2	H	14.1	$27,552	$2,579	$4,606	$303	$1,246
Dairy	Hose	Liquid/Solid	Large 1	CE	2	L	14.1	$4,210	$2,063	$3,654	$243	$1,246
Dairy	Hose	Liquid/Solid	Large 1	CE	2	M	28.1	$17,625	$2,321	$4,164	$273	$1,246
Dairy	Hose	Liquid/Solid	Large 1	CE	3	H	5.5	$6,503	$1,045	$5,450	$20	$0
Dairy	Hose	Liquid/Solid	Large 1	CE	3	L	5.5	$0	$836	$5,050	$16	$0
Dairy	Hose	Liquid/Solid	Large 1	CE	3	M	11.0	$4,996	$941	$5,285	$18	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Hose	Liquid/Solid	Large 1	MA	1	H	2.3	$38,923	$3,337	$3,738	$645	$6,911
Dairy	Hose	Liquid/Solid	Large 1	MA	1	L	2.3	$12,572	$2,669	$2,333	$516	$6,911
Dairy	Hose	Liquid/Solid	Large 1	MA	1	M	4.7	$28,521	$3,003	$3,110	$581	$6,911
Dairy	Hose	Liquid/Solid	Large 1	MA	2	H	7.8	$33,559	$1,528	$6,955	$158	$1,063
Dairy	Hose	Liquid/Solid	Large 1	MA	2	L	7.8	$10,526	$1,222	$5,338	$127	$1,063
Dairy	Hose	Liquid/Solid	Large 1	MA	2	M	15.6	$24,671	$1,375	$6,239	$142	$1,063
Dairy	Hose	Liquid/Solid	Large 1	MA	3	H	2.9	$6,593	$659	$57,740	$13	$0
Dairy	Hose	Liquid/Solid	Large 1	MA	3	L	2.9	$237	$527	$57,443	$10	$0
Dairy	Hose	Liquid/Solid	Large 1	MA	3	M	5.7	$5,313	$593	$57,630	$11	$0
Dairy	Hose	Liquid/Solid	Large 1	MW	1	H	2.4	$39,785	$5,295	$5,357	$1,024	$7,015
Dairy	Hose	Liquid/Solid	Large 1	MW	1	L	2.4	$5,389	$4,236	$3,138	$819	$7,015
Dairy	Hose	Liquid/Solid	Large 1	MW	1	M	4.9	$25,951	$4,765	$4,358	$922	$7,015
Dairy	Hose	Liquid/Solid	Large 1	MW	2	H	6.9	$48,469	$2,893	$5,515	$380	$1,610
Dairy	Hose	Liquid/Solid	Large 1	MW	2	L	6.9	$6,682	$2,314	$3,228	$304	$1,610
Dairy	Hose	Liquid/Solid	Large 1	MW	2	M	13.8	$31,332	$2,603	$4,500	$342	$1,610
Dairy	Hose	Liquid/Solid	Large 1	MW	3	H	2.6	$7,371	$1,045	$5,661	$20	$0
Dairy	Hose	Liquid/Solid	Large 1	MW	3	L	2.6	$561	$836	$5,255	$16	$0
Dairy	Hose	Liquid/Solid	Large 1	MW	3	M	5.3	$5,864	$941	$5,496	$18	$0
Dairy	Hose	Liquid/Solid	Large 1	PA	1	H	7.9	$25,602	$3,847	$3,889	$631	$4,206
Dairy	Hose	Liquid/Solid	Large 1	PA	1	L	7.9	$3,820	$3,077	$2,413	$505	$4,206
Dairy	Hose	Liquid/Solid	Large 1	PA	1	M	16.1	$16,455	$3,462	$3,186	$568	$4,206
Dairy	Hose	Liquid/Solid	Large 1	PA	2	H	28.8	$30,521	$2,074	$6,515	$153	$642
Dairy	Hose	Liquid/Solid	Large 1	PA	2	L	28.8	$4,804	$1,659	$5,024	$123	$642
Dairy	Hose	Liquid/Solid	Large 1	PA	2	M	58.8	$19,407	$1,866	$5,805	$138	$642
Dairy	Hose	Liquid/Solid	Large 1	PA	3	H	10.3	$6,503	$1,045	$24,889	$20	$0
Dairy	Hose	Liquid/Solid	Large 1	PA	3	L	10.3	$0	$836	$24,489	$16	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Hose	Liquid/Solid	Large 1	PA	3	M	21.1	$4,996	$941	$24,723	$18	$0
Dairy	Hose	Liquid/Solid	Large 1	SO	1	H	1.2	$43,717	$3,346	$3,209	$500	$2,721
Dairy	Hose	Liquid/Solid	Large 1	SO	1	L	1.2	$21,009	$2,677	$2,321	$400	$2,721
Dairy	Hose	Liquid/Solid	Large 1	SO	1	M	2.2	$34,261	$3,011	$2,803	$450	$2,721
Dairy	Hose	Liquid/Solid	Large 1	SO	2	H	3.5	$24,261	$1,605	$18,632	$28	$85
Dairy	Hose	Liquid/Solid	Large 1	SO	2	L	3.5	$9,934	$1,284	$17,827	$22	$85
Dairy	Hose	Liquid/Solid	Large 1	SO	2	M	6.4	$18,995	$1,445	$18,267	$25	$85
Dairy	Hose	Liquid/Solid	Large 1	SO	3	H	1.3	$6,809	$1,045	$22,726	$20	$0
Dairy	Hose	Liquid/Solid	Large 1	SO	3	L	1.3	$0	$836	$22,320	$16	$0
Dairy	Hose	Liquid/Solid	Large 1	SO	3	M	2.4	$5,303	$941	$22,561	$18	$0
Dairy	Hose	Liquid/Solid	Medium 1	CE	1	H	6.4	$22,903	$2,261	$2,732	$2,158	$1,149
Dairy	Hose	Liquid/Solid	Medium 1	CE	1	L	6.4	$8,895	$1,809	$1,788	$2,115	$1,149
Dairy	Hose	Liquid/Solid	Medium 1	CE	1	M	12.9	$17,277	$2,035	$2,288	$2,137	$1,149
Dairy	Hose	Liquid/Solid	Medium 1	CE	2	H	7.8	$22,903	$2,374	$3,103	$2,189	$941
Dairy	Hose	Liquid/Solid	Medium 1	CE	2	L	7.8	$8,895	$1,899	$2,147	$2,139	$941
Dairy	Hose	Liquid/Solid	Medium 1	CE	2	M	15.8	$17,277	$2,137	$2,653	$2,164	$941
Dairy	Hose	Liquid/Solid	Medium 1	CE	3	H	2.3	$9,479	$1,045	$2,948	$1,962	$0
Dairy	Hose	Liquid/Solid	Medium 1	CE	3	L	2.3	$6,210	$836	$2,640	$1,958	$0
Dairy	Hose	Liquid/Solid	Medium 1	CE	3	M	4.7	$9,223	$941	$2,822	$1,960	$0
Dairy	Hose	Liquid/Solid	Medium 1	MA	1	H	38.7	$24,210	$1,446	$2,182	$1,945	$1,165
Dairy	Hose	Liquid/Solid	Medium 1	MA	1	L	38.7	$10,951	$1,157	$1,398	$1,918	$1,165
Dairy	Hose	Liquid/Solid	Medium 1	MA	1	M	77.2	$19,374	$1,302	$1,837	$1,931	$1,165
Dairy	Hose	Liquid/Solid	Medium 1	MA	2	H	48.3	$24,210	$1,539	$2,738	$1,972	$942
Dairy	Hose	Liquid/Solid	Medium 1	MA	2	L	48.3	$10,951	$1,231	$1,942	$1,940	$942
Dairy	Hose	Liquid/Solid	Medium 1	MA	2	M	96.4	$19,374	$1,385	$2,386	$1,956	$942
Dairy	Hose	Liquid/Solid	Medium 1	MA	3	H	14.2	$8,984	$673	$12,869	$1,824	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Hose	Liquid/Solid	Medium 1	MA	3	L	14.2	$5,746	$538	$12,649	$1,821	$0
Dairy	Hose	Liquid/Solid	Medium 1	MA	3	M	28.3	$8,807	$605	$12,788	$1,822	$0
Dairy	Hose	Liquid/Solid	Medium 1	MW	1	H	35.4	$33,370	$2,315	$3,276	$1,673	$1,277
Dairy	Hose	Liquid/Solid	Medium 1	MW	1	L	35.4	$8,842	$1,852	$1,805	$1,629	$1,277
Dairy	Hose	Liquid/Solid	Medium 1	MW	1	M	70.7	$23,409	$2,083	$2,612	$1,651	$1,277
Dairy	Hose	Liquid/Solid	Medium 1	MW	2	H	41.6	$33,370	$2,489	$3,555	$1,714	$1,051
Dairy	Hose	Liquid/Solid	Medium 1	MW	2	L	41.6	$8,842	$1,991	$2,064	$1,661	$1,051
Dairy	Hose	Liquid/Solid	Medium 1	MW	2	M	83.3	$23,409	$2,240	$2,882	$1,688	$1,051
Dairy	Hose	Liquid/Solid	Medium 1	MW	3	H	12.5	$8,852	$1,045	$2,625	$1,470	$0
Dairy	Hose	Liquid/Solid	Medium 1	MW	3	L	12.5	$5,397	$836	$2,314	$1,466	$0
Dairy	Hose	Liquid/Solid	Medium 1	MW	3	M	25.1	$8,567	$941	$2,499	$1,468	$0
Dairy	Hose	Liquid/Solid	Medium 1	PA	1	H	3.6	$25,328	$1,995	$2,699	$2,951	$735
Dairy	Hose	Liquid/Solid	Medium 1	PA	1	L	3.6	$11,320	$1,596	$1,786	$2,923	$735
Dairy	Hose	Liquid/Solid	Medium 1	PA	1	M	7.1	$19,702	$1,796	$2,270	$2,937	$735
Dairy	Hose	Liquid/Solid	Medium 1	PA	2	H	5.2	$25,328	$2,069	$3,188	$2,974	$595
Dairy	Hose	Liquid/Solid	Medium 1	PA	2	L	5.2	$11,320	$1,655	$2,266	$2,942	$595
Dairy	Hose	Liquid/Solid	Medium 1	PA	2	M	10.4	$19,702	$1,862	$2,755	$2,958	$595
Dairy	Hose	Liquid/Solid	Medium 1	PA	3	H	1.4	$11,904	$1,045	$6,744	$2,834	$0
Dairy	Hose	Liquid/Solid	Medium 1	PA	3	L	1.4	$8,636	$836	$6,437	$2,830	$0
Dairy	Hose	Liquid/Solid	Medium 1	PA	3	M	2.8	$11,648	$941	$6,618	$2,832	$0
Dairy	Hose	Liquid/Solid	Medium 1	SO	1	H	5.5	$28,639	$1,857	$2,780	$3,033	$450
Dairy	Hose	Liquid/Solid	Medium 1	SO	1	L	5.5	$17,725	$1,486	$2,042	$3,014	$450
Dairy	Hose	Liquid/Solid	Medium 1	SO	1	M	10.7	$24,624	$1,671	$2,440	$3,024	$450
Dairy	Hose	Liquid/Solid	Medium 1	SO	2	H	5.3	$28,639	$1,834	$3,033	$3,031	$343
Dairy	Hose	Liquid/Solid	Medium 1	SO	2	L	5.3	$17,725	$1,467	$2,297	$3,012	$343
Dairy	Hose	Liquid/Solid	Medium 1	SO	2	M	10.4	$24,624	$1,650	$2,694	$3,021	$343

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Hose	Liquid/Solid	Medium 1	SO	3	H	1.8	$11,188	$1,045	$5,398	$2,956	$0
Dairy	Hose	Liquid/Solid	Medium 1	SO	3	L	1.8	$7,791	$836	$5,088	$2,952	$0
Dairy	Hose	Liquid/Solid	Medium 1	SO	3	M	3.4	$10,932	$941	$5,272	$2,954	$0
Dairy	Hose	Liquid/Solid	Medium 2	CE	1	H	2.3	$25,653	$2,746	$3,133	$3,648	$1,931
Dairy	Hose	Liquid/Solid	Medium 2	CE	1	L	2.3	$11,120	$2,197	$2,122	$3,579	$1,931
Dairy	Hose	Liquid/Solid	Medium 2	CE	1	M	4.7	$19,949	$2,471	$2,659	$3,613	$1,931
Dairy	Hose	Liquid/Solid	Medium 2	CE	2	H	2.8	$25,653	$2,053	$3,491	$3,454	$573
Dairy	Hose	Liquid/Solid	Medium 2	CE	2	L	2.8	$11,120	$1,642	$2,561	$3,423	$573
Dairy	Hose	Liquid/Solid	Medium 2	CE	2	M	5.7	$19,949	$1,848	$3,057	$3,439	$573
Dairy	Hose	Liquid/Solid	Medium 2	CE	3	H	0.8	$12,229	$1,045	$3,622	$3,322	$0
Dairy	Hose	Liquid/Solid	Medium 2	CE	3	L	0.8	$8,436	$836	$3,304	$3,318	$0
Dairy	Hose	Liquid/Solid	Medium 2	CE	3	M	1.7	$11,895	$941	$3,494	$3,320	$0
Dairy	Hose	Liquid/Solid	Medium 2	MA	1	H	13.9	$33,153	$1,774	$2,364	$3,297	$2,004
Dairy	Hose	Liquid/Solid	Medium 2	MA	1	L	13.9	$15,262	$1,419	$1,613	$3,253	$2,004
Dairy	Hose	Liquid/Solid	Medium 2	MA	1	M	28.0	$26,350	$1,596	$2,036	$3,275	$2,004
Dairy	Hose	Liquid/Solid	Medium 2	MA	2	H	17.3	$38,150	$1,284	$3,086	$3,164	$501
Dairy	Hose	Liquid/Solid	Medium 2	MA	2	L	17.3	$16,971	$1,027	$2,457	$3,147	$501
Dairy	Hose	Liquid/Solid	Medium 2	MA	2	M	34.9	$29,818	$1,155	$2,817	$3,155	$501
Dairy	Hose	Liquid/Solid	Medium 2	MA	3	H	5.1	$11,674	$673	$19,884	$3,091	$0
Dairy	Hose	Liquid/Solid	Medium 2	MA	3	L	5.1	$7,921	$538	$19,653	$3,088	$0
Dairy	Hose	Liquid/Solid	Medium 2	MA	3	M	10.2	$11,443	$605	$19,802	$3,090	$0
Dairy	Hose	Liquid/Solid	Medium 2	MW	1	H	12.8	$36,034	$2,852	$3,699	$2,835	$2,168
Dairy	Hose	Liquid/Solid	Medium 2	MW	1	L	12.8	$10,924	$2,282	$2,155	$2,761	$2,168
Dairy	Hose	Liquid/Solid	Medium 2	MW	1	M	25.4	$25,986	$2,567	$3,003	$2,798	$2,168
Dairy	Hose	Liquid/Solid	Medium 2	MW	2	H	15.1	$36,034	$2,160	$3,751	$2,644	$685
Dairy	Hose	Liquid/Solid	Medium 2	MW	2	L	15.1	$10,924	$1,728	$2,287	$2,608	$685

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Hose	Liquid/Solid	Medium 2	MW	2	M	29.9	$25,986	$1,944	$3,095	$2,626	$685
Dairy	Hose	Liquid/Solid	Medium 2	MW	3	H	4.5	$11,516	$1,045	$3,274	$2,486	$0
Dairy	Hose	Liquid/Solid	Medium 2	MW	3	L	4.5	$7,479	$836	$2,951	$2,482	$0
Dairy	Hose	Liquid/Solid	Medium 2	MW	3	M	9.0	$11,144	$941	$3,145	$2,484	$0
Dairy	Hose	Liquid/Solid	Medium 2	PA	1	H	1.3	$53,519	$2,310	$3,048	$1,453	$1,249
Dairy	Hose	Liquid/Solid	Medium 2	PA	1	L	1.3	$38,986	$1,848	$2,088	$1,407	$1,249
Dairy	Hose	Liquid/Solid	Medium 2	PA	1	M	2.5	$47,815	$2,079	$2,600	$1,430	$1,249
Dairy	Hose	Liquid/Solid	Medium 2	PA	2	H	1.9	$53,519	$1,822	$3,771	$1,322	$314
Dairy	Hose	Liquid/Solid	Medium 2	PA	2	L	1.9	$38,986	$1,458	$2,868	$1,302	$314
Dairy	Hose	Liquid/Solid	Medium 2	PA	2	M	3.7	$47,815	$1,640	$3,351	$1,312	$314
Dairy	Hose	Liquid/Solid	Medium 2	PA	3	H	0.5	$40,095	$1,045	$9,767	$1,244	$0
Dairy	Hose	Liquid/Solid	Medium 2	PA	3	L	0.5	$36,301	$836	$9,450	$1,240	$0
Dairy	Hose	Liquid/Solid	Medium 2	PA	3	M	1.0	$39,761	$941	$9,640	$1,242	$0
Dairy	Hose	Liquid/Solid	Medium 2	SO	1	H	1.8	$56,407	$2,071	$3,049	$1,392	$759
Dairy	Hose	Liquid/Solid	Medium 2	SO	1	L	1.8	$44,929	$1,657	$2,274	$1,358	$759
Dairy	Hose	Liquid/Solid	Medium 2	SO	1	M	4.0	$52,314	$1,864	$2,694	$1,375	$759
Dairy	Hose	Liquid/Solid	Medium 2	SO	2	H	1.8	$56,407	$1,624	$3,407	$1,255	$92
Dairy	Hose	Liquid/Solid	Medium 2	SO	2	L	1.8	$44,929	$1,299	$2,684	$1,249	$92
Dairy	Hose	Liquid/Solid	Medium 2	SO	2	M	3.8	$52,314	$1,462	$3,078	$1,252	$92
Dairy	Hose	Liquid/Solid	Medium 2	SO	3	H	0.6	$38,956	$1,045	$7,560	$1,244	$0
Dairy	Hose	Liquid/Solid	Medium 2	SO	3	L	0.6	$34,995	$836	$7,239	$1,240	$0
Dairy	Hose	Liquid/Solid	Medium 2	SO	3	M	1.3	$38,622	$941	$7,433	$1,242	$0
Dairy	Hose	Liquid/Solid	Medium 3	CE	1	H	1.2	$28,306	$3,197	$3,069	$5,121	$2,663
Dairy	Hose	Liquid/Solid	Medium 3	CE	1	L	1.2	$13,290	$2,558	$2,350	$5,029	$2,663
Dairy	Hose	Liquid/Solid	Medium 3	CE	1	M	2.5	$22,539	$2,878	$2,744	$5,075	$2,663
Dairy	Hose	Liquid/Solid	Medium 3	CE	2	H	1.4	$28,306	$2,730	$4,191	$4,998	$1,336

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Hose	Liquid/Solid	Medium 3	CE	2	L	1.4	$13,290	$2,184	$3,173	$4,931	$1,336
Dairy	Hose	Liquid/Solid	Medium 3	CE	2	M	3.0	$22,539	$2,457	$3,717	$4,965	$1,336
Dairy	Hose	Liquid/Solid	Medium 3	CE	3	H	0.4	$14,882	$1,045	$4,223	$4,681	$0
Dairy	Hose	Liquid/Solid	Medium 3	CE	3	L	0.4	$10,605	$836	$3,895	$4,677	$0
Dairy	Hose	Liquid/Solid	Medium 3	CE	3	M	0.9	$14,484	$941	$4,094	$4,679	$0
Dairy	Hose	Liquid/Solid	Medium 3	MA	1	H	2.9	$52,456	$2,129	$2,939	$1,128	$2,902
Dairy	Hose	Liquid/Solid	Medium 3	MA	1	L	2.9	$33,759	$1,703	$1,966	$1,065	$2,902
Dairy	Hose	Liquid/Solid	Medium 3	MA	1	M	5.9	$45,456	$1,916	$2,510	$1,097	$2,902
Dairy	Hose	Liquid/Solid	Medium 3	MA	2	H	3.7	$57,569	$1,771	$4,345	$1,037	$1,357
Dairy	Hose	Liquid/Solid	Medium 3	MA	2	L	3.7	$35,507	$1,417	$3,346	$992	$1,357
Dairy	Hose	Liquid/Solid	Medium 3	MA	2	M	7.4	$49,004	$1,594	$3,905	$1,015	$1,357
Dairy	Hose	Liquid/Solid	Medium 3	MA	3	H	1.1	$30,474	$673	$27,608	$827	$0
Dairy	Hose	Liquid/Solid	Medium 3	MA	3	L	1.1	$26,245	$538	$27,368	$824	$0
Dairy	Hose	Liquid/Solid	Medium 3	MA	3	M	2.2	$30,200	$605	$27,525	$826	$0
Dairy	Hose	Liquid/Solid	Medium 3	MW	1	H	2.0	$54,861	$3,337	$4,088	$1,315	$2,984
Dairy	Hose	Liquid/Solid	Medium 3	MW	1	L	2.0	$29,223	$2,669	$2,477	$1,215	$2,984
Dairy	Hose	Liquid/Solid	Medium 3	MW	1	M	3.7	$44,743	$3,003	$3,362	$1,265	$2,984
Dairy	Hose	Liquid/Solid	Medium 3	MW	2	H	2.3	$54,861	$2,927	$4,418	$1,202	$1,533
Dairy	Hose	Liquid/Solid	Medium 3	MW	2	L	2.3	$29,223	$2,342	$2,854	$1,125	$1,533
Dairy	Hose	Liquid/Solid	Medium 3	MW	2	M	4.4	$44,743	$2,635	$3,716	$1,163	$1,533
Dairy	Hose	Liquid/Solid	Medium 3	MW	3	H	0.7	$30,344	$1,045	$3,836	$834	$0
Dairy	Hose	Liquid/Solid	Medium 3	MW	3	L	0.7	$25,778	$836	$3,503	$830	$0
Dairy	Hose	Liquid/Solid	Medium 3	MW	3	M	1.3	$29,901	$941	$3,706	$832	$0
Dairy	Hose	Liquid/Solid	Medium 3	PA	1	H	1.3	$57,051	$2,627	$3,392	$1,533	$1,765
Dairy	Hose	Liquid/Solid	Medium 3	PA	1	L	1.3	$42,035	$2,102	$2,385	$1,471	$1,765
Dairy	Hose	Liquid/Solid	Medium 3	PA	1	M	2.6	$51,284	$2,364	$2,923	$1,502	$1,765

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Dairy	Hose	Liquid/Solid	Medium 3	PA	2	H	1.9	$57,051	$2,271	$4,489	$1,442	$825
Dairy	Hose	Liquid/Solid	Medium 3	PA	2	L	1.9	$42,035	$1,817	$3,524	$1,399	$825
Dairy	Hose	Liquid/Solid	Medium 3	PA	2	M	3.8	$51,284	$2,044	$4,042	$1,420	$825
Dairy	Hose	Liquid/Solid	Medium 3	PA	3	H	0.5	$43,627	$1,045	$12,783	$1,244	$0
Dairy	Hose	Liquid/Solid	Medium 3	PA	3	L	0.5	$39,350	$836	$12,456	$1,240	$0
Dairy	Hose	Liquid/Solid	Medium 3	PA	3	M	1.0	$43,229	$941	$12,654	$1,242	$0
Dairy	Hose	Liquid/Solid	Medium 3	SO	1	H	0.8	$59,522	$2,331	$3,337	$1,453	$1,136
Dairy	Hose	Liquid/Solid	Medium 3	SO	1	L	0.8	$47,529	$1,865	$2,522	$1,408	$1,136
Dairy	Hose	Liquid/Solid	Medium 3	SO	1	M	1.7	$55,365	$2,098	$2,967	$1,431	$1,136
Dairy	Hose	Liquid/Solid	Medium 3	SO	2	H	0.7	$59,522	$1,904	$3,915	$1,343	$431
Dairy	Hose	Liquid/Solid	Medium 3	SO	2	L	0.7	$47,529	$1,523	$3,150	$1,319	$431
Dairy	Hose	Liquid/Solid	Medium 3	SO	2	M	1.6	$55,365	$1,714	$3,570	$1,331	$431
Dairy	Hose	Liquid/Solid	Medium 3	SO	3	H	0.2	$42,070	$1,045	$11,449	$1,244	$0
Dairy	Hose	Liquid/Solid	Medium 3	SO	3	L	0.2	$37,595	$836	$11,117	$1,240	$0
Dairy	Hose	Liquid/Solid	Medium 3	SO	3	M	0.5	$41,673	$941	$11,320	$1,242	$0
Heifers	Heifers	Liquid/Solid	Large 1	CE	1	H	16.5	$39,561	$2,221	$3,569	$202	$1,355
Heifers	Heifers	Liquid/Solid	Large 1	CE	1	L	16.5	$13,621	$1,776	$2,060	$162	$1,355
Heifers	Heifers	Liquid/Solid	Large 1	CE	1	M	33.5	$27,983	$1,998	$2,871	$182	$1,355
Heifers	Heifers	Liquid/Solid	Large 1	CE	2	H	15.5	$55,457	$2,730	$5,066	$335	$1,164
Heifers	Heifers	Liquid/Solid	Large 1	CE	2	L	15.5	$19,081	$2,184	$3,144	$268	$1,164
Heifers	Heifers	Liquid/Solid	Large 1	CE	2	M	31.4	$39,110	$2,457	$4,177	$301	$1,164
Heifers	Heifers	Liquid/Solid	Large 1	CE	3	H	4.0	$3,924	$1,045	$8,661	$20	$0
Heifers	Heifers	Liquid/Solid	Large 1	CE	3	L	4.0	$1,380	$836	$8,324	$16	$0
Heifers	Heifers	Liquid/Solid	Large 1	CE	3	M	8.0	$3,037	$941	$8,503	$18	$0
Heifers	Heifers	Liquid/Solid	Large 1	MA	1	H	0.0	$56,544	$2,165	$5,759	$186	$1,317
Heifers	Heifers	Liquid/Solid	Large 1	MA	1	L	0.0	$18,036	$1,700	$2,687	$146	$1,317

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Heifers	Heifers	Liquid/Solid	Large 1	MA	1	M	0.0	$38,414	$2,063	$4,472	$177	$1,317
Heifers	Heifers	Liquid/Solid	Large 1	MA	2	H	0.0	$61,011	$2,737	$8,755	$341	$1,117
Heifers	Heifers	Liquid/Solid	Large 1	MA	2	L	0.0	$19,477	$2,150	$4,680	$268	$1,117
Heifers	Heifers	Liquid/Solid	Large 1	MA	2	M	0.0	$41,547	$2,608	$7,042	$325	$1,117
Heifers	Heifers	Liquid/Solid	Large 1	MA	3	H	0.0	$196,885	$1,045	$55,927	$20	$0
Heifers	Heifers	Liquid/Solid	Large 1	MA	3	L	0.0	$192,284	$821	$55,504	$16	$0
Heifers	Heifers	Liquid/Solid	Large 1	MA	3	M	0.0	$193,693	$996	$55,786	$19	$0
Heifers	Heifers	Liquid/Solid	Large 1	MW	1	H	0.0	$37,257	$2,042	$3,841	$152	$1,079
Heifers	Heifers	Liquid/Solid	Large 1	MW	1	L	0.0	$13,996	$1,633	$2,206	$122	$1,079
Heifers	Heifers	Liquid/Solid	Large 1	MW	1	M	0.0	$26,525	$1,838	$3,048	$137	$1,079
Heifers	Heifers	Liquid/Solid	Large 1	MW	2	H	0.0	$54,633	$2,612	$6,367	$308	$916
Heifers	Heifers	Liquid/Solid	Large 1	MW	2	L	0.0	$20,946	$2,090	$3,573	$247	$916
Heifers	Heifers	Liquid/Solid	Large 1	MW	2	M	0.0	$38,688	$2,351	$4,995	$277	$916
Heifers	Heifers	Liquid/Solid	Large 1	MW	3	H	0.0	$4,449	$1,045	$6,951	$20	$0
Heifers	Heifers	Liquid/Solid	Large 1	MW	3	L	0.0	$872	$836	$6,570	$16	$0
Heifers	Heifers	Liquid/Solid	Large 1	MW	3	M	0.0	$3,559	$941	$6,785	$18	$0
Heifers	Heifers	Liquid/Solid	Large 1	PA	1	H	9.7	$42,750	$2,015	$4,611	$145	$961
Heifers	Heifers	Liquid/Solid	Large 1	PA	1	L	9.7	$16,193	$1,612	$2,508	$116	$961
Heifers	Heifers	Liquid/Solid	Large 1	PA	1	M	19.8	$30,318	$1,813	$3,581	$130	$961
Heifers	Heifers	Liquid/Solid	Large 1	PA	2	H	11.7	$61,083	$2,376	$8,116	$242	$828
Heifers	Heifers	Liquid/Solid	Large 1	PA	2	L	11.7	$23,526	$1,901	$4,650	$194	$828
Heifers	Heifers	Liquid/Solid	Large 1	PA	2	M	23.8	$43,151	$2,138	$6,405	$218	$828
Heifers	Heifers	Liquid/Solid	Large 1	PA	3	H	2.6	$3,933	$1,045	$46,021	$20	$0
Heifers	Heifers	Liquid/Solid	Large 1	PA	3	L	2.6	$666	$836	$45,656	$16	$0
Heifers	Heifers	Liquid/Solid	Large 1	PA	3	M	5.4	$3,146	$941	$45,860	$18	$0
Heifers	Heifers	Liquid/Solid	Large 1	SO	1	H	0.0	$64,695	$1,886	$5,280	$109	$588

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Heifers	Heifers	Liquid/Solid	Large 1	SO	1	L	0.0	$17,539	$1,509	$2,253	$87	$588
Heifers	Heifers	Liquid/Solid	Large 1	SO	1	M	0.0	$45,344	$1,754	$4,061	$102	$588
Heifers	Heifers	Liquid/Solid	Large 1	SO	2	H	0.0	$65,449	$2,025	$9,971	$156	$500
Heifers	Heifers	Liquid/Solid	Large 1	SO	2	L	0.0	$17,726	$1,620	$6,566	$125	$500
Heifers	Heifers	Liquid/Solid	Large 1	SO	2	M	0.0	$45,865	$1,883	$8,598	$145	$500
Heifers	Heifers	Liquid/Solid	Large 1	SO	3	H	0.0	$7,307	$1,045	$40,172	$20	$0
Heifers	Heifers	Liquid/Solid	Large 1	SO	3	L	0.0	$3,340	$836	$39,760	$16	$0
Heifers	Heifers	Liquid/Solid	Large 1	SO	3	M	0.0	$5,705	$972	$40,024	$19	$0
Heifers	Heifers	Liquid/Solid	Medium 1	CE	1	H	1.7	$61,508	$1,767	$4,442	$564	$323
Heifers	Heifers	Liquid/Solid	Medium 1	CE	1	L	1.7	$23,704	$1,413	$2,298	$548	$323
Heifers	Heifers	Liquid/Solid	Medium 1	CE	1	M	3.0	$44,892	$1,590	$3,482	$556	$323
Heifers	Heifers	Liquid/Solid	Medium 1	CE	2	H	0.4	$61,508	$1,709	$4,641	$550	$154
Heifers	Heifers	Liquid/Solid	Medium 1	CE	2	L	0.4	$23,704	$1,367	$2,503	$537	$154
Heifers	Heifers	Liquid/Solid	Medium 1	CE	2	M	0.7	$44,892	$1,538	$3,684	$543	$154
Heifers	Heifers	Liquid/Solid	Medium 1	CE	3	H	0.2	$7,812	$1,045	$3,190	$505	$0
Heifers	Heifers	Liquid/Solid	Medium 1	CE	3	L	0.2	$6,583	$836	$2,916	$501	$0
Heifers	Heifers	Liquid/Solid	Medium 1	CE	3	M	0.3	$7,305	$941	$3,057	$503	$0
Heifers	Heifers	Liquid/Solid	Medium 1	MA	1	H	0.0	$74,801	$1,776	$4,735	$1,650	$340
Heifers	Heifers	Liquid/Solid	Medium 1	MA	1	L	0.0	$29,427	$1,395	$2,457	$1,633	$340
Heifers	Heifers	Liquid/Solid	Medium 1	MA	1	M	0.0	$54,183	$1,692	$3,788	$1,646	$340
Heifers	Heifers	Liquid/Solid	Medium 1	MA	2	H	0.0	$92,379	$1,703	$7,307	$1,635	$145
Heifers	Heifers	Liquid/Solid	Medium 1	MA	2	L	0.0	$35,096	$1,337	$4,653	$1,621	$145
Heifers	Heifers	Liquid/Solid	Medium 1	MA	2	M	0.0	$66,514	$1,623	$6,192	$1,632	$145
Heifers	Heifers	Liquid/Solid	Medium 1	MA	3	H	0.0	$10,979	$1,045	$26,642	$1,589	$0
Heifers	Heifers	Liquid/Solid	Medium 1	MA	3	L	0.0	$8,843	$821	$26,325	$1,584	$0
Heifers	Heifers	Liquid/Solid	Medium 1	MA	3	M	0.0	$9,411	$996	$26,549	$1,588	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Heifers	Heifers	Liquid/Solid	Medium 1	MW	1	H	30.4	$62,441	$1,741	$4,485	$889	$292
Heifers	Heifers	Liquid/Solid	Medium 1	MW	1	L	30.4	$27,075	$1,393	$2,469	$875	$292
Heifers	Heifers	Liquid/Solid	Medium 1	MW	1	M	61.1	$45,877	$1,567	$3,525	$882	$292
Heifers	Heifers	Liquid/Solid	Medium 1	MW	2	H	4.3	$62,441	$1,691	$4,607	$878	$126
Heifers	Heifers	Liquid/Solid	Medium 1	MW	2	L	4.3	$27,075	$1,353	$2,597	$866	$126
Heifers	Heifers	Liquid/Solid	Medium 1	MW	2	M	8.7	$45,877	$1,522	$3,651	$872	$126
Heifers	Heifers	Liquid/Solid	Medium 1	MW	3	H	2.6	$8,745	$1,045	$3,096	$836	$0
Heifers	Heifers	Liquid/Solid	Medium 1	MW	3	L	2.6	$7,189	$836	$2,809	$832	$0
Heifers	Heifers	Liquid/Solid	Medium 1	MW	3	M	5.3	$8,290	$941	$2,961	$834	$0
Heifers	Heifers	Liquid/Solid	Medium 1	PA	1	H	0.8	$65,075	$1,723	$4,612	$1,757	$257
Heifers	Heifers	Liquid/Solid	Medium 1	PA	1	L	0.8	$31,313	$1,378	$2,681	$1,745	$257
Heifers	Heifers	Liquid/Solid	Medium 1	PA	1	M	1.4	$48,607	$1,551	$3,657	$1,751	$257
Heifers	Heifers	Liquid/Solid	Medium 1	PA	2	H	0.2	$65,075	$1,668	$7,745	$1,748	$123
Heifers	Heifers	Liquid/Solid	Medium 1	PA	2	L	0.2	$31,313	$1,334	$5,820	$1,738	$123
Heifers	Heifers	Liquid/Solid	Medium 1	PA	2	M	0.4	$48,607	$1,501	$6,793	$1,743	$123
Heifers	Heifers	Liquid/Solid	Medium 1	PA	3	H	0.1	$11,379	$1,045	$13,622	$1,715	$0
Heifers	Heifers	Liquid/Solid	Medium 1	PA	3	L	0.1	$9,835	$836	$13,338	$1,711	$0
Heifers	Heifers	Liquid/Solid	Medium 1	PA	3	M	0.1	$11,020	$941	$13,490	$1,713	$0
Heifers	Heifers	Liquid/Solid	Medium 1	SO	1	H	0.0	$64,170	$1,657	$4,504	$1,914	$157
Heifers	Heifers	Liquid/Solid	Medium 1	SO	1	L	0.0	$23,338	$1,325	$2,221	$1,904	$157
Heifers	Heifers	Liquid/Solid	Medium 1	SO	1	M	0.0	$47,372	$1,541	$3,583	$1,911	$157
Heifers	Heifers	Liquid/Solid	Medium 1	SO	2	H	0.0	$64,170	$1,609	$8,994	$1,901	$68
Heifers	Heifers	Liquid/Solid	Medium 1	SO	2	L	0.0	$23,338	$1,287	$6,717	$1,894	$68
Heifers	Heifers	Liquid/Solid	Medium 1	SO	2	M	0.0	$47,372	$1,496	$8,076	$1,899	$68
Heifers	Heifers	Liquid/Solid	Medium 1	SO	3	H	0.0	$12,085	$1,045	$12,246	$1,885	$0
Heifers	Heifers	Liquid/Solid	Medium 1	SO	3	L	0.0	$10,451	$836	$11,952	$1,881	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Heifers	Heifers	Liquid/Solid	Medium 1	SO	3	M	0.0	$11,396	$972	$12,141	$1,884	$0
Heifers	Heifers	Liquid/Solid	Medium 2	CE	1	H	4.1	$35,802	$1,886	$3,216	$493	$498
Heifers	Heifers	Liquid/Solid	Medium 2	CE	1	L	4.1	$16,216	$1,509	$1,976	$470	$498
Heifers	Heifers	Liquid/Solid	Medium 2	CE	1	M	8.3	$27,144	$1,697	$2,649	$481	$498
Heifers	Heifers	Liquid/Solid	Medium 2	CE	2	H	0.9	$35,802	$1,905	$3,553	$493	$331
Heifers	Heifers	Liquid/Solid	Medium 2	CE	2	L	0.9	$16,216	$1,524	$2,312	$470	$331
Heifers	Heifers	Liquid/Solid	Medium 2	CE	2	M	1.9	$27,144	$1,715	$2,985	$482	$331
Heifers	Heifers	Liquid/Solid	Medium 2	CE	3	H	0.4	$8,954	$1,045	$4,106	$399	$0
Heifers	Heifers	Liquid/Solid	Medium 2	CE	3	L	0.4	$7,392	$836	$3,823	$395	$0
Heifers	Heifers	Liquid/Solid	Medium 2	CE	3	M	0.8	$8,350	$941	$3,970	$397	$0
Heifers	Heifers	Liquid/Solid	Medium 2	MA	1	H	0.0	$46,080	$1,906	$4,093	$1,340	$532
Heifers	Heifers	Liquid/Solid	Medium 2	MA	1	L	0.0	$21,234	$1,497	$2,340	$1,316	$532
Heifers	Heifers	Liquid/Solid	Medium 2	MA	1	M	0.0	$34,357	$1,817	$3,379	$1,335	$532
Heifers	Heifers	Liquid/Solid	Medium 2	MA	2	H	0.0	$55,483	$1,915	$6,674	$1,342	$337
Heifers	Heifers	Liquid/Solid	Medium 2	MA	2	L	0.0	$24,267	$1,504	$4,388	$1,317	$337
Heifers	Heifers	Liquid/Solid	Medium 2	MA	2	M	0.0	$40,953	$1,825	$5,725	$1,337	$337
Heifers	Heifers	Liquid/Solid	Medium 2	MA	3	H	0.0	$13,447	$1,045	$40,783	$1,246	$0
Heifers	Heifers	Liquid/Solid	Medium 2	MA	3	L	0.0	$10,710	$821	$40,448	$1,241	$0
Heifers	Heifers	Liquid/Solid	Medium 2	MA	3	M	0.0	$11,464	$996	$40,680	$1,245	$0
Heifers	Heifers	Liquid/Solid	Medium 2	MW	1	H	4.0	$47,154	$1,852	$3,339	$737	$457
Heifers	Heifers	Liquid/Solid	Medium 2	MW	1	L	4.0	$22,407	$1,482	$2,121	$717	$457
Heifers	Heifers	Liquid/Solid	Medium 2	MW	1	M	8.1	$35,552	$1,667	$2,754	$727	$457
Heifers	Heifers	Liquid/Solid	Medium 2	MW	2	H	0.6	$58,271	$1,887	$3,633	$748	$291
Heifers	Heifers	Liquid/Solid	Medium 2	MW	2	L	0.6	$26,673	$1,509	$2,369	$726	$291
Heifers	Heifers	Liquid/Solid	Medium 2	MW	2	M	1.2	$43,334	$1,698	$3,025	$737	$291
Heifers	Heifers	Liquid/Solid	Medium 2	MW	3	H	0.3	$10,312	$1,045	$4,005	$658	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Heifers	Heifers	Liquid/Solid	Medium 2	MW	3	L	0.3	$8,268	$836	$3,703	$654	$0
Heifers	Heifers	Liquid/Solid	Medium 2	MW	3	M	0.7	$9,762	$941	$3,867	$656	$0
Heifers	Heifers	Liquid/Solid	Medium 2	PA	1	H	1.1	$57,181	$1,823	$3,947	$1,417	$401
Heifers	Heifers	Liquid/Solid	Medium 2	PA	1	L	1.1	$29,363	$1,458	$2,501	$1,398	$401
Heifers	Heifers	Liquid/Solid	Medium 2	PA	1	M	2.3	$43,795	$1,641	$3,237	$1,407	$401
Heifers	Heifers	Liquid/Solid	Medium 2	PA	2	H	0.4	$66,837	$1,816	$6,483	$1,411	$268
Heifers	Heifers	Liquid/Solid	Medium 2	PA	2	L	0.4	$33,226	$1,453	$4,863	$1,394	$268
Heifers	Heifers	Liquid/Solid	Medium 2	PA	2	M	0.7	$50,554	$1,635	$5,686	$1,402	$268
Heifers	Heifers	Liquid/Solid	Medium 2	PA	3	H	0.1	$14,093	$1,045	$20,430	$1,344	$0
Heifers	Heifers	Liquid/Solid	Medium 2	PA	3	L	0.1	$12,128	$836	$20,134	$1,340	$0
Heifers	Heifers	Liquid/Solid	Medium 2	PA	3	M	0.2	$13,633	$941	$20,295	$1,342	$0
Heifers	Heifers	Liquid/Solid	Medium 2	SO	1	H	0.0	$51,912	$1,709	$4,166	$1,520	$231
Heifers	Heifers	Liquid/Solid	Medium 2	SO	1	L	0.0	$21,918	$1,368	$2,231	$1,507	$231
Heifers	Heifers	Liquid/Solid	Medium 2	SO	1	M	0.0	$39,574	$1,590	$3,390	$1,516	$231
Heifers	Heifers	Liquid/Solid	Medium 2	SO	2	H	0.0	$62,410	$1,694	$7,103	$1,512	$153
Heifers	Heifers	Liquid/Solid	Medium 2	SO	2	L	0.0	$24,516	$1,355	$5,983	$1,501	$153
Heifers	Heifers	Liquid/Solid	Medium 2	SO	2	M	0.0	$46,825	$1,575	$6,661	$1,508	$153
Heifers	Heifers	Liquid/Solid	Medium 2	SO	3	H	0.0	$14,939	$1,045	$16,347	$1,477	$0
Heifers	Heifers	Liquid/Solid	Medium 2	SO	3	L	0.0	$12,770	$836	$16,033	$1,473	$0
Heifers	Heifers	Liquid/Solid	Medium 2	SO	3	M	0.0	$14,035	$972	$16,235	$1,476	$0
Heifers	Heifers	Liquid/Solid	Medium 3	CE	1	H	1.7	$37,144	$2,068	$3,374	$688	$758
Heifers	Heifers	Liquid/Solid	Medium 3	CE	1	L	1.7	$17,034	$1,654	$2,093	$656	$758
Heifers	Heifers	Liquid/Solid	Medium 3	CE	1	M	3.3	$28,338	$1,861	$2,793	$672	$758
Heifers	Heifers	Liquid/Solid	Medium 3	CE	2	H	0.4	$37,144	$2,150	$3,840	$716	$576
Heifers	Heifers	Liquid/Solid	Medium 3	CE	2	L	0.4	$17,034	$1,720	$2,550	$679	$576
Heifers	Heifers	Liquid/Solid	Medium 3	CE	2	M	0.8	$28,338	$1,935	$3,255	$698	$576

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Heifers	Heifers	Liquid/Solid	Medium 3	CE	3	H	0.2	$10,296	$1,045	$5,621	$550	$0
Heifers	Heifers	Liquid/Solid	Medium 3	CE	3	L	0.2	$8,474	$836	$5,332	$546	$0
Heifers	Heifers	Liquid/Solid	Medium 3	CE	3	M	0.3	$9,544	$941	$5,482	$548	$0
Heifers	Heifers	Liquid/Solid	Medium 3	MA	1	H	0.0	$63,759	$2,068	$4,912	$1,880	$767
Heifers	Heifers	Liquid/Solid	Medium 3	MA	1	L	0.0	$27,987	$1,624	$2,702	$1,845	$767
Heifers	Heifers	Liquid/Solid	Medium 3	MA	1	M	0.0	$47,089	$1,970	$3,999	$1,872	$767
Heifers	Heifers	Liquid/Solid	Medium 3	MA	2	H	0.0	$59,970	$2,162	$7,422	$1,897	$571
Heifers	Heifers	Liquid/Solid	Medium 3	MA	2	L	0.0	$26,765	$1,697	$4,500	$1,858	$571
Heifers	Heifers	Liquid/Solid	Medium 3	MA	2	M	0.0	$44,431	$2,060	$6,197	$1,888	$571
Heifers	Heifers	Liquid/Solid	Medium 3	MA	3	H	0.0	$15,866	$1,045	$58,709	$1,736	$0
Heifers	Heifers	Liquid/Solid	Medium 3	MA	3	L	0.0	$12,541	$821	$58,357	$1,732	$0
Heifers	Heifers	Liquid/Solid	Medium 3	MA	3	M	0.0	$13,491	$996	$58,596	$1,735	$0
Heifers	Heifers	Liquid/Solid	Medium 3	MW	1	H	1.8	$49,359	$1,974	$3,927	$1,032	$639
Heifers	Heifers	Liquid/Solid	Medium 3	MW	1	L	1.8	$23,464	$1,579	$2,386	$1,004	$639
Heifers	Heifers	Liquid/Solid	Medium 3	MW	1	M	2.9	$37,466	$1,777	$3,198	$1,018	$639
Heifers	Heifers	Liquid/Solid	Medium 3	MW	2	H	0.3	$60,906	$2,106	$4,793	$1,058	$478
Heifers	Heifers	Liquid/Solid	Medium 3	MW	2	L	0.3	$27,741	$1,685	$2,886	$1,025	$478
Heifers	Heifers	Liquid/Solid	Medium 3	MW	2	M	0.4	$45,549	$1,895	$3,889	$1,042	$478
Heifers	Heifers	Liquid/Solid	Medium 3	MW	3	H	0.2	$12,130	$1,045	$5,014	$913	$0
Heifers	Heifers	Liquid/Solid	Medium 3	MW	3	L	0.2	$9,676	$836	$4,698	$909	$0
Heifers	Heifers	Liquid/Solid	Medium 3	MW	3	M	0.3	$11,406	$941	$4,870	$911	$0
Heifers	Heifers	Liquid/Solid	Medium 3	PA	1	H	0.5	$60,564	$1,933	$5,570	$1,978	$560
Heifers	Heifers	Liquid/Solid	Medium 3	PA	1	L	0.5	$31,869	$1,547	$3,237	$1,953	$560
Heifers	Heifers	Liquid/Solid	Medium 3	PA	1	M	0.9	$46,843	$1,740	$4,419	$1,965	$560
Heifers	Heifers	Liquid/Solid	Medium 3	PA	2	H	0.2	$70,683	$1,979	$6,789	$1,994	$429
Heifers	Heifers	Liquid/Solid	Medium 3	PA	2	L	0.2	$35,917	$1,583	$4,469	$1,966	$429

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Heifers	Heifers	Liquid/Solid	Medium 3	PA	2	M	0.3	$53,927	$1,781	$5,644	$1,980	$429
Heifers	Heifers	Liquid/Solid	Medium 3	PA	3	H	0.0	$16,697	$1,045	$27,976	$1,874	$0
Heifers	Heifers	Liquid/Solid	Medium 3	PA	3	L	0.0	$14,323	$836	$27,667	$1,870	$0
Heifers	Heifers	Liquid/Solid	Medium 3	PA	3	M	0.1	$16,136	$941	$27,837	$1,872	$0
Heifers	Heifers	Liquid/Solid	Medium 3	SO	1	H	0.0	$73,409	$1,790	$3,784	$2,126	$343
Heifers	Heifers	Liquid/Solid	Medium 3	SO	1	L	0.0	$28,909	$1,432	$2,242	$2,109	$343
Heifers	Heifers	Liquid/Solid	Medium 3	SO	1	M	0.0	$55,118	$1,665	$3,171	$2,120	$343
Heifers	Heifers	Liquid/Solid	Medium 3	SO	2	H	0.0	$67,170	$1,790	$6,392	$2,127	$255
Heifers	Heifers	Liquid/Solid	Medium 3	SO	2	L	0.0	$27,365	$1,432	$4,498	$2,110	$255
Heifers	Heifers	Liquid/Solid	Medium 3	SO	2	M	0.0	$50,809	$1,665	$5,634	$2,121	$255
Heifers	Heifers	Liquid/Solid	Medium 3	SO	3	H	0.0	$17,885	$1,045	$24,516	$2,060	$0
Heifers	Heifers	Liquid/Solid	Medium 3	SO	3	L	0.0	$15,171	$836	$24,182	$2,056	$0
Heifers	Heifers	Liquid/Solid	Medium 3	SO	3	M	0.0	$16,767	$972	$24,397	$2,059	$0
Veal	Flush	Liquid	Medium 1	CE	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	CE	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	CE	1	M	0.1	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	CE	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	CE	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	CE	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	CE	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	CE	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	CE	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	MA	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	MA	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	MA	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	MA	2	H	0.0	$0	$1,545	$1,290	$20	$500

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 1	MA	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	MA	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	MA	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	MA	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	MA	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	MW	1	H	0.5	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	MW	1	L	0.5	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	MW	1	M	1.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	MW	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	MW	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	MW	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	MW	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	MW	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	MW	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	PA	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	PA	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	PA	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	PA	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	PA	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	PA	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	PA	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	PA	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	PA	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	SO	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	SO	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 1	SO	1	M	0.0	$0	$1,930	$1,514	$120	$500

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 1	SO	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	SO	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	SO	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 1	SO	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	SO	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 1	SO	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	CE	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	CE	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	CE	1	M	0.1	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	CE	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	CE	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	CE	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	CE	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	CE	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	CE	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	MA	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	MA	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	MA	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	MA	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	MA	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	MA	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	MA	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	MA	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	MA	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	MW	1	H	0.2	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	MW	1	L	0.2	$0	$1,930	$1,514	$120	$500

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 2	MW	1	M	0.5	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	MW	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	MW	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	MW	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	MW	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	MW	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	MW	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	PA	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	PA	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	PA	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	PA	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	PA	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	PA	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	PA	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	PA	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	PA	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	SO	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	SO	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	SO	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 2	SO	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	SO	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	SO	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 2	SO	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	SO	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 2	SO	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	CE	1	H	0.0	$0	$1,930	$1,514	$120	$500

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 3	CE	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	CE	1	M	1.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	CE	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	CE	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	CE	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	CE	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	CE	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	CE	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	MA	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	MA	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	MA	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	MA	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	MA	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	MA	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	MA	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	MA	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	MA	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	MW	1	H	4.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	MW	1	L	4.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	MW	1	M	8.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	MW	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	MW	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	MW	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	MW	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	MW	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	MW	3	M	0.0	$0	$1,045	$1,210	$20	$500

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 3	PA	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	PA	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	PA	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	PA	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	PA	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	PA	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	PA	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	PA	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	PA	3	M	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	SO	1	H	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	SO	1	L	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	SO	1	M	0.0	$0	$1,930	$1,514	$120	$500
Veal	Flush	Liquid	Medium 3	SO	2	H	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	SO	2	L	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	SO	2	M	0.0	$0	$1,545	$1,290	$20	$500
Veal	Flush	Liquid	Medium 3	SO	3	H	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	SO	3	L	0.0	$0	$1,045	$1,210	$20	$500
Veal	Flush	Liquid	Medium 3	SO	3	M	0.0	$0	$1,045	$1,210	$20	$500
Chicken	Liquid	LW	Large 1	SO	1	H	7.1	$4,735	$5,860	$3,562	$327	$4,900
Chicken	Liquid	LW	Large 1	SO	1	L	7.1	$30	$0	$896	$261	$0
Chicken	Liquid	LW	Large 1	SO	1	M	14.2	$698	$0	$1,385	$294	$0
Chicken	Liquid	LW	Large 1	SO	2	H	43.0	$76,973	$2,256	$8,663	$87	$1,296
Chicken	Liquid	LW	Large 1	SO	2	L	43.0	$30	$0	$896	$69	$0
Chicken	Liquid	LW	Large 1	SO	2	M	85.9	$75,427	$0	$6,436	$78	$0
Chicken	Liquid	LW	Large 1	SO	3	H	45.6	$30,575	$0	$3,351	$0	$0
Chicken	Liquid	LW	Large 1	SO	3	L	45.6	$30	$0	$896	$0	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Liquid	LW	Large 1	SO	3	M	91.2	$30,084	$0	$2,792	$0	$0
Chicken	Liquid	LW	Medium 3	SO	1	H	0.6	$1,541	$1,613	$1,461	$43	$653
Chicken	Liquid	LW	Medium 3	SO	1	L	0.6	$30	$0	$784	$35	$0
Chicken	Liquid	LW	Medium 3	SO	1	M	1.2	$378	$0	$1,063	$39	$0
Chicken	Liquid	LW	Medium 3	SO	2	H	2.7	$1,669	$1,859	$1,573	$60	$899
Chicken	Liquid	LW	Medium 3	SO	2	L	2.7	$30	$0	$784	$48	$0
Chicken	Liquid	LW	Medium 3	SO	2	M	5.4	$391	$0	$1,074	$54	$0
Chicken	Liquid	LW	Medium 3	SO	3	H	2.7	$8,476	$0	$1,477	$0	$0
Chicken	Liquid	LW	Medium 3	SO	3	L	2.7	$30	$0	$784	$0	$0
Chicken	Liquid	LW	Medium 3	SO	3	M	5.4	$7,984	$0	$1,311	$0	$0
Chicken	Solid	BR	Large 1	MA	1	H	3.6	$38,325	$3,427	$2,864	$164	$2,467
Chicken	Solid	BR	Large 1	MA	1	L	3.6	$2,656	$1,885	$2,537	$131	$1,357
Chicken	Solid	BR	Large 1	MA	1	M	7.2	$2,886	$3,369	$2,709	$148	$2,425
Chicken	Solid	BR	Large 1	MA	2	H	53.8	$39,399	$1,824	$2,124	$57	$864
Chicken	Solid	BR	Large 1	MA	2	L	53.8	$1,471	$1,004	$1,797	$46	$476
Chicken	Solid	BR	Large 1	MA	2	M	107.5	$1,700	$1,793	$1,969	$52	$849
Chicken	Solid	BR	Large 1	MA	3	H	26.7	$43,132	$0	$1,720	$0	$0
Chicken	Solid	BR	Large 1	MA	3	L	26.7	$589	$0	$1,404	$0	$0
Chicken	Solid	BR	Large 1	MA	3	M	53.4	$602	$0	$1,562	$0	$0
Chicken	Solid	BR	Large 1	SO	1	H	2.8	$92,823	$5,225	$3,694	$284	$4,265
Chicken	Solid	BR	Large 1	SO	1	L	2.8	$3,761	$522	$3,259	$228	$426
Chicken	Solid	BR	Large 1	SO	1	M	5.5	$43,214	$5,162	$3,538	$256	$4,213
Chicken	Solid	BR	Large 1	SO	2	H	126.0	$97,203	$1,604	$2,023	$43	$644
Chicken	Solid	BR	Large 1	SO	2	L	126.0	$1,041	$161	$1,588	$34	$65
Chicken	Solid	BR	Large 1	SO	2	M	251.9	$43,631	$1,585	$1,867	$39	$637
Chicken	Solid	BR	Large 1	SO	3	H	45.7	$94,105	$0	$1,685	$0	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Solid	BR	Large 1	SO	3	L	45.7	$55	$0	$1,250	$0	$0
Chicken	Solid	BR	Large 1	SO	3	M	91.4	$41,712	$0	$1,529	$0	$0
Chicken	Solid	BR	Large 2	MA	1	H	2.1	$79,892	$5,996	$4,450	$336	$5,036
Chicken	Solid	BR	Large 2	MA	1	L	2.1	$4,931	$3,298	$4,044	$268	$2,770
Chicken	Solid	BR	Large 2	MA	1	M	4.2	$5,161	$5,894	$4,255	$302	$4,950
Chicken	Solid	BR	Large 2	MA	2	H	31.1	$95,475	$2,447	$3,102	$99	$1,487
Chicken	Solid	BR	Large 2	MA	2	L	31.1	$2,421	$1,345	$2,639	$79	$817
Chicken	Solid	BR	Large 2	MA	2	M	62.2	$2,650	$2,405	$2,878	$89	$1,461
Chicken	Solid	BR	Large 2	MA	3	H	15.4	$109,980	$0	$2,548	$0	$0
Chicken	Solid	BR	Large 2	MA	3	L	15.4	$1,168	$0	$2,069	$0	$0
Chicken	Solid	BR	Large 2	MA	3	M	30.9	$1,181	$0	$2,308	$0	$0
Chicken	Solid	BR	Large 2	SO	1	H	1.6	$179,230	$8,919	$5,785	$530	$7,959
Chicken	Solid	BR	Large 2	SO	1	L	1.6	$6,567	$892	$5,269	$425	$796
Chicken	Solid	BR	Large 2	SO	1	M	3.2	$82,948	$8,812	$5,591	$477	$7,863
Chicken	Solid	BR	Large 2	SO	2	H	72.8	$224,355	$2,028	$2,823	$71	$1,068
Chicken	Solid	BR	Large 2	SO	2	L	72.8	$1,404	$203	$2,260	$57	$107
Chicken	Solid	BR	Large 2	SO	2	M	145.7	$99,997	$2,004	$2,607	$64	$1,055
Chicken	Solid	BR	Large 2	SO	3	H	26.4	$231,930	$0	$2,326	$0	$0
Chicken	Solid	BR	Large 2	SO	3	L	26.4	$104	$0	$1,756	$0	$0
Chicken	Solid	BR	Large 2	SO	3	M	52.9	$102,618	$0	$2,106	$0	$0
Chicken	Solid	BR	Medium 1	MA	1	H	1.1	$12,806	$1,912	$1,680	$63	$952
Chicken	Solid	BR	Medium 1	MA	1	L	1.1	$1,200	$669	$1,441	$51	$333
Chicken	Solid	BR	Medium 1	MA	1	M	2.1	$1,541	$1,898	$1,573	$57	$945
Chicken	Solid	BR	Medium 1	MA	2	H	5.4	$12,462	$1,409	$1,448	$30	$449
Chicken	Solid	BR	Medium 1	MA	2	L	5.4	$822	$494	$1,209	$24	$158
Chicken	Solid	BR	Medium 1	MA	2	M	10.8	$1,163	$1,399	$1,341	$27	$446

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Solid	BR	Medium 1	MA	3	H	5.5	$11,555	$0	$1,201	$0	$0
Chicken	Solid	BR	Medium 1	MA	3	L	5.5	$309	$0	$988	$0	$0
Chicken	Solid	BR	Medium 1	MA	3	M	11.1	$328	$0	$1,094	$0	$0
Chicken	Solid	BR	Medium 1	SO	1	H	1.7	$29,604	$2,482	$1,944	$101	$1,522
Chicken	Solid	BR	Medium 1	SO	1	L	1.7	$1,693	$372	$1,616	$81	$228
Chicken	Solid	BR	Medium 1	SO	1	M	3.3	$17,441	$2,446	$1,836	$91	$1,500
Chicken	Solid	BR	Medium 1	SO	2	H	13.9	$29,026	$1,314	$1,404	$24	$354
Chicken	Solid	BR	Medium 1	SO	2	L	13.9	$815	$197	$1,076	$19	$53
Chicken	Solid	BR	Medium 1	SO	2	M	27.8	$16,731	$1,294	$1,296	$21	$349
Chicken	Solid	BR	Medium 1	SO	3	H	7.0	$28,261	$0	$1,201	$0	$0
Chicken	Solid	BR	Medium 1	SO	3	L	7.0	$49	$0	$872	$0	$0
Chicken	Solid	BR	Medium 1	SO	3	M	14.0	$15,965	$0	$1,092	$0	$0
Chicken	Solid	BR	Medium 2	MA	1	H	1.0	$17,653	$2,231	$1,913	$85	$1,271
Chicken	Solid	BR	Medium 2	MA	1	L	1.0	$1,479	$781	$1,657	$68	$445
Chicken	Solid	BR	Medium 2	MA	1	M	2.1	$1,820	$2,215	$1,798	$76	$1,261
Chicken	Solid	BR	Medium 2	MA	2	H	8.9	$17,786	$1,512	$1,582	$37	$552
Chicken	Solid	BR	Medium 2	MA	2	L	8.9	$945	$530	$1,326	$30	$194
Chicken	Solid	BR	Medium 2	MA	2	M	17.8	$1,286	$1,501	$1,466	$33	$548
Chicken	Solid	BR	Medium 2	MA	3	H	6.2	$16,292	$0	$1,287	$0	$0
Chicken	Solid	BR	Medium 2	MA	3	L	6.2	$350	$0	$1,057	$0	$0
Chicken	Solid	BR	Medium 2	MA	3	M	12.3	$369	$0	$1,172	$0	$0
Chicken	Solid	BR	Medium 2	SO	1	H	1.2	$41,055	$2,920	$2,232	$131	$1,960
Chicken	Solid	BR	Medium 2	SO	1	L	1.2	$2,028	$438	$1,886	$104	$294
Chicken	Solid	BR	Medium 2	SO	1	M	2.3	$24,015	$2,876	$2,115	$118	$1,930
Chicken	Solid	BR	Medium 2	SO	2	H	23.1	$42,041	$1,368	$1,515	$27	$408
Chicken	Solid	BR	Medium 2	SO	2	L	23.1	$863	$205	$1,169	$22	$61

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Solid	BR	Medium 2	SO	2	M	46.2	$24,057	$1,348	$1,398	$24	$402
Chicken	Solid	BR	Medium 2	SO	3	H	8.9	$41,158	$0	$1,287	$0	$0
Chicken	Solid	BR	Medium 2	SO	3	L	8.9	$56	$0	$941	$0	$0
Chicken	Solid	BR	Medium 2	SO	3	M	17.8	$23,207	$0	$1,170	$0	$0
Chicken	Solid	BR	Medium 3	MA	1	H	1.0	$26,689	$2,897	$2,307	$129	$1,937
Chicken	Solid	BR	Medium 3	MA	1	L	1.0	$2,054	$1,014	$2,034	$103	$678
Chicken	Solid	BR	Medium 3	MA	1	M	2.0	$2,395	$2,877	$2,184	$116	$1,924
Chicken	Solid	BR	Medium 3	MA	2	H	8.9	$26,849	$1,732	$1,769	$51	$772
Chicken	Solid	BR	Medium 3	MA	2	L	8.9	$1,187	$606	$1,496	$41	$270
Chicken	Solid	BR	Medium 3	MA	2	M	17.7	$1,528	$1,720	$1,646	$46	$766
Chicken	Solid	BR	Medium 3	MA	3	H	6.2	$24,917	$0	$1,373	$0	$0
Chicken	Solid	BR	Medium 3	MA	3	L	6.2	$425	$0	$1,126	$0	$0
Chicken	Solid	BR	Medium 3	MA	3	M	12.3	$444	$0	$1,250	$0	$0
Chicken	Solid	BR	Medium 3	SO	1	H	1.0	$62,714	$4,011	$2,822	$203	$3,051
Chicken	Solid	BR	Medium 3	SO	1	L	1.0	$2,859	$602	$2,457	$162	$458
Chicken	Solid	BR	Medium 3	SO	1	M	2.1	$36,535	$3,950	$2,696	$183	$3,005
Chicken	Solid	BR	Medium 3	SO	2	H	21.1	$64,173	$1,528	$1,676	$38	$568
Chicken	Solid	BR	Medium 3	SO	2	L	21.1	$995	$229	$1,311	$30	$85
Chicken	Solid	BR	Medium 3	SO	2	M	42.3	$36,536	$1,506	$1,550	$34	$560
Chicken	Solid	BR	Medium 3	SO	3	H	7.9	$63,173	$0	$1,373	$0	$0
Chicken	Solid	BR	Medium 3	SO	3	L	7.9	$67	$0	$1,009	$0	$0
Chicken	Solid	BR	Medium 3	SO	3	M	15.9	$35,568	$0	$1,248	$0	$0
Chicken	Solid	LA	Large 1	MW	1	H	7.5	$56,177	$11,460	$5,873	$700	$10,500
Chicken	Solid	LA	Large 1	MW	1	L	7.5	$8,191	$0	$1,644	$560	$0
Chicken	Solid	LA	Large 1	MW	1	M	15.0	$32,960	$1,284	$2,024	$630	$1,176
Chicken	Solid	LA	Large 1	MW	2	H	45.7	$50,432	$1,272	$2,669	$21	$312

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Solid	LA	Large 1	MW	2	L	45.7	$8,191	$0	$1,644	$17	$0
Chicken	Solid	LA	Large 1	MW	2	M	91.4	$32,906	$142	$2,221	$19	$35
Chicken	Solid	LA	Large 1	MW	3	H	48.5	$49,756	$0	$2,511	$0	$0
Chicken	Solid	LA	Large 1	MW	3	L	48.5	$8,191	$0	$1,644	$0	$0
Chicken	Solid	LA	Large 1	MW	3	M	97.0	$32,772	$0	$2,202	$0	$0
Chicken	Solid	LA	Large 1	SO	1	H	3.3	$75,947	$13,083	$7,838	$808	$12,123
Chicken	Solid	LA	Large 1	SO	1	L	3.3	$16,382	$0	$1,644	$647	$0
Chicken	Solid	LA	Large 1	SO	1	M	6.7	$50,385	$0	$2,561	$727	$0
Chicken	Solid	LA	Large 1	SO	2	H	27.5	$67,066	$1,272	$2,899	$21	$312
Chicken	Solid	LA	Large 1	SO	2	L	27.5	$16,382	$0	$1,644	$17	$0
Chicken	Solid	LA	Large 1	SO	2	M	54.9	$49,497	$0	$2,379	$19	$0
Chicken	Solid	LA	Large 1	SO	3	H	28.1	$66,332	$0	$3,348	$0	$0
Chicken	Solid	LA	Large 1	SO	3	L	28.1	$16,382	$0	$1,644	$0	$0
Chicken	Solid	LA	Large 1	SO	3	M	56.1	$49,224	$0	$2,792	$0	$0
Chicken	Solid	LA	Large 2	MW	1	H	1.1	$163,914	$31,844	$14,903	$2,059	$30,884
Chicken	Solid	LA	Large 2	MW	1	L	1.1	$24,092	$0	$3,208	$1,647	$0
Chicken	Solid	LA	Large 2	MW	1	M	2.3	$96,679	$3,567	$3,849	$1,853	$3,459
Chicken	Solid	LA	Large 2	MW	2	H	7.0	$146,725	$1,362	$4,766	$27	$402
Chicken	Solid	LA	Large 2	MW	2	L	7.0	$24,092	$0	$3,208	$21	$0
Chicken	Solid	LA	Large 2	MW	2	M	13.9	$96,519	$153	$4,047	$24	$45
Chicken	Solid	LA	Large 2	MW	3	H	7.4	$145,999	$0	$5,095	$0	$0
Chicken	Solid	LA	Large 2	MW	3	L	7.4	$24,092	$0	$3,208	$0	$0
Chicken	Solid	LA	Large 2	MW	3	M	14.8	$96,385	$0	$4,393	$0	$0
Chicken	Solid	LA	Large 2	SO	1	H	0.3	$221,963	$36,616	$20,680	$2,377	$35,656
Chicken	Solid	LA	Large 2	SO	1	L	0.3	$48,185	$0	$3,208	$1,902	$0
Chicken	Solid	LA	Large 2	SO	1	M	0.7	$147,674	$0	$5,409	$2,139	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Solid	LA	Large 2	SO	2	H	2.9	$195,457	$1,362	$5,067	$27	$402
Chicken	Solid	LA	Large 2	SO	2	L	2.9	$48,185	$0	$3,208	$21	$0
Chicken	Solid	LA	Large 2	SO	2	M	5.7	$145,023	$0	$4,250	$24	$0
Chicken	Solid	LA	Large 2	SO	3	H	2.9	$194,655	$0	$7,554	$0	$0
Chicken	Solid	LA	Large 2	SO	3	L	2.9	$48,185	$0	$3,208	$0	$0
Chicken	Solid	LA	Large 2	SO	3	M	5.9	$144,743	$0	$6,127	$0	$0
Chicken	Solid	LA	Medium 1	MW	1	H	0.4	$13,615	$2,210	$1,672	$84	$1,250
Chicken	Solid	LA	Medium 1	MW	1	L	0.4	$2,029	$0	$852	$67	$0
Chicken	Solid	LA	Medium 1	MW	1	M	0.7	$8,260	$247	$1,103	$75	$140
Chicken	Solid	LA	Medium 1	MW	2	H	1.1	$13,229	$1,526	$1,577	$38	$566
Chicken	Solid	LA	Medium 1	MW	2	L	1.1	$2,029	$0	$852	$30	$0
Chicken	Solid	LA	Medium 1	MW	2	M	2.2	$8,257	$171	$1,201	$34	$63
Chicken	Solid	LA	Medium 1	MW	3	H	0.6	$12,410	$0	$1,238	$0	$0
Chicken	Solid	LA	Medium 1	MW	3	L	0.6	$2,029	$0	$852	$0	$0
Chicken	Solid	LA	Medium 1	MW	3	M	1.2	$8,122	$0	$1,116	$0	$0
Chicken	Solid	LA	Medium 1	SO	1	H	0.3	$18,103	$2,379	$1,896	$95	$1,419
Chicken	Solid	LA	Medium 1	SO	1	L	0.3	$4,059	$0	$852	$76	$0
Chicken	Solid	LA	Medium 1	SO	1	M	0.5	$12,560	$0	$1,175	$85	$0
Chicken	Solid	LA	Medium 1	SO	2	H	1.2	$17,462	$1,526	$1,724	$38	$566
Chicken	Solid	LA	Medium 1	SO	2	L	1.2	$4,059	$0	$852	$30	$0
Chicken	Solid	LA	Medium 1	SO	2	M	2.4	$12,496	$0	$1,293	$34	$0
Chicken	Solid	LA	Medium 1	SO	3	H	0.6	$16,536	$0	$1,342	$0	$0
Chicken	Solid	LA	Medium 1	SO	3	L	0.6	$4,059	$0	$852	$0	$0
Chicken	Solid	LA	Medium 1	SO	3	M	1.2	$12,204	$0	$1,189	$0	$0
Chicken	Solid	LA	Medium 2	MW	1	H	0.1	$22,868	$3,187	$2,096	$149	$2,227
Chicken	Solid	LA	Medium 2	MW	1	L	0.1	$3,474	$0	$920	$119	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Solid	LA	Medium 2	MW	1	M	0.3	$14,043	$357	$1,183	$134	$249
Chicken	Solid	LA	Medium 2	MW	2	H	0.5	$22,203	$2,008	$1,914	$70	$1,048
Chicken	Solid	LA	Medium 2	MW	2	L	0.5	$3,474	$0	$920	$56	$0
Chicken	Solid	LA	Medium 2	MW	2	M	1.0	$14,037	$225	$1,339	$63	$117
Chicken	Solid	LA	Medium 2	MW	3	H	0.4	$21,113	$0	$1,352	$0	$0
Chicken	Solid	LA	Medium 2	MW	3	L	0.4	$3,474	$0	$920	$0	$0
Chicken	Solid	LA	Medium 2	MW	3	M	0.9	$13,899	$0	$1,212	$0	$0
Chicken	Solid	LA	Medium 2	SO	1	H	0.1	$30,573	$3,530	$2,513	$172	$2,570
Chicken	Solid	LA	Medium 2	SO	1	L	0.1	$6,947	$0	$920	$137	$0
Chicken	Solid	LA	Medium 2	SO	1	M	0.2	$21,317	$0	$1,305	$154	$0
Chicken	Solid	LA	Medium 2	SO	2	H	0.5	$29,428	$2,008	$2,171	$70	$1,048
Chicken	Solid	LA	Medium 2	SO	2	L	0.5	$6,947	$0	$920	$56	$0
Chicken	Solid	LA	Medium 2	SO	2	M	0.9	$21,202	$0	$1,489	$63	$0
Chicken	Solid	LA	Medium 2	SO	3	H	0.4	$28,140	$0	$1,530	$0	$0
Chicken	Solid	LA	Medium 2	SO	3	L	0.4	$6,947	$0	$920	$0	$0
Chicken	Solid	LA	Medium 2	SO	3	M	0.8	$20,873	$0	$1,338	$0	$0
Chicken	Solid	LA	Medium 3	MW	1	H	0.0	$28,911	$3,793	$2,391	$189	$2,833
Chicken	Solid	LA	Medium 3	MW	1	L	0.0	$4,419	$0	$988	$151	$0
Chicken	Solid	LA	Medium 3	MW	1	M	0.0	$17,830	$425	$1,261	$170	$318
Chicken	Solid	LA	Medium 3	MW	2	H	0.1	$29,087	$4,106	$2,557	$210	$3,146
Chicken	Solid	LA	Medium 3	MW	2	L	0.1	$4,419	$0	$988	$168	$0
Chicken	Solid	LA	Medium 3	MW	2	M	0.2	$17,832	$460	$1,303	$189	$352
Chicken	Solid	LA	Medium 3	MW	3	H	0.1	$26,813	$0	$1,455	$0	$0
Chicken	Solid	LA	Medium 3	MW	3	L	0.1	$4,419	$0	$988	$0	$0
Chicken	Solid	LA	Medium 3	MW	3	M	0.2	$17,683	$0	$1,302	$0	$0
Chicken	Solid	LA	Medium 3	SO	1	H	0.0	$38,700	$4,230	$2,922	$218	$3,270

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Solid	LA	Medium 3	SO	1	L	0.0	$8,839	$0	$988	$175	$0
Chicken	Solid	LA	Medium 3	SO	1	M	0.0	$27,049	$0	$1,413	$196	$0
Chicken	Solid	LA	Medium 3	SO	2	H	0.1	$38,821	$4,392	$3,080	$229	$3,432
Chicken	Solid	LA	Medium 3	SO	2	L	0.1	$8,839	$0	$988	$183	$0
Chicken	Solid	LA	Medium 3	SO	2	M	0.1	$27,061	$0	$1,480	$206	$0
Chicken	Solid	LA	Medium 3	SO	3	H	0.1	$35,741	$0	$1,682	$0	$0
Chicken	Solid	LA	Medium 3	SO	3	L	0.1	$8,839	$0	$988	$0	$0
Chicken	Solid	LA	Medium 3	SO	3	M	0.1	$26,552	$0	$1,460	$0	$0
Swine	Evapor	FF	Large 1	CE	1	H	4.3	$1,396	$1,723	$1,283	$51	$763
Swine	Evapor	FF	Large 1	CE	1	L	4.3	$0	$0	$896	$40	$0
Swine	Evapor	FF	Large 1	CE	1	M	8.6	$454	$968	$1,146	$46	$429
Swine	Evapor	FF	Large 1	CE	2	H	9.7	$1,535	$1,880	$1,288	$61	$920
Swine	Evapor	FF	Large 1	CE	2	L	9.7	$0	$0	$896	$49	$0
Swine	Evapor	FF	Large 1	CE	2	M	19.5	$521	$1,057	$1,147	$55	$517
Swine	Evapor	FF	Large 1	CE	3	H	5.5	$1,191	$0	$1,273	$0	$0
Swine	Evapor	FF	Large 1	CE	3	L	5.5	$0	$0	$896	$0	$0
Swine	Evapor	FF	Large 1	CE	3	M	11.1	$582	$0	$1,149	$0	$0
Swine	Evapor	FF	Large 2	CE	1	H	3.1	$1,886	$2,833	$1,312	$125	$1,873
Swine	Evapor	FF	Large 2	CE	1	L	3.1	$0	$0	$896	$100	$0
Swine	Evapor	FF	Large 2	CE	1	M	6.2	$682	$1,593	$1,151	$112	$1,053
Swine	Evapor	FF	Large 2	CE	2	H	7.0	$2,246	$3,716	$1,335	$184	$2,756
Swine	Evapor	FF	Large 2	CE	2	L	7.0	$0	$0	$896	$147	$0
Swine	Evapor	FF	Large 2	CE	2	M	14.0	$849	$2,088	$1,154	$165	$1,549
Swine	Evapor	FF	Large 2	CE	3	H	4.0	$2,970	$0	$1,308	$0	$0
Swine	Evapor	FF	Large 2	CE	3	L	4.0	$0	$0	$896	$0	$0
Swine	Evapor	FF	Large 2	CE	3	M	7.9	$1,471	$0	$1,167	$0	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Evapor	GF	Large 1	CE	1	H	4.4	$1,396	$1,723	$1,283	$51	$763
Swine	Evapor	GF	Large 1	CE	1	L	4.4	$0	$0	$896	$40	$0
Swine	Evapor	GF	Large 1	CE	1	M	8.9	$454	$968	$1,146	$46	$429
Swine	Evapor	GF	Large 1	CE	2	H	10.0	$1,535	$1,880	$1,288	$61	$920
Swine	Evapor	GF	Large 1	CE	2	L	10.0	$0	$0	$896	$49	$0
Swine	Evapor	GF	Large 1	CE	2	M	20.0	$521	$1,057	$1,147	$55	$517
Swine	Evapor	GF	Large 1	CE	3	H	5.7	$1,191	$0	$1,273	$0	$0
Swine	Evapor	GF	Large 1	CE	3	L	5.7	$0	$0	$896	$0	$0
Swine	Evapor	GF	Large 1	CE	3	M	11.3	$582	$0	$1,149	$0	$0
Swine	Evapor	GF	Large 2	CE	1	H	3.2	$1,886	$2,833	$1,312	$125	$1,873
Swine	Evapor	GF	Large 2	CE	1	L	3.2	$0	$0	$896	$100	$0
Swine	Evapor	GF	Large 2	CE	1	M	6.3	$682	$1,593	$1,151	$112	$1,053
Swine	Evapor	GF	Large 2	CE	2	H	7.2	$2,246	$3,716	$1,335	$184	$2,756
Swine	Evapor	GF	Large 2	CE	2	L	7.2	$0	$0	$896	$147	$0
Swine	Evapor	GF	Large 2	CE	2	M	14.3	$849	$2,088	$1,154	$165	$1,549
Swine	Evapor	GF	Large 2	CE	3	H	4.1	$2,970	$0	$1,308	$0	$0
Swine	Evapor	GF	Large 2	CE	3	L	4.1	$0	$0	$896	$0	$0
Swine	Evapor	GF	Large 2	CE	3	M	8.1	$1,471	$0	$1,167	$0	$0
Swine	Liquid	FF	Large 1	MA	1	H	7.8	$1,337	$2,052	$1,287	$73	$1,092
Swine	Liquid	FF	Large 1	MA	1	L	7.8	$0	$0	$896	$58	$0
Swine	Liquid	FF	Large 1	MA	1	M	15.6	$420	$229	$1,146	$66	$122
Swine	Liquid	FF	Large 1	MA	2	H	45.6	$8,259	$1,650	$1,417	$46	$5,240
Swine	Liquid	FF	Large 1	MA	2	L	45.6	$8,353	$0	$1,062	$37	$4,507
Swine	Liquid	FF	Large 1	MA	2	M	91.2	$7,339	$185	$1,282	$42	$4,584
Swine	Liquid	FF	Large 1	MA	3	H	13.3	$1,002	$0	$1,269	$0	$5,098
Swine	Liquid	FF	Large 1	MA	3	L	13.3	$0	$0	$896	$0	$5,098

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Liquid	FF	Large 1	MA	3	M	26.7	$487	$0	$1,148	$0	$5,098
Swine	Liquid	FF	Large 1	MW	1	H	26.9	$1,320	$2,019	$1,286	$71	$1,059
Swine	Liquid	FF	Large 1	MW	1	L	26.9	$0	$0	$896	$57	$0
Swine	Liquid	FF	Large 1	MW	1	M	53.8	$411	$1,135	$1,145	$64	$595
Swine	Liquid	FF	Large 1	MW	2	H	26.8	$6,732	$2,166	$1,396	$80	$3,231
Swine	Liquid	FF	Large 1	MW	2	L	26.8	$6,689	$0	$1,028	$64	$2,024
Swine	Liquid	FF	Large 1	MW	2	M	53.7	$5,854	$1,217	$1,253	$73	$2,703
Swine	Liquid	FF	Large 1	MW	3	H	22.5	$1,009	$0	$1,269	$0	$5,140
Swine	Liquid	FF	Large 1	MW	3	L	22.5	$0	$0	$896	$0	$5,140
Swine	Liquid	FF	Large 1	MW	3	M	45.0	$491	$0	$1,148	$0	$5,140
Swine	Liquid	FF	Large 2	MA	1	H	5.6	$1,849	$3,864	$1,329	$194	$2,904
Swine	Liquid	FF	Large 2	MA	1	L	5.6	$0	$0	$896	$155	$0
Swine	Liquid	FF	Large 2	MA	1	M	11.2	$648	$433	$1,150	$175	$325
Swine	Liquid	FF	Large 2	MA	2	H	32.7	$17,105	$3,026	$1,617	$138	$15,688
Swine	Liquid	FF	Large 2	MA	2	L	32.7	$17,583	$0	$1,244	$110	$13,491
Swine	Liquid	FF	Large 2	MA	2	M	65.4	$15,892	$339	$1,452	$124	$13,723
Swine	Liquid	FF	Large 2	MA	3	H	9.6	$1,722	$0	$1,283	$0	$17,212
Swine	Liquid	FF	Large 2	MA	3	L	9.6	$0	$0	$896	$0	$17,212
Swine	Liquid	FF	Large 2	MA	3	M	19.1	$847	$0	$1,155	$0	$17,212
Swine	Liquid	FF	Large 2	MW	1	H	19.3	$1,674	$3,161	$1,313	$147	$2,201
Swine	Liquid	FF	Large 2	MW	1	L	19.3	$0	$0	$896	$118	$0
Swine	Liquid	FF	Large 2	MW	1	M	38.6	$571	$1,777	$1,149	$132	$1,237
Swine	Liquid	FF	Large 2	MW	2	H	19.2	$14,190	$4,752	$1,590	$253	$10,458
Swine	Liquid	FF	Large 2	MW	2	L	19.2	$14,496	$0	$1,183	$203	$6,666
Swine	Liquid	FF	Large 2	MW	2	M	38.5	$13,001	$2,671	$1,395	$227	$8,797
Swine	Liquid	FF	Large 2	MW	3	H	16.1	$1,817	$0	$1,285	$0	$19,177

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Liquid	FF	Large 2	MW	3	L	16.1	$0	$0	$896	$0	$19,177
Swine	Liquid	FF	Large 2	MW	3	M	32.3	$895	$0	$1,156	$0	$19,177
Swine	Liquid	FF	Medium 1	MA	1	H	5.5	$1,553	$1,623	$1,466	$45	$663
Swine	Liquid	FF	Medium 1	MA	1	L	5.5	$1,599	$81	$1,271	$35	$33
Swine	Liquid	FF	Medium 1	MA	1	M	10.9	$1,553	$1,586	$1,368	$40	$648
Swine	Liquid	FF	Medium 1	MA	2	H	3.5	$4,330	$1,557	$1,492	$40	$1,235
Swine	Liquid	FF	Medium 1	MA	2	L	3.5	$4,971	$77	$1,309	$32	$667
Swine	Liquid	FF	Medium 1	MA	2	M	7.0	$4,330	$1,522	$1,394	$36	$1,221
Swine	Liquid	FF	Medium 1	MA	3	H	2.1	$573	$0	$1,120	$0	$1,097
Swine	Liquid	FF	Medium 1	MA	3	L	2.1	$620	$0	$925	$0	$1,097
Swine	Liquid	FF	Medium 1	MA	3	M	4.2	$573	$0	$1,022	$0	$1,097
Swine	Liquid	FF	Medium 1	MW	1	H	41.1	$1,403	$1,430	$1,376	$31	$470
Swine	Liquid	FF	Medium 1	MW	1	L	41.1	$1,449	$858	$1,181	$25	$282
Swine	Liquid	FF	Medium 1	MW	1	M	82.2	$1,403	$1,410	$1,278	$28	$463
Swine	Liquid	FF	Medium 1	MW	2	H	7.4	$4,261	$1,585	$1,503	$42	$1,135
Swine	Liquid	FF	Medium 1	MW	2	L	7.4	$4,882	$951	$1,319	$34	$885
Swine	Liquid	FF	Medium 1	MW	2	M	14.7	$4,261	$1,563	$1,405	$37	$1,126
Swine	Liquid	FF	Medium 1	MW	3	H	6.8	$573	$0	$1,120	$0	$1,115
Swine	Liquid	FF	Medium 1	MW	3	L	6.8	$620	$0	$925	$0	$1,115
Swine	Liquid	FF	Medium 1	MW	3	M	13.6	$573	$0	$1,022	$0	$1,115
Swine	Liquid	FF	Medium 2	MA	1	H	2.2	$1,817	$1,852	$1,573	$59	$892
Swine	Liquid	FF	Medium 2	MA	1	L	2.2	$1,863	$93	$1,378	$47	$45
Swine	Liquid	FF	Medium 2	MA	1	M	4.4	$1,817	$1,809	$1,475	$53	$872
Swine	Liquid	FF	Medium 2	MA	2	H	3.9	$5,127	$1,466	$1,466	$34	$1,893
Swine	Liquid	FF	Medium 2	MA	2	L	3.9	$5,955	$73	$1,287	$27	$1,413
Swine	Liquid	FF	Medium 2	MA	2	M	7.8	$5,127	$1,432	$1,368	$31	$1,881

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Liquid	FF	Medium 2	MA	3	H	1.7	$666	$0	$1,122	$0	$1,667
Swine	Liquid	FF	Medium 2	MA	3	L	1.7	$713	$0	$927	$0	$1,667
Swine	Liquid	FF	Medium 2	MA	3	M	3.5	$666	$0	$1,024	$0	$1,667
Swine	Liquid	FF	Medium 2	MW	1	H	15.1	$1,646	$1,632	$1,472	$45	$672
Swine	Liquid	FF	Medium 2	MW	1	L	15.1	$1,692	$979	$1,277	$36	$403
Swine	Liquid	FF	Medium 2	MW	1	M	30.3	$1,646	$1,609	$1,374	$40	$663
Swine	Liquid	FF	Medium 2	MW	2	H	5.5	$5,260	$1,832	$1,633	$58	$1,953
Swine	Liquid	FF	Medium 2	MW	2	L	5.5	$6,064	$1,099	$1,453	$46	$1,604
Swine	Liquid	FF	Medium 2	MW	2	M	11.1	$5,260	$1,806	$1,535	$53	$1,940
Swine	Liquid	FF	Medium 2	MW	3	H	3.7	$674	$0	$1,122	$0	$1,741
Swine	Liquid	FF	Medium 2	MW	3	L	3.7	$721	$0	$927	$0	$1,741
Swine	Liquid	FF	Medium 2	MW	3	M	7.3	$674	$0	$1,024	$0	$1,741
Swine	Liquid	FF	Medium 3	MA	1	H	1.1	$2,173	$2,210	$1,740	$83	$1,250
Swine	Liquid	FF	Medium 3	MA	1	L	1.1	$2,219	$111	$1,545	$67	$63
Swine	Liquid	FF	Medium 3	MA	1	M	2.1	$2,173	$2,159	$1,642	$75	$1,221
Swine	Liquid	FF	Medium 3	MA	2	H	1.9	$6,105	$1,663	$1,574	$47	$2,629
Swine	Liquid	FF	Medium 3	MA	2	L	1.9	$7,129	$84	$1,398	$37	$1,961
Swine	Liquid	FF	Medium 3	MA	2	M	3.8	$6,105	$1,625	$1,476	$42	$2,613
Swine	Liquid	FF	Medium 3	MA	3	H	0.8	$755	$0	$1,124	$0	$2,317
Swine	Liquid	FF	Medium 3	MA	3	L	0.8	$803	$0	$929	$0	$2,317
Swine	Liquid	FF	Medium 3	MA	3	M	1.7	$755	$0	$1,026	$0	$2,317
Swine	Liquid	FF	Medium 3	MW	1	H	7.4	$1,958	$1,925	$1,609	$65	$965
Swine	Liquid	FF	Medium 3	MW	1	L	7.4	$2,005	$1,155	$1,414	$52	$579
Swine	Liquid	FF	Medium 3	MW	1	M	14.7	$1,958	$1,899	$1,511	$58	$952
Swine	Liquid	FF	Medium 3	MW	2	H	2.7	$6,318	$2,171	$1,805	$81	$2,712
Swine	Liquid	FF	Medium 3	MW	2	L	2.7	$7,302	$1,302	$1,628	$64	$2,227

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Liquid	FF	Medium 3	MW	2	M	5.4	$6,318	$2,140	$1,707	$73	$2,695
Swine	Liquid	FF	Medium 3	MW	3	H	1.8	$764	$0	$1,124	$0	$2,420
Swine	Liquid	FF	Medium 3	MW	3	L	1.8	$812	$0	$929	$0	$2,420
Swine	Liquid	FF	Medium 3	MW	3	M	3.6	$764	$0	$1,026	$0	$2,420
Swine	Liquid	GF	Large 1	MA	1	H	6.6	$1,337	$2,052	$1,287	$73	$1,092
Swine	Liquid	GF	Large 1	MA	1	L	6.6	$0	$0	$896	$58	$0
Swine	Liquid	GF	Large 1	MA	1	M	13.1	$420	$229	$1,146	$66	$122
Swine	Liquid	GF	Large 1	MA	2	H	38.4	$8,259	$1,650	$1,417	$46	$5,240
Swine	Liquid	GF	Large 1	MA	2	L	38.4	$8,353	$0	$1,062	$37	$4,507
Swine	Liquid	GF	Large 1	MA	2	M	76.7	$7,339	$185	$1,282	$42	$4,584
Swine	Liquid	GF	Large 1	MA	3	H	11.2	$1,002	$0	$1,269	$0	$5,098
Swine	Liquid	GF	Large 1	MA	3	L	11.2	$0	$0	$896	$0	$5,098
Swine	Liquid	GF	Large 1	MA	3	M	22.5	$487	$0	$1,148	$0	$5,098
Swine	Liquid	GF	Large 1	MW	1	H	18.5	$1,320	$2,019	$1,286	$71	$1,059
Swine	Liquid	GF	Large 1	MW	1	L	18.5	$0	$0	$896	$57	$0
Swine	Liquid	GF	Large 1	MW	1	M	37.1	$411	$1,135	$1,145	$64	$595
Swine	Liquid	GF	Large 1	MW	2	H	18.5	$6,732	$2,166	$1,396	$80	$3,231
Swine	Liquid	GF	Large 1	MW	2	L	18.5	$6,689	$0	$1,028	$64	$2,024
Swine	Liquid	GF	Large 1	MW	2	M	36.9	$5,854	$1,217	$1,253	$73	$2,703
Swine	Liquid	GF	Large 1	MW	3	H	15.5	$1,009	$0	$1,269	$0	$5,140
Swine	Liquid	GF	Large 1	MW	3	L	15.5	$0	$0	$896	$0	$5,140
Swine	Liquid	GF	Large 1	MW	3	M	31.0	$491	$0	$1,148	$0	$5,140
Swine	Liquid	GF	Large 2	MA	1	H	4.7	$1,849	$3,864	$1,329	$194	$2,904
Swine	Liquid	GF	Large 2	MA	1	L	4.7	$0	$0	$896	$155	$0
Swine	Liquid	GF	Large 2	MA	1	M	9.4	$648	$433	$1,150	$175	$325
Swine	Liquid	GF	Large 2	MA	2	H	27.5	$17,105	$3,026	$1,617	$138	$15,688

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Liquid	GF	Large 2	MA	2	L	27.5	$17,583	$0	$1,244	$110	$13,491
Swine	Liquid	GF	Large 2	MA	2	M	55.0	$15,892	$339	$1,452	$124	$13,723
Swine	Liquid	GF	Large 2	MA	3	H	8.1	$1,722	$0	$1,283	$0	$17,212
Swine	Liquid	GF	Large 2	MA	3	L	8.1	$0	$0	$896	$0	$17,212
Swine	Liquid	GF	Large 2	MA	3	M	16.1	$847	$0	$1,155	$0	$17,212
Swine	Liquid	GF	Large 2	MW	1	H	13.3	$1,674	$3,161	$1,313	$147	$2,201
Swine	Liquid	GF	Large 2	MW	1	L	13.3	$0	$0	$896	$118	$0
Swine	Liquid	GF	Large 2	MW	1	M	26.6	$571	$1,777	$1,149	$132	$1,237
Swine	Liquid	GF	Large 2	MW	2	H	13.2	$14,190	$4,752	$1,590	$253	$10,458
Swine	Liquid	GF	Large 2	MW	2	L	13.2	$14,496	$0	$1,183	$203	$6,666
Swine	Liquid	GF	Large 2	MW	2	M	26.5	$13,001	$2,671	$1,395	$227	$8,797
Swine	Liquid	GF	Large 2	MW	3	H	11.1	$1,817	$0	$1,285	$0	$19,177
Swine	Liquid	GF	Large 2	MW	3	L	11.1	$0	$0	$896	$0	$19,177
Swine	Liquid	GF	Large 2	MW	3	M	22.2	$895	$0	$1,156	$0	$19,177
Swine	Liquid	GF	Medium 1	MA	1	H	2.5	$1,553	$1,623	$1,466	$45	$663
Swine	Liquid	GF	Medium 1	MA	1	L	2.5	$1,599	$81	$1,271	$35	$33
Swine	Liquid	GF	Medium 1	MA	1	M	5.1	$1,553	$1,586	$1,368	$40	$648
Swine	Liquid	GF	Medium 1	MA	2	H	1.6	$4,330	$1,557	$1,492	$40	$1,235
Swine	Liquid	GF	Medium 1	MA	2	L	1.6	$4,971	$77	$1,309	$32	$667
Swine	Liquid	GF	Medium 1	MA	2	M	3.2	$4,330	$1,522	$1,394	$36	$1,221
Swine	Liquid	GF	Medium 1	MA	3	H	1.0	$573	$0	$1,120	$0	$1,097
Swine	Liquid	GF	Medium 1	MA	3	L	1.0	$620	$0	$925	$0	$1,097
Swine	Liquid	GF	Medium 1	MA	3	M	1.9	$573	$0	$1,022	$0	$1,097
Swine	Liquid	GF	Medium 1	MW	1	H	15.8	$1,403	$1,430	$1,376	$31	$470
Swine	Liquid	GF	Medium 1	MW	1	L	15.8	$1,449	$858	$1,181	$25	$282
Swine	Liquid	GF	Medium 1	MW	1	M	31.7	$1,403	$1,410	$1,278	$28	$463

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Liquid	GF	Medium 1	MW	2	H	2.8	$4,261	$1,585	$1,503	$42	$1,135
Swine	Liquid	GF	Medium 1	MW	2	L	2.8	$4,882	$951	$1,319	$34	$885
Swine	Liquid	GF	Medium 1	MW	2	M	5.7	$4,261	$1,563	$1,405	$37	$1,126
Swine	Liquid	GF	Medium 1	MW	3	H	2.6	$573	$0	$1,120	$0	$1,115
Swine	Liquid	GF	Medium 1	MW	3	L	2.6	$620	$0	$925	$0	$1,115
Swine	Liquid	GF	Medium 1	MW	3	M	5.2	$573	$0	$1,022	$0	$1,115
Swine	Liquid	GF	Medium 2	MA	1	H	1.3	$1,817	$1,852	$1,573	$59	$892
Swine	Liquid	GF	Medium 2	MA	1	L	1.3	$1,863	$93	$1,378	$47	$45
Swine	Liquid	GF	Medium 2	MA	1	M	2.6	$1,817	$1,809	$1,475	$53	$872
Swine	Liquid	GF	Medium 2	MA	2	H	2.3	$5,127	$1,466	$1,466	$34	$1,893
Swine	Liquid	GF	Medium 2	MA	2	L	2.3	$5,955	$73	$1,287	$27	$1,413
Swine	Liquid	GF	Medium 2	MA	2	M	4.6	$5,127	$1,432	$1,368	$31	$1,881
Swine	Liquid	GF	Medium 2	MA	3	H	1.0	$666	$0	$1,122	$0	$1,667
Swine	Liquid	GF	Medium 2	MA	3	L	1.0	$713	$0	$927	$0	$1,667
Swine	Liquid	GF	Medium 2	MA	3	M	2.1	$666	$0	$1,024	$0	$1,667
Swine	Liquid	GF	Medium 2	MW	1	H	7.4	$1,646	$1,632	$1,472	$45	$672
Swine	Liquid	GF	Medium 2	MW	1	L	7.4	$1,692	$979	$1,277	$36	$403
Swine	Liquid	GF	Medium 2	MW	1	M	14.9	$1,646	$1,609	$1,374	$40	$663
Swine	Liquid	GF	Medium 2	MW	2	H	2.7	$5,260	$1,832	$1,633	$58	$1,953
Swine	Liquid	GF	Medium 2	MW	2	L	2.7	$6,064	$1,099	$1,453	$46	$1,604
Swine	Liquid	GF	Medium 2	MW	2	M	5.4	$5,260	$1,806	$1,535	$53	$1,940
Swine	Liquid	GF	Medium 2	MW	3	H	1.8	$674	$0	$1,122	$0	$1,741
Swine	Liquid	GF	Medium 2	MW	3	L	1.8	$721	$0	$927	$0	$1,741
Swine	Liquid	GF	Medium 2	MW	3	M	3.6	$674	$0	$1,024	$0	$1,741
Swine	Liquid	GF	Medium 3	MA	1	H	0.8	$2,173	$2,210	$1,740	$83	$1,250
Swine	Liquid	GF	Medium 3	MA	1	L	0.8	$2,219	$111	$1,545	$67	$63

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Liquid	GF	Medium 3	MA	1	M	1.5	$2,173	$2,159	$1,642	$75	$1,221
Swine	Liquid	GF	Medium 3	MA	2	H	1.4	$6,105	$1,663	$1,574	$47	$2,629
Swine	Liquid	GF	Medium 3	MA	2	L	1.4	$7,129	$84	$1,398	$37	$1,961
Swine	Liquid	GF	Medium 3	MA	2	M	2.8	$6,105	$1,625	$1,476	$42	$2,613
Swine	Liquid	GF	Medium 3	MA	3	H	0.6	$755	$0	$1,124	$0	$2,317
Swine	Liquid	GF	Medium 3	MA	3	L	0.6	$803	$0	$929	$0	$2,317
Swine	Liquid	GF	Medium 3	MA	3	M	1.2	$755	$0	$1,026	$0	$2,317
Swine	Liquid	GF	Medium 3	MW	1	H	4.4	$1,958	$1,925	$1,609	$65	$965
Swine	Liquid	GF	Medium 3	MW	1	L	4.4	$2,005	$1,155	$1,414	$52	$579
Swine	Liquid	GF	Medium 3	MW	1	M	8.8	$1,958	$1,899	$1,511	$58	$952
Swine	Liquid	GF	Medium 3	MW	2	H	1.6	$6,318	$2,171	$1,805	$81	$2,712
Swine	Liquid	GF	Medium 3	MW	2	L	1.6	$7,302	$1,302	$1,628	$64	$2,227
Swine	Liquid	GF	Medium 3	MW	2	M	3.2	$6,318	$2,140	$1,707	$73	$2,695
Swine	Liquid	GF	Medium 3	MW	3	H	1.1	$764	$0	$1,124	$0	$2,420
Swine	Liquid	GF	Medium 3	MW	3	L	1.1	$812	$0	$929	$0	$2,420
Swine	Liquid	GF	Medium 3	MW	3	M	2.1	$764	$0	$1,026	$0	$2,420
Swine	Pit	FF	Large 1	MA	1	H	2.5	$569	$2,259	$1,276	$86	$1,299
Swine	Pit	FF	Large 1	MA	1	L	2.5	$0	$0	$896	$69	$0
Swine	Pit	FF	Large 1	MA	1	M	4.9	$33	$253	$1,138	$78	$146
Swine	Pit	FF	Large 1	MA	2	H	14.3	$550	$1,650	$25,442	$46	$690
Swine	Pit	FF	Large 1	MA	2	L	14.3	$0	$0	$24,898	$37	$0
Swine	Pit	FF	Large 1	MA	2	M	28.6	$33	$185	$25,140	$42	$78
Swine	Pit	FF	Large 1	MA	3	H	4.2	$30	$0	$30,027	$0	$0
Swine	Pit	FF	Large 1	MA	3	L	4.2	$0	$0	$29,673	$0	$0
Swine	Pit	FF	Large 1	MA	3	M	8.4	$2	$0	$29,915	$0	$0
Swine	Pit	FF	Large 1	MW	1	H	34.8	$564	$2,110	$1,272	$77	$1,150

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Pit	FF	Large 1	MW	1	L	34.8	$0	$0	$896	$62	$0
Swine	Pit	FF	Large 1	MW	1	M	69.6	$33	$1,186	$1,138	$69	$646
Swine	Pit	FF	Large 1	MW	2	H	34.7	$566	$2,166	$4,336	$80	$1,206
Swine	Pit	FF	Large 1	MW	2	L	34.7	$0	$0	$3,958	$64	$0
Swine	Pit	FF	Large 1	MW	2	M	69.4	$33	$1,217	$4,200	$73	$678
Swine	Pit	FF	Large 1	MW	3	H	29.1	$30	$0	$12,095	$0	$0
Swine	Pit	FF	Large 1	MW	3	L	29.1	$0	$0	$11,741	$0	$0
Swine	Pit	FF	Large 1	MW	3	M	58.2	$2	$0	$11,983	$0	$0
Swine	Pit	FF	Large 2	MA	1	H	1.8	$636	$4,473	$1,317	$235	$3,513
Swine	Pit	FF	Large 2	MA	1	L	1.8	$0	$0	$896	$187	$0
Swine	Pit	FF	Large 2	MA	1	M	3.5	$33	$501	$1,138	$211	$393
Swine	Pit	FF	Large 2	MA	2	H	10.3	$592	$3,026	$73,666	$138	$2,066
Swine	Pit	FF	Large 2	MA	2	L	10.3	$0	$0	$72,745	$110	$0
Swine	Pit	FF	Large 2	MA	2	M	20.5	$33	$339	$72,987	$124	$232
Swine	Pit	FF	Large 2	MA	3	H	3.0	$30	$0	$98,409	$0	$0
Swine	Pit	FF	Large 2	MA	3	L	3.0	$0	$0	$98,055	$0	$0
Swine	Pit	FF	Large 2	MA	3	M	6.0	$2	$0	$98,297	$0	$0
Swine	Pit	FF	Large 2	MW	1	H	25.0	$602	$3,375	$1,296	$161	$2,415
Swine	Pit	FF	Large 2	MW	1	L	25.0	$0	$0	$896	$129	$0
Swine	Pit	FF	Large 2	MW	1	M	50.0	$33	$1,897	$1,138	$145	$1,357
Swine	Pit	FF	Large 2	MW	2	H	24.9	$644	$4,752	$11,934	$253	$3,792
Swine	Pit	FF	Large 2	MW	2	L	24.9	$0	$0	$11,507	$203	$0
Swine	Pit	FF	Large 2	MW	2	M	49.8	$33	$2,671	$11,749	$227	$2,131
Swine	Pit	FF	Large 2	MW	3	H	20.9	$30	$0	$41,710	$0	$0
Swine	Pit	FF	Large 2	MW	3	L	20.9	$0	$0	$41,356	$0	$0
Swine	Pit	FF	Large 2	MW	3	M	41.7	$2	$0	$41,598	$0	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Pit	FF	Medium 1	MA	1	H	0.9	$1,063	$1,670	$1,478	$47	$710
Swine	Pit	FF	Medium 1	MA	1	L	0.9	$1,063	$84	$1,282	$38	$36
Swine	Pit	FF	Medium 1	MA	1	M	1.8	$1,063	$1,631	$1,380	$42	$693
Swine	Pit	FF	Medium 1	MA	2	H	0.6	$981	$1,559	$2,333	$40	$599
Swine	Pit	FF	Medium 1	MA	2	L	0.6	$981	$78	$1,978	$32	$30
Swine	Pit	FF	Medium 1	MA	2	M	1.2	$981	$1,524	$2,076	$36	$586
Swine	Pit	FF	Medium 1	MA	3	H	0.4	$30	$0	$7,301	$0	$0
Swine	Pit	FF	Medium 1	MA	3	L	0.4	$30	$0	$7,105	$0	$0
Swine	Pit	FF	Medium 1	MA	3	M	0.7	$30	$0	$7,203	$0	$0
Swine	Pit	FF	Medium 1	MW	1	H	50.0	$901	$1,453	$1,378	$33	$493
Swine	Pit	FF	Medium 1	MW	1	L	50.0	$901	$872	$1,182	$27	$296
Swine	Pit	FF	Medium 1	MW	1	M	100.0	$901	$1,433	$1,280	$30	$487
Swine	Pit	FF	Medium 1	MW	2	H	9.0	$1,000	$1,585	$1,842	$42	$625
Swine	Pit	FF	Medium 1	MW	2	L	9.0	$1,000	$951	$1,646	$34	$375
Swine	Pit	FF	Medium 1	MW	2	M	17.9	$1,000	$1,563	$1,744	$37	$616
Swine	Pit	FF	Medium 1	MW	3	H	8.3	$30	$0	$3,463	$0	$0
Swine	Pit	FF	Medium 1	MW	3	L	8.3	$30	$0	$3,267	$0	$0
Swine	Pit	FF	Medium 1	MW	3	M	16.5	$30	$0	$3,365	$0	$0
Swine	Pit	FF	Medium 2	MA	1	H	0.4	$1,261	$1,933	$1,599	$65	$973
Swine	Pit	FF	Medium 2	MA	1	L	0.4	$1,261	$97	$1,403	$52	$49
Swine	Pit	FF	Medium 2	MA	1	M	0.7	$1,261	$1,889	$1,501	$58	$951
Swine	Pit	FF	Medium 2	MA	2	H	0.7	$913	$1,469	$8,254	$34	$509
Swine	Pit	FF	Medium 2	MA	2	L	0.7	$913	$73	$7,342	$27	$25
Swine	Pit	FF	Medium 2	MA	2	M	1.3	$913	$1,435	$7,441	$31	$497
Swine	Pit	FF	Medium 2	MA	3	H	0.3	$30	$0	$10,521	$0	$0
Swine	Pit	FF	Medium 2	MA	3	L	0.3	$30	$0	$10,325	$0	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Pit	FF	Medium 2	MA	3	M	0.6	$30	$0	$10,423	$0	$0
Swine	Pit	FF	Medium 2	MW	1	H	18.4	$1,065	$1,671	$1,478	$47	$711
Swine	Pit	FF	Medium 2	MW	1	L	18.4	$1,065	$1,003	$1,282	$38	$427
Swine	Pit	FF	Medium 2	MW	1	M	36.9	$1,065	$1,648	$1,380	$43	$701
Swine	Pit	FF	Medium 2	MW	2	H	6.7	$1,185	$1,832	$2,162	$58	$872
Swine	Pit	FF	Medium 2	MW	2	L	6.7	$1,185	$1,099	$1,966	$46	$523
Swine	Pit	FF	Medium 2	MW	2	M	13.5	$1,185	$1,806	$2,064	$53	$859
Swine	Pit	FF	Medium 2	MW	3	H	4.5	$30	$0	$4,782	$0	$0
Swine	Pit	FF	Medium 2	MW	3	L	4.5	$30	$0	$4,586	$0	$0
Swine	Pit	FF	Medium 2	MW	3	M	8.9	$30	$0	$4,684	$0	$0
Swine	Pit	FF	Medium 3	MA	1	H	0.2	$1,554	$2,322	$1,779	$91	$1,362
Swine	Pit	FF	Medium 3	MA	1	L	0.2	$1,554	$116	$1,583	$73	$68
Swine	Pit	FF	Medium 3	MA	1	M	0.4	$1,554	$2,269	$1,681	$82	$1,331
Swine	Pit	FF	Medium 3	MA	2	H	0.3	$1,061	$1,667	$11,018	$47	$707
Swine	Pit	FF	Medium 3	MA	2	L	0.3	$1,061	$84	$9,827	$37	$36
Swine	Pit	FF	Medium 3	MA	2	M	0.6	$1,061	$1,628	$9,926	$42	$690
Swine	Pit	FF	Medium 3	MA	3	H	0.1	$30	$0	$14,190	$0	$0
Swine	Pit	FF	Medium 3	MA	3	L	0.1	$30	$0	$13,994	$0	$0
Swine	Pit	FF	Medium 3	MA	3	M	0.3	$30	$0	$14,092	$0	$0
Swine	Pit	FF	Medium 3	MW	1	H	9.0	$1,298	$1,981	$1,621	$68	$1,021
Swine	Pit	FF	Medium 3	MW	1	L	9.0	$1,298	$1,189	$1,425	$54	$613
Swine	Pit	FF	Medium 3	MW	1	M	17.9	$1,298	$1,954	$1,523	$61	$1,007
Swine	Pit	FF	Medium 3	MW	2	H	3.3	$1,440	$2,171	$2,555	$81	$1,211
Swine	Pit	FF	Medium 3	MW	2	L	3.3	$1,440	$1,302	$2,359	$64	$726
Swine	Pit	FF	Medium 3	MW	2	M	6.6	$1,440	$2,140	$2,457	$73	$1,194
Swine	Pit	FF	Medium 3	MW	3	H	2.2	$30	$0	$6,216	$0	$0

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Pit	FF	Medium 3	MW	3	L	2.2	$30	$0	$6,020	$0	$0
Swine	Pit	FF	Medium 3	MW	3	M	4.3	$30	$0	$6,118	$0	$0
Swine	Pit	GF	Large 1	MA	1	H	3.9	$569	$2,259	$1,276	$86	$1,299
Swine	Pit	GF	Large 1	MA	1	L	3.9	$0	$0	$896	$69	$0
Swine	Pit	GF	Large 1	MA	1	M	7.9	$33	$253	$1,138	$78	$146
Swine	Pit	GF	Large 1	MA	2	H	23.0	$550	$1,650	$25,926	$46	$690
Swine	Pit	GF	Large 1	MA	2	L	23.0	$0	$0	$25,382	$37	$0
Swine	Pit	GF	Large 1	MA	2	M	46.0	$33	$185	$25,624	$42	$78
Swine	Pit	GF	Large 1	MA	3	H	6.7	$30	$0	$30,027	$0	$0
Swine	Pit	GF	Large 1	MA	3	L	6.7	$0	$0	$29,673	$0	$0
Swine	Pit	GF	Large 1	MA	3	M	13.5	$2	$0	$29,915	$0	$0
Swine	Pit	GF	Large 1	MW	1	H	44.7	$564	$2,110	$1,272	$77	$1,150
Swine	Pit	GF	Large 1	MW	1	L	44.7	$0	$0	$896	$62	$0
Swine	Pit	GF	Large 1	MW	1	M	89.4	$33	$1,186	$1,138	$69	$646
Swine	Pit	GF	Large 1	MW	2	H	44.6	$566	$2,166	$4,737	$80	$1,206
Swine	Pit	GF	Large 1	MW	2	L	44.6	$0	$0	$4,359	$64	$0
Swine	Pit	GF	Large 1	MW	2	M	89.1	$33	$1,217	$4,601	$73	$678
Swine	Pit	GF	Large 1	MW	3	H	37.4	$30	$0	$12,095	$0	$0
Swine	Pit	GF	Large 1	MW	3	L	37.4	$0	$0	$11,741	$0	$0
Swine	Pit	GF	Large 1	MW	3	M	74.7	$2	$0	$11,983	$0	$0
Swine	Pit	GF	Large 2	MA	1	H	2.8	$636	$4,473	$1,317	$235	$3,513
Swine	Pit	GF	Large 2	MA	1	L	2.8	$0	$0	$896	$187	$0
Swine	Pit	GF	Large 2	MA	1	M	5.7	$33	$501	$1,138	$211	$393
Swine	Pit	GF	Large 2	MA	2	H	16.5	$592	$3,026	$75,116	$138	$2,066
Swine	Pit	GF	Large 2	MA	2	L	16.5	$0	$0	$74,195	$110	$0
Swine	Pit	GF	Large 2	MA	2	M	33.0	$33	$339	$74,437	$124	$232

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Pit	GF	Large 2	MA	3	H	4.8	$30	$0	$98,409	$0	$0
Swine	Pit	GF	Large 2	MA	3	L	4.8	$0	$0	$98,055	$0	$0
Swine	Pit	GF	Large 2	MA	3	M	9.7	$2	$0	$98,297	$0	$0
Swine	Pit	GF	Large 2	MW	1	H	32.1	$602	$3,375	$1,296	$161	$2,415
Swine	Pit	GF	Large 2	MW	1	L	32.1	$0	$0	$896	$129	$0
Swine	Pit	GF	Large 2	MW	1	M	64.1	$33	$1,897	$1,138	$145	$1,357
Swine	Pit	GF	Large 2	MW	2	H	32.0	$644	$4,752	$13,210	$253	$3,792
Swine	Pit	GF	Large 2	MW	2	L	32.0	$0	$0	$12,784	$203	$0
Swine	Pit	GF	Large 2	MW	2	M	63.9	$33	$2,671	$13,026	$227	$2,131
Swine	Pit	GF	Large 2	MW	3	H	26.8	$30	$0	$41,710	$0	$0
Swine	Pit	GF	Large 2	MW	3	L	26.8	$0	$0	$41,356	$0	$0
Swine	Pit	GF	Large 2	MW	3	M	53.6	$2	$0	$41,598	$0	$0
Swine	Pit	GF	Medium 1	MA	1	H	0.9	$1,063	$1,670	$1,478	$47	$710
Swine	Pit	GF	Medium 1	MA	1	L	0.9	$1,063	$84	$1,282	$38	$36
Swine	Pit	GF	Medium 1	MA	1	M	1.8	$1,063	$1,631	$1,380	$42	$693
Swine	Pit	GF	Medium 1	MA	2	H	0.6	$981	$1,559	$2,454	$40	$599
Swine	Pit	GF	Medium 1	MA	2	L	0.6	$981	$78	$2,104	$32	$30
Swine	Pit	GF	Medium 1	MA	2	M	1.2	$981	$1,524	$2,202	$36	$586
Swine	Pit	GF	Medium 1	MA	3	H	0.3	$30	$0	$7,301	$0	$0
Swine	Pit	GF	Medium 1	MA	3	L	0.3	$30	$0	$7,105	$0	$0
Swine	Pit	GF	Medium 1	MA	3	M	0.7	$30	$0	$7,203	$0	$0
Swine	Pit	GF	Medium 1	MW	1	H	33.2	$901	$1,453	$1,378	$33	$493
Swine	Pit	GF	Medium 1	MW	1	L	33.2	$901	$872	$1,182	$27	$296
Swine	Pit	GF	Medium 1	MW	1	M	66.4	$901	$1,433	$1,280	$30	$487
Swine	Pit	GF	Medium 1	MW	2	H	6.0	$1,000	$1,585	$1,976	$42	$625
Swine	Pit	GF	Medium 1	MW	2	L	6.0	$1,000	$951	$1,780	$34	$375

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Pit	GF	Medium 1	MW	2	M	11.9	$1,000	$1,563	$1,878	$37	$616
Swine	Pit	GF	Medium 1	MW	3	H	5.5	$30	$0	$3,463	$0	$0
Swine	Pit	GF	Medium 1	MW	3	L	5.5	$30	$0	$3,267	$0	$0
Swine	Pit	GF	Medium 1	MW	3	M	11.0	$30	$0	$3,365	$0	$0
Swine	Pit	GF	Medium 2	MA	1	H	0.5	$1,261	$1,933	$1,599	$65	$973
Swine	Pit	GF	Medium 2	MA	1	L	0.5	$1,261	$97	$1,403	$52	$49
Swine	Pit	GF	Medium 2	MA	1	M	0.9	$1,261	$1,889	$1,501	$58	$951
Swine	Pit	GF	Medium 2	MA	2	H	0.8	$913	$1,469	$8,410	$34	$509
Swine	Pit	GF	Medium 2	MA	2	L	0.8	$913	$73	$7,523	$27	$25
Swine	Pit	GF	Medium 2	MA	2	M	1.7	$913	$1,435	$7,621	$31	$497
Swine	Pit	GF	Medium 2	MA	3	H	0.4	$30	$0	$10,521	$0	$0
Swine	Pit	GF	Medium 2	MA	3	L	0.4	$30	$0	$10,325	$0	$0
Swine	Pit	GF	Medium 2	MA	3	M	0.7	$30	$0	$10,423	$0	$0
Swine	Pit	GF	Medium 2	MW	1	H	15.6	$1,065	$1,671	$1,478	$47	$711
Swine	Pit	GF	Medium 2	MW	1	L	15.6	$1,065	$1,003	$1,282	$38	$427
Swine	Pit	GF	Medium 2	MW	1	M	31.2	$1,065	$1,648	$1,380	$43	$701
Swine	Pit	GF	Medium 2	MW	2	H	5.7	$1,185	$1,832	$2,364	$58	$872
Swine	Pit	GF	Medium 2	MW	2	L	5.7	$1,185	$1,099	$2,168	$46	$523
Swine	Pit	GF	Medium 2	MW	2	M	11.4	$1,185	$1,806	$2,266	$53	$859
Swine	Pit	GF	Medium 2	MW	3	H	3.8	$30	$0	$4,782	$0	$0
Swine	Pit	GF	Medium 2	MW	3	L	3.8	$30	$0	$4,586	$0	$0
Swine	Pit	GF	Medium 2	MW	3	M	7.6	$30	$0	$4,684	$0	$0
Swine	Pit	GF	Medium 3	MA	1	H	0.3	$1,554	$2,322	$1,779	$91	$1,362
Swine	Pit	GF	Medium 3	MA	1	L	0.3	$1,554	$116	$1,583	$73	$68
Swine	Pit	GF	Medium 3	MA	1	M	0.5	$1,554	$2,269	$1,681	$82	$1,331
Swine	Pit	GF	Medium 3	MA	2	H	0.5	$1,061	$1,667	$11,235	$47	$707

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Pit	GF	Medium 3	MA	2	L	0.5	$1,061	$84	$10,079	$37	$36
Swine	Pit	GF	Medium 3	MA	2	M	1.0	$1,061	$1,628	$10,177	$42	$690
Swine	Pit	GF	Medium 3	MA	3	H	0.2	$30	$0	$14,190	$0	$0
Swine	Pit	GF	Medium 3	MA	3	L	0.2	$30	$0	$13,994	$0	$0
Swine	Pit	GF	Medium 3	MA	3	M	0.4	$30	$0	$14,092	$0	$0
Swine	Pit	GF	Medium 3	MW	1	H	9.3	$1,298	$1,981	$1,621	$68	$1,021
Swine	Pit	GF	Medium 3	MW	1	L	9.3	$1,298	$1,189	$1,425	$54	$613
Swine	Pit	GF	Medium 3	MW	1	M	18.5	$1,298	$1,954	$1,523	$61	$1,007
Swine	Pit	GF	Medium 3	MW	2	H	3.4	$1,440	$2,171	$2,836	$81	$1,211
Swine	Pit	GF	Medium 3	MW	2	L	3.4	$1,440	$1,302	$2,640	$64	$726
Swine	Pit	GF	Medium 3	MW	2	M	6.8	$1,440	$2,140	$2,738	$73	$1,194
Swine	Pit	GF	Medium 3	MW	3	H	2.2	$30	$0	$6,216	$0	$0
Swine	Pit	GF	Medium 3	MW	3	L	2.2	$30	$0	$6,020	$0	$0
Swine	Pit	GF	Medium 3	MW	3	M	4.5	$30	$0	$6,118	$0	$0
Turkey	Solid	SL	Large 1	MA	1	H	1.2	$151,930	$7,127	$5,851	$411	$6,167
Turkey	Solid	SL	Large 1	MA	1	L	1.2	$20,456	$6,770	$5,285	$329	$5,858
Turkey	Solid	SL	Large 1	MA	1	M	2.4	$78,903	$7,120	$5,569	$370	$6,161
Turkey	Solid	SL	Large 1	MA	2	H	23.8	$148,939	$3,147	$19,105	$146	$2,187
Turkey	Solid	SL	Large 1	MA	2	L	23.8	$17,465	$2,990	$3,448	$117	$2,078
Turkey	Solid	SL	Large 1	MA	2	M	47.6	$75,912	$3,144	$10,372	$131	$2,185
Turkey	Solid	SL	Large 1	MA	3	H	15.8	$146,794	$0	$14,657	$0	$0
Turkey	Solid	SL	Large 1	MA	3	L	15.8	$15,345	$0	$2,400	$0	$0
Turkey	Solid	SL	Large 1	MA	3	M	31.5	$73,768	$0	$7,827	$0	$0
Turkey	Solid	SL	Large 1	MW	1	H	1.7	$151,140	$6,076	$5,366	$341	$5,116
Turkey	Solid	SL	Large 1	MW	1	L	1.7	$19,481	$6,076	$4,786	$273	$5,116
Turkey	Solid	SL	Large 1	MW	1	M	3.4	$78,113	$6,076	$5,084	$307	$5,116

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Turkey	Solid	SL	Large 1	MW	2	H	32.8	$148,939	$3,147	$10,028	$146	$2,187
Turkey	Solid	SL	Large 1	MW	2	L	32.8	$17,279	$3,147	$3,434	$117	$2,187
Turkey	Solid	SL	Large 1	MW	2	M	65.6	$75,911	$3,147	$6,378	$131	$2,187
Turkey	Solid	SL	Large 1	MW	3	H	21.7	$146,794	$0	$4,601	$0	$0
Turkey	Solid	SL	Large 1	MW	3	L	21.7	$15,334	$0	$2,400	$0	$0
Turkey	Solid	SL	Large 1	MW	3	M	43.5	$73,767	$0	$3,403	$0	$0
Turkey	Solid	SL	Medium 1	MA	1	H	0.2	$28,009	$3,202	$2,446	$150	$2,242
Turkey	Solid	SL	Medium 1	MA	1	L	0.2	$5,050	$3,170	$2,199	$119	$2,220
Turkey	Solid	SL	Medium 1	MA	1	M	0.5	$15,256	$3,193	$2,322	$135	$2,236
Turkey	Solid	SL	Medium 1	MA	2	H	1.6	$26,968	$1,816	$4,086	$57	$856
Turkey	Solid	SL	Medium 1	MA	2	L	1.6	$4,008	$1,798	$1,558	$46	$848
Turkey	Solid	SL	Medium 1	MA	2	M	3.3	$14,214	$1,811	$2,730	$51	$854
Turkey	Solid	SL	Medium 1	MA	3	H	0.8	$25,824	$0	$3,412	$0	$0
Turkey	Solid	SL	Medium 1	MA	3	L	0.8	$2,870	$0	$1,124	$0	$0
Turkey	Solid	SL	Medium 1	MA	3	M	1.7	$13,071	$0	$2,145	$0	$0
Turkey	Solid	SL	Medium 1	MW	1	H	0.2	$28,199	$3,454	$2,562	$167	$2,494
Turkey	Solid	SL	Medium 1	MW	1	L	0.2	$4,715	$3,454	$2,275	$133	$2,494
Turkey	Solid	SL	Medium 1	MW	1	M	0.4	$15,306	$3,454	$2,428	$150	$2,494
Turkey	Solid	SL	Medium 1	MW	2	H	1.4	$26,968	$1,816	$2,694	$57	$856
Turkey	Solid	SL	Medium 1	MW	2	L	1.4	$3,484	$1,816	$1,519	$46	$856
Turkey	Solid	SL	Medium 1	MW	2	M	2.8	$14,074	$1,816	$2,063	$51	$856
Turkey	Solid	SL	Medium 1	MW	3	H	0.7	$25,824	$0	$1,657	$0	$0
Turkey	Solid	SL	Medium 1	MW	3	L	0.7	$2,840	$0	$1,124	$0	$0
Turkey	Solid	SL	Medium 1	MW	3	M	1.4	$13,064	$0	$1,373	$0	$0
Turkey	Solid	SL	Medium 2	MA	1	H	0.1	$43,207	$4,451	$3,194	$233	$3,491
Turkey	Solid	SL	Medium 2	MA	1	L	0.1	$7,460	$4,407	$2,913	$186	$3,456

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Turkey	Solid	SL	Medium 2	MA	1	M	0.1	$23,349	$4,438	$3,053	$210	$3,481
Turkey	Solid	SL	Medium 2	MA	2	H	0.9	$41,256	$1,856	$5,846	$60	$896
Turkey	Solid	SL	Medium 2	MA	2	L	0.9	$5,509	$1,837	$1,714	$48	$887
Turkey	Solid	SL	Medium 2	MA	2	M	1.9	$21,398	$1,851	$3,549	$54	$894
Turkey	Solid	SL	Medium 2	MA	3	H	0.5	$40,082	$0	$4,720	$0	$0
Turkey	Solid	SL	Medium 2	MA	3	L	0.5	$4,340	$0	$1,261	$0	$0
Turkey	Solid	SL	Medium 2	MA	3	M	0.9	$20,226	$0	$2,800	$0	$0
Turkey	Solid	SL	Medium 2	MW	1	H	0.0	$43,503	$4,844	$3,375	$259	$3,884
Turkey	Solid	SL	Medium 2	MW	1	L	0.0	$7,231	$4,844	$3,054	$207	$3,884
Turkey	Solid	SL	Medium 2	MW	1	M	0.1	$23,505	$4,844	$3,224	$233	$3,884
Turkey	Solid	SL	Medium 2	MW	2	H	0.8	$41,256	$1,856	$3,470	$60	$896
Turkey	Solid	SL	Medium 2	MW	2	L	0.8	$4,984	$1,856	$1,675	$48	$896
Turkey	Solid	SL	Medium 2	MW	2	M	1.6	$21,258	$1,856	$2,493	$54	$896
Turkey	Solid	SL	Medium 2	MW	3	H	0.4	$40,082	$0	$1,987	$0	$0
Turkey	Solid	SL	Medium 2	MW	3	L	0.4	$4,310	$0	$1,261	$0	$0
Turkey	Solid	SL	Medium 2	MW	3	M	0.8	$20,218	$0	$1,597	$0	$0
Turkey	Solid	SL	Medium 3	MA	1	H	0.0	$59,018	$5,751	$3,965	$319	$4,791
Turkey	Solid	SL	Medium 3	MA	1	L	0.0	$9,967	$5,693	$3,649	$256	$4,743
Turkey	Solid	SL	Medium 3	MA	1	M	0.1	$31,769	$5,733	$3,807	$287	$4,776
Turkey	Solid	SL	Medium 3	MA	2	H	0.5	$56,473	$2,366	$7,595	$93	$1,406
Turkey	Solid	SL	Medium 3	MA	2	L	0.5	$7,422	$2,342	$2,086	$75	$1,392
Turkey	Solid	SL	Medium 3	MA	2	M	0.9	$29,224	$2,359	$4,559	$84	$1,402
Turkey	Solid	SL	Medium 3	MA	3	H	0.3	$54,916	$0	$6,075	$0	$0
Turkey	Solid	SL	Medium 3	MA	3	L	0.3	$5,870	$0	$1,398	$0	$0
Turkey	Solid	SL	Medium 3	MA	3	M	0.6	$27,668	$0	$3,474	$0	$0
Turkey	Solid	SL	Medium 3	MW	1	H	0.0	$59,423	$6,290	$4,214	$355	$5,330

Table C-2b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Turkey	Solid	SL	Medium 3	MW	1	L	0.0	$9,847	$6,290	$3,859	$284	$5,330
Turkey	Solid	SL	Medium 3	MW	1	M	0.1	$32,034	$6,290	$4,046	$320	$5,330
Turkey	Solid	SL	Medium 3	MW	2	H	0.4	$56,473	$2,366	$4,421	$93	$1,406
Turkey	Solid	SL	Medium 3	MW	2	L	0.4	$6,897	$2,366	$2,047	$75	$1,406
Turkey	Solid	SL	Medium 3	MW	2	M	0.8	$29,084	$2,366	$3,122	$84	$1,406
Turkey	Solid	SL	Medium 3	MW	3	H	0.3	$54,916	$0	$2,324	$0	$0
Turkey	Solid	SL	Medium 3	MW	3	L	0.3	$5,840	$0	$1,398	$0	$0
Turkey	Solid	SL	Medium 3	MW	3	M	0.5	$27,660	$0	$1,824	$0	$0

Table C-3a

Summary of Industry Costs for Option 5

Animal Type	Manure Type	Operation Type	Capital	Annual	Fixed	3-Year Recurring	5-Year Recurring
Chicken	Liquid	LW	$22,224,957	$1,711,084	$200,193	$35,781	$148,929
Chicken	Solid	BR	$184,992,580	$4,120,237	$2,303,023	$83,562	$1,127,487
Chicken	Solid	LA	$32,642,246	$1,929,765	$333,911	$47,230	$224,575
Swine	Evapor	FF	$43,483,000	$1,830,320	$138,485	$10,060	$89,300
Swine	Evapor	GF	$44,603,942	$1,877,631	$142,109	$10,321	$91,605
Swine	Liquid	FF	$341,161,677	$10,805,902	$1,458,059	$98,623	$838,708
Swine	Liquid	GF	$250,152,138	$7,850,690	$920,791	$69,564	$552,835
Swine	Pit	FF	$37,452,731	$12,278,113	$1,398,631	$82,198	$781,926
Swine	Pit	GF	$46,434,556	$18,034,408	$1,538,482	$101,262	$910,429
Turkey	Solid	SL	$31,276,907	$2,864,728	$835,304	$35,254	$584,319
Veal	Liquid	Flush	$1,036,004	$82,351	$38,948	$2,422	$10,090

Table C-3b

Model Farm Costs for Option 5

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Liquid	LW	Large 1	SO	1	H	7.1	$89,513	$13,599	$8,714	$842	$12,639
Chicken	Liquid	LW	Large 1	SO	1	L	7.1	$79,016	$0	$2,476	$674	$0
Chicken	Liquid	LW	Large 1	SO	1	M	14.2	$80,230	$0	$3,322	$759	$0
Chicken	Liquid	LW	Large 1	SO	2	H	43	$80,986	$2,256	$8,743	$87	$1,296
Chicken	Liquid	LW	Large 1	SO	2	L	43	$79,016	$0	$2,476	$69	$0
Chicken	Liquid	LW	Large 1	SO	2	M	85.9	$79,378	$0	$6,515	$78	$0
Chicken	Liquid	LW	Large 1	SO	3	H	45.6	$34,507	$0	$3,430	$0	$0
Chicken	Liquid	LW	Large 1	SO	3	L	45.6	$4,010	$0	$976	$0	$0
Chicken	Liquid	LW	Large 1	SO	3	M	91.2	$34,026	$0	$2,871	$0	$0
Chicken	Liquid	LW	Medium 3	SO	1	H	0.6	$68,917	$2,643	$3,269	$112	$1,683
Chicken	Liquid	LW	Medium 3	SO	1	L	0.6	$75,332	$0	$2,290	$90	$0
Chicken	Liquid	LW	Medium 3	SO	1	M	1.2	$66,973	$0	$2,441	$101	$0
Chicken	Liquid	LW	Medium 3	SO	2	H	2.7	$57,136	$1,869	$3,153	$61	$909
Chicken	Liquid	LW	Medium 3	SO	2	L	2.7	$55,406	$0	$1,892	$49	$0
Chicken	Liquid	LW	Medium 3	SO	2	M	5.4	$55,768	$0	$2,511	$54	$0
Chicken	Liquid	LW	Medium 3	SO	3	H	2.7	$52,204	$0	$5,909	$0	$0
Chicken	Liquid	LW	Medium 3	SO	3	L	2.7	$51,577	$0	$1,815	$0	$0
Chicken	Liquid	LW	Medium 3	SO	3	M	5.4	$51,629	$0	$4,696	$0	$0
Chicken	Solid	BR	Large 1	MA	1	H	3.6	$91,471	$3,427	$2,864	$164	$2,467
Chicken	Solid	BR	Large 1	MA	1	L	3.6	$2,656	$1,885	$2,537	$131	$1,357
Chicken	Solid	BR	Large 1	MA	1	M	7.2	$82,604	$3,369	$2,709	$148	$2,425
Chicken	Solid	BR	Large 1	MA	2	H	53.8	$95,933	$1,824	$2,124	$57	$864
Chicken	Solid	BR	Large 1	MA	2	L	53.8	$1,471	$1,004	$1,797	$46	$476
Chicken	Solid	BR	Large 1	MA	2	M	107.5	$86,501	$1,793	$1,969	$52	$849
Chicken	Solid	BR	Large 1	MA	3	H	26.7	$106,928	$0	$1,720	$0	$0
Chicken	Solid	BR	Large 1	MA	3	L	26.7	$589	$0	$1,404	$0	$0

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Solid	BR	Large 1	MA	3	M	53.4	$96,295	$0	$1,562	$0	$0
Chicken	Solid	BR	Large 1	SO	1	H	2.8	$92,823	$5,225	$3,694	$284	$4,265
Chicken	Solid	BR	Large 1	SO	1	L	2.8	$3,761	$522	$3,259	$228	$426
Chicken	Solid	BR	Large 1	SO	1	M	5.5	$83,959	$5,162	$3,538	$256	$4,213
Chicken	Solid	BR	Large 1	SO	2	H	126	$97,203	$1,604	$2,023	$43	$644
Chicken	Solid	BR	Large 1	SO	2	L	126	$1,041	$161	$1,588	$34	$65
Chicken	Solid	BR	Large 1	SO	2	M	251.9	$87,631	$1,585	$1,867	$39	$637
Chicken	Solid	BR	Large 1	SO	3	H	45.7	$94,105	$0	$1,685	$0	$0
Chicken	Solid	BR	Large 1	SO	3	L	45.7	$55	$0	$1,250	$0	$0
Chicken	Solid	BR	Large 1	SO	3	M	91.4	$84,744	$0	$1,529	$0	$0
Chicken	Solid	BR	Large 2	MA	1	H	2.1	$191,977	$5,996	$4,450	$336	$5,036
Chicken	Solid	BR	Large 2	MA	1	L	2.1	$4,931	$3,298	$4,044	$268	$2,770
Chicken	Solid	BR	Large 2	MA	1	M	4.2	$173,287	$5,894	$4,255	$302	$4,950
Chicken	Solid	BR	Large 2	MA	2	H	31.1	$234,700	$2,447	$3,102	$99	$1,487
Chicken	Solid	BR	Large 2	MA	2	L	31.1	$2,421	$1,345	$2,639	$79	$817
Chicken	Solid	BR	Large 2	MA	2	M	62.2	$211,487	$2,405	$2,878	$89	$1,461
Chicken	Solid	BR	Large 2	MA	3	H	15.4	$273,178	$0	$2,548	$0	$0
Chicken	Solid	BR	Large 2	MA	3	L	15.4	$1,168	$0	$2,069	$0	$0
Chicken	Solid	BR	Large 2	MA	3	M	30.9	$245,978	$0	$2,308	$0	$0
Chicken	Solid	BR	Large 2	SO	1	H	1.6	$179,230	$8,919	$5,785	$530	$7,959
Chicken	Solid	BR	Large 2	SO	1	L	1.6	$6,567	$892	$5,269	$425	$796
Chicken	Solid	BR	Large 2	SO	1	M	3.2	$162,029	$8,812	$5,591	$477	$7,863
Chicken	Solid	BR	Large 2	SO	2	H	72.8	$224,355	$2,028	$2,823	$71	$1,068
Chicken	Solid	BR	Large 2	SO	2	L	72.8	$1,404	$203	$2,260	$57	$107
Chicken	Solid	BR	Large 2	SO	2	M	145.7	$202,138	$2,004	$2,607	$64	$1,055
Chicken	Solid	BR	Large 2	SO	3	H	26.4	$231,930	$0	$2,326	$0	$0
Chicken	Solid	BR	Large 2	SO	3	L	26.4	$104	$0	$1,756	$0	$0
Chicken	Solid	BR	Large 2	SO	3	M	52.9	$208,828	$0	$2,106	$0	$0

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Solid	BR	Medium 1	MA	1	H	1.1	$29,696	$1,912	$1,680	$63	$952
Chicken	Solid	BR	Medium 1	MA	1	L	1.1	$1,200	$669	$1,441	$51	$333
Chicken	Solid	BR	Medium 1	MA	1	M	2.1	$26,877	$1,898	$1,573	$57	$945
Chicken	Solid	BR	Medium 1	MA	2	H	5.4	$29,403	$1,409	$1,448	$30	$449
Chicken	Solid	BR	Medium 1	MA	2	L	5.4	$822	$494	$1,209	$24	$158
Chicken	Solid	BR	Medium 1	MA	2	M	10.8	$26,576	$1,399	$1,341	$27	$446
Chicken	Solid	BR	Medium 1	MA	3	H	5.5	$28,396	$0	$1,201	$0	$0
Chicken	Solid	BR	Medium 1	MA	3	L	5.5	$309	$0	$988	$0	$0
Chicken	Solid	BR	Medium 1	MA	3	M	11.1	$25,589	$0	$1,094	$0	$0
Chicken	Solid	BR	Medium 1	SO	1	H	1.7	$29,604	$2,482	$1,944	$101	$1,522
Chicken	Solid	BR	Medium 1	SO	1	L	1.7	$1,693	$372	$1,616	$81	$228
Chicken	Solid	BR	Medium 1	SO	1	M	3.3	$26,837	$2,446	$1,836	$91	$1,500
Chicken	Solid	BR	Medium 1	SO	2	H	13.9	$29,026	$1,314	$1,404	$24	$354
Chicken	Solid	BR	Medium 1	SO	2	L	13.9	$815	$197	$1,076	$19	$53
Chicken	Solid	BR	Medium 1	SO	2	M	27.8	$26,228	$1,294	$1,296	$21	$349
Chicken	Solid	BR	Medium 1	SO	3	H	7	$28,261	$0	$1,201	$0	$0
Chicken	Solid	BR	Medium 1	SO	3	L	7	$49	$0	$872	$0	$0
Chicken	Solid	BR	Medium 1	SO	3	M	14	$25,463	$0	$1,092	$0	$0
Chicken	Solid	BR	Medium 2	MA	1	H	1	$41,397	$2,231	$1,913	$85	$1,271
Chicken	Solid	BR	Medium 2	MA	1	L	1	$1,479	$781	$1,657	$68	$445
Chicken	Solid	BR	Medium 2	MA	1	M	2.1	$37,435	$2,215	$1,798	$76	$1,261
Chicken	Solid	BR	Medium 2	MA	2	H	8.9	$42,532	$1,512	$1,582	$37	$552
Chicken	Solid	BR	Medium 2	MA	2	L	8.9	$945	$530	$1,326	$30	$194
Chicken	Solid	BR	Medium 2	MA	2	M	17.8	$38,404	$1,501	$1,466	$33	$548
Chicken	Solid	BR	Medium 2	MA	3	H	6.2	$40,176	$0	$1,287	$0	$0
Chicken	Solid	BR	Medium 2	MA	3	L	6.2	$350	$0	$1,057	$0	$0
Chicken	Solid	BR	Medium 2	MA	3	M	12.3	$36,195	$0	$1,172	$0	$0
Chicken	Solid	BR	Medium 2	SO	1	H	1.2	$41,055	$2,920	$2,232	$131	$1,960

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Solid	BR	Medium 2	SO	1	L	1.2	$2,028	$438	$1,886	$104	$294
Chicken	Solid	BR	Medium 2	SO	1	M	2.3	$37,178	$2,876	$2,115	$118	$1,930
Chicken	Solid	BR	Medium 2	SO	2	H	23.1	$42,041	$1,368	$1,515	$27	$408
Chicken	Solid	BR	Medium 2	SO	2	L	23.1	$863	$205	$1,169	$22	$61
Chicken	Solid	BR	Medium 2	SO	2	M	46.2	$37,950	$1,348	$1,398	$24	$402
Chicken	Solid	BR	Medium 2	SO	3	H	8.9	$41,158	$0	$1,287	$0	$0
Chicken	Solid	BR	Medium 2	SO	3	L	8.9	$56	$0	$941	$0	$0
Chicken	Solid	BR	Medium 2	SO	3	M	17.8	$37,074	$0	$1,170	$0	$0
Chicken	Solid	BR	Medium 3	MA	1	H	1	$63,124	$2,897	$2,307	$129	$1,937
Chicken	Solid	BR	Medium 3	MA	1	L	1	$2,054	$1,014	$2,034	$103	$678
Chicken	Solid	BR	Medium 3	MA	1	M	2	$57,047	$2,877	$2,184	$116	$1,924
Chicken	Solid	BR	Medium 3	MA	2	H	8.9	$64,824	$1,732	$1,769	$51	$772
Chicken	Solid	BR	Medium 3	MA	2	L	8.9	$1,187	$606	$1,496	$41	$270
Chicken	Solid	BR	Medium 3	MA	2	M	17.7	$58,492	$1,720	$1,646	$46	$766
Chicken	Solid	BR	Medium 3	MA	3	H	6.2	$61,627	$0	$1,373	$0	$0
Chicken	Solid	BR	Medium 3	MA	3	L	6.2	$425	$0	$1,126	$0	$0
Chicken	Solid	BR	Medium 3	MA	3	M	12.3	$55,508	$0	$1,250	$0	$0
Chicken	Solid	BR	Medium 3	SO	1	H	1	$62,714	$4,011	$2,822	$203	$3,051
Chicken	Solid	BR	Medium 3	SO	1	L	1	$2,859	$602	$2,457	$162	$458
Chicken	Solid	BR	Medium 3	SO	1	M	2.1	$56,759	$3,950	$2,696	$183	$3,005
Chicken	Solid	BR	Medium 3	SO	2	H	21.1	$64,173	$1,528	$1,676	$38	$568
Chicken	Solid	BR	Medium 3	SO	2	L	21.1	$995	$229	$1,311	$30	$85
Chicken	Solid	BR	Medium 3	SO	2	M	42.3	$57,886	$1,506	$1,550	$34	$560
Chicken	Solid	BR	Medium 3	SO	3	H	7.9	$63,173	$0	$1,373	$0	$0
Chicken	Solid	BR	Medium 3	SO	3	L	7.9	$67	$0	$1,009	$0	$0
Chicken	Solid	BR	Medium 3	SO	3	M	15.9	$56,894	$0	$1,248	$0	$0
Chicken	Solid	LA	Large 1	MW	1	H	7.5	$56,177	$11,460	$5,873	$700	$10,500
Chicken	Solid	LA	Large 1	MW	1	L	7.5	$8,191	$0	$1,644	$560	$0

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Solid	LA	Large 1	MW	1	M	15	$32,960	$1,284	$2,024	$630	$1,176
Chicken	Solid	LA	Large 1	MW	2	H	45.7	$50,432	$1,272	$2,669	$21	$312
Chicken	Solid	LA	Large 1	MW	2	L	45.7	$8,191	$0	$1,644	$17	$0
Chicken	Solid	LA	Large 1	MW	2	M	91.4	$32,906	$142	$2,221	$19	$35
Chicken	Solid	LA	Large 1	MW	3	H	48.5	$49,756	$0	$2,511	$0	$0
Chicken	Solid	LA	Large 1	MW	3	L	48.5	$8,191	$0	$1,644	$0	$0
Chicken	Solid	LA	Large 1	MW	3	M	97	$32,772	$0	$2,202	$0	$0
Chicken	Solid	LA	Large 1	SO	1	H	3.3	$75,947	$13,083	$7,838	$808	$12,123
Chicken	Solid	LA	Large 1	SO	1	L	3.3	$16,382	$0	$1,644	$647	$0
Chicken	Solid	LA	Large 1	SO	1	M	6.7	$50,385	$0	$2,561	$727	$0
Chicken	Solid	LA	Large 1	SO	2	H	27.5	$67,066	$1,272	$2,899	$21	$312
Chicken	Solid	LA	Large 1	SO	2	L	27.5	$16,382	$0	$1,644	$17	$0
Chicken	Solid	LA	Large 1	SO	2	M	54.9	$49,497	$0	$2,379	$19	$0
Chicken	Solid	LA	Large 1	SO	3	H	28.1	$66,332	$0	$3,348	$0	$0
Chicken	Solid	LA	Large 1	SO	3	L	28.1	$16,382	$0	$1,644	$0	$0
Chicken	Solid	LA	Large 1	SO	3	M	56.1	$49,224	$0	$2,792	$0	$0
Chicken	Solid	LA	Large 2	MW	1	H	1.1	$163,914	$31,844	$14,903	$2,059	$30,884
Chicken	Solid	LA	Large 2	MW	1	L	1.1	$24,092	$0	$3,208	$1,647	$0
Chicken	Solid	LA	Large 2	MW	1	M	2.3	$96,679	$3,567	$3,849	$1,853	$3,459
Chicken	Solid	LA	Large 2	MW	2	H	7	$146,725	$1,362	$4,766	$27	$402
Chicken	Solid	LA	Large 2	MW	2	L	7	$24,092	$0	$3,208	$21	$0
Chicken	Solid	LA	Large 2	MW	2	M	13.9	$96,519	$153	$4,047	$24	$45
Chicken	Solid	LA	Large 2	MW	3	H	7.4	$145,999	$0	$5,095	$0	$0
Chicken	Solid	LA	Large 2	MW	3	L	7.4	$24,092	$0	$3,208	$0	$0
Chicken	Solid	LA	Large 2	MW	3	M	14.8	$96,385	$0	$4,393	$0	$0
Chicken	Solid	LA	Large 2	SO	1	H	0.3	$221,963	$36,616	$20,680	$2,377	$35,656
Chicken	Solid	LA	Large 2	SO	1	L	0.3	$48,185	$0	$3,208	$1,902	$0
Chicken	Solid	LA	Large 2	SO	1	M	0.7	$147,674	$0	$5,409	$2,139	$0

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Solid	LA	Large 2	SO	2	H	2.9	$195,457	$1,362	$5,067	$27	$402
Chicken	Solid	LA	Large 2	SO	2	L	2.9	$48,185	$0	$3,208	$21	$0
Chicken	Solid	LA	Large 2	SO	2	M	5.7	$145,023	$0	$4,250	$24	$0
Chicken	Solid	LA	Large 2	SO	3	H	2.9	$194,655	$0	$7,554	$0	$0
Chicken	Solid	LA	Large 2	SO	3	L	2.9	$48,185	$0	$3,208	$0	$0
Chicken	Solid	LA	Large 2	SO	3	M	5.9	$144,743	$0	$6,127	$0	$0
Chicken	Solid	LA	Medium 1	MW	1	H	0.4	$13,615	$2,210	$1,672	$84	$1,250
Chicken	Solid	LA	Medium 1	MW	1	L	0.4	$2,029	$0	$852	$67	$0
Chicken	Solid	LA	Medium 1	MW	1	M	0.7	$8,260	$247	$1,103	$75	$140
Chicken	Solid	LA	Medium 1	MW	2	H	1.1	$13,229	$1,526	$1,577	$38	$566
Chicken	Solid	LA	Medium 1	MW	2	L	1.1	$2,029	$0	$852	$30	$0
Chicken	Solid	LA	Medium 1	MW	2	M	2.2	$8,257	$171	$1,201	$34	$63
Chicken	Solid	LA	Medium 1	MW	3	H	0.6	$12,410	$0	$1,238	$0	$0
Chicken	Solid	LA	Medium 1	MW	3	L	0.6	$2,029	$0	$852	$0	$0
Chicken	Solid	LA	Medium 1	MW	3	M	1.2	$8,122	$0	$1,116	$0	$0
Chicken	Solid	LA	Medium 1	SO	1	H	0.3	$18,103	$2,379	$1,896	$95	$1,419
Chicken	Solid	LA	Medium 1	SO	1	L	0.3	$4,059	$0	$852	$76	$0
Chicken	Solid	LA	Medium 1	SO	1	M	0.5	$12,560	$0	$1,175	$85	$0
Chicken	Solid	LA	Medium 1	SO	2	H	1.2	$17,462	$1,526	$1,724	$38	$566
Chicken	Solid	LA	Medium 1	SO	2	L	1.2	$4,059	$0	$852	$30	$0
Chicken	Solid	LA	Medium 1	SO	2	M	2.4	$12,496	$0	$1,293	$34	$0
Chicken	Solid	LA	Medium 1	SO	3	H	0.6	$16,536	$0	$1,342	$0	$0
Chicken	Solid	LA	Medium 1	SO	3	L	0.6	$4,059	$0	$852	$0	$0
Chicken	Solid	LA	Medium 1	SO	3	M	1.2	$12,204	$0	$1,189	$0	$0
Chicken	Solid	LA	Medium 2	MW	1	H	0.1	$22,868	$3,187	$2,096	$149	$2,227
Chicken	Solid	LA	Medium 2	MW	1	L	0.1	$3,474	$0	$920	$119	$0
Chicken	Solid	LA	Medium 2	MW	1	M	0.3	$14,043	$357	$1,183	$134	$249
Chicken	Solid	LA	Medium 2	MW	2	H	0.5	$22,203	$2,008	$1,914	$70	$1,048

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Solid	LA	Medium 2	MW	2	L	0.5	$3,474	$0	$920	$56	$0
Chicken	Solid	LA	Medium 2	MW	2	M	1	$14,037	$225	$1,339	$63	$117
Chicken	Solid	LA	Medium 2	MW	3	H	0.4	$21,113	$0	$1,352	$0	$0
Chicken	Solid	LA	Medium 2	MW	3	L	0.4	$3,474	$0	$920	$0	$0
Chicken	Solid	LA	Medium 2	MW	3	M	0.9	$13,899	$0	$1,212	$0	$0
Chicken	Solid	LA	Medium 2	SO	1	H	0.1	$30,573	$3,530	$2,513	$172	$2,570
Chicken	Solid	LA	Medium 2	SO	1	L	0.1	$6,947	$0	$920	$137	$0
Chicken	Solid	LA	Medium 2	SO	1	M	0.2	$21,317	$0	$1,305	$154	$0
Chicken	Solid	LA	Medium 2	SO	2	H	0.5	$29,428	$2,008	$2,171	$70	$1,048
Chicken	Solid	LA	Medium 2	SO	2	L	0.5	$6,947	$0	$920	$56	$0
Chicken	Solid	LA	Medium 2	SO	2	M	0.9	$21,202	$0	$1,489	$63	$0
Chicken	Solid	LA	Medium 2	SO	3	H	0.4	$28,140	$0	$1,530	$0	$0
Chicken	Solid	LA	Medium 2	SO	3	L	0.4	$6,947	$0	$920	$0	$0
Chicken	Solid	LA	Medium 2	SO	3	M	0.8	$20,873	$0	$1,338	$0	$0
Chicken	Solid	LA	Medium 3	MW	1	H	0	$28,911	$3,793	$2,391	$189	$2,833
Chicken	Solid	LA	Medium 3	MW	1	L	0	$4,419	$0	$988	$151	$0
Chicken	Solid	LA	Medium 3	MW	1	M	0	$17,830	$425	$1,261	$170	$318
Chicken	Solid	LA	Medium 3	MW	2	H	0.1	$29,087	$4,106	$2,557	$210	$3,146
Chicken	Solid	LA	Medium 3	MW	2	L	0.1	$4,419	$0	$988	$168	$0
Chicken	Solid	LA	Medium 3	MW	2	M	0.2	$17,832	$460	$1,303	$189	$352
Chicken	Solid	LA	Medium 3	MW	3	H	0.1	$26,813	$0	$1,455	$0	$0
Chicken	Solid	LA	Medium 3	MW	3	L	0.1	$4,419	$0	$988	$0	$0
Chicken	Solid	LA	Medium 3	MW	3	M	0.2	$17,683	$0	$1,302	$0	$0
Chicken	Solid	LA	Medium 3	SO	1	H	0	$38,700	$4,230	$2,922	$218	$3,270
Chicken	Solid	LA	Medium 3	SO	1	L	0	$8,839	$0	$988	$175	$0
Chicken	Solid	LA	Medium 3	SO	1	M	0	$27,049	$0	$1,413	$196	$0
Chicken	Solid	LA	Medium 3	SO	2	H	0.1	$38,821	$4,392	$3,080	$229	$3,432
Chicken	Solid	LA	Medium 3	SO	2	L	0.1	$8,839	$0	$988	$183	$0

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Chicken	Solid	LA	Medium 3	SO	2	M	0.1	$27,061	$0	$1,480	$206	$0
Chicken	Solid	LA	Medium 3	SO	3	H	0.1	$35,741	$0	$1,682	$0	$0
Chicken	Solid	LA	Medium 3	SO	3	L	0.1	$8,839	$0	$988	$0	$0
Chicken	Solid	LA	Medium 3	SO	3	M	0.1	$26,552	$0	$1,460	$0	$0
Swine	Evapor	FF	Large 1	CE	1	H	4.3	$100,539	$2,085	$4,140	$75	$1,125
Swine	Evapor	FF	Large 1	CE	1	L	4.3	$107,538	$0	$3,966	$60	$0
Swine	Evapor	FF	Large 1	CE	1	M	8.6	$100,007	$1,172	$4,005	$67	$632
Swine	Evapor	FF	Large 1	CE	2	H	9.7	$134,195	$1,887	$6,796	$62	$927
Swine	Evapor	FF	Large 1	CE	2	L	9.7	$133,636	$0	$6,423	$49	$0
Swine	Evapor	FF	Large 1	CE	2	M	19.5	$133,669	$1,061	$6,665	$55	$522
Swine	Evapor	FF	Large 1	CE	3	H	5.5	$187,786	$0	$8,404	$0	$0
Swine	Evapor	FF	Large 1	CE	3	L	5.5	$187,755	$0	$8,050	$0	$0
Swine	Evapor	FF	Large 1	CE	3	M	11.1	$187,757	$0	$8,292	$0	$0
Swine	Evapor	FF	Large 2	CE	1	H	3.1	$235,910	$3,783	$8,004	$188	$2,823
Swine	Evapor	FF	Large 2	CE	1	L	3.1	$247,302	$0	$7,918	$151	$0
Swine	Evapor	FF	Large 2	CE	1	M	6.2	$235,327	$2,126	$7,838	$169	$1,586
Swine	Evapor	FF	Large 2	CE	2	H	7	$371,311	$3,736	$16,922	$185	$2,776
Swine	Evapor	FF	Large 2	CE	2	L	7	$370,696	$0	$16,515	$148	$0
Swine	Evapor	FF	Large 2	CE	2	M	14	$370,729	$2,099	$16,757	$166	$1,560
Swine	Evapor	FF	Large 2	CE	3	H	4	$1,197,059	$0	$47,546	$0	$0
Swine	Evapor	FF	Large 2	CE	3	L	4	$1,197,028	$0	$47,192	$0	$0
Swine	Evapor	FF	Large 2	CE	3	M	7.9	$1,197,030	$0	$47,434	$0	$0
Swine	Evapor	GF	Large 1	CE	1	H	4.4	$100,539	$2,085	$4,140	$75	$1,125
Swine	Evapor	GF	Large 1	CE	1	L	4.4	$107,538	$0	$3,966	$60	$0
Swine	Evapor	GF	Large 1	CE	1	M	8.9	$100,007	$1,172	$4,005	$67	$632
Swine	Evapor	GF	Large 1	CE	2	H	10	$134,195	$1,887	$6,796	$62	$927

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Evapor	GF	Large 1	CE	2	L	10	$133,636	$0	$6,423	$49	$0
Swine	Evapor	GF	Large 1	CE	2	M	20	$133,669	$1,061	$6,665	$55	$522
Swine	Evapor	GF	Large 1	CE	3	H	5.7	$187,786	$0	$8,404	$0	$0
Swine	Evapor	GF	Large 1	CE	3	L	5.7	$187,755	$0	$8,050	$0	$0
Swine	Evapor	GF	Large 1	CE	3	M	11.3	$187,757	$0	$8,292	$0	$0
Swine	Evapor	GF	Large 2	CE	1	H	3.2	$235,910	$3,783	$8,004	$188	$2,823
Swine	Evapor	GF	Large 2	CE	1	L	3.2	$247,302	$0	$7,918	$151	$0
Swine	Evapor	GF	Large 2	CE	1	M	6.3	$235,327	$2,126	$7,838	$169	$1,586
Swine	Evapor	GF	Large 2	CE	2	H	7.2	$371,311	$3,736	$16,922	$185	$2,776
Swine	Evapor	GF	Large 2	CE	2	L	7.2	$370,696	$0	$16,515	$148	$0
Swine	Evapor	GF	Large 2	CE	2	M	14.3	$370,729	$2,099	$16,757	$166	$1,560
Swine	Evapor	GF	Large 2	CE	3	H	4.1	$1,197,059	$0	$47,546	$0	$0
Swine	Evapor	GF	Large 2	CE	3	L	4.1	$1,197,028	$0	$47,192	$0	$0
Swine	Evapor	GF	Large 2	CE	3	M	8.1	$1,197,030	$0	$47,434	$0	$0
Swine	Liquid	FF	Large 1	MA	1	H	7.8	$164,523	$2,762	$4,563	$120	$1,802
Swine	Liquid	FF	Large 1	MA	1	L	7.8	$176,127	$0	$4,418	$96	$0
Swine	Liquid	FF	Large 1	MA	1	M	15.6	$163,583	$309	$4,409	$108	$202
Swine	Liquid	FF	Large 1	MA	2	H	45.6	$181,085	$1,650	$6,393	$46	$690
Swine	Liquid	FF	Large 1	MA	2	L	45.6	$179,733	$0	$5,980	$37	$0
Swine	Liquid	FF	Large 1	MA	2	M	91.2	$180,166	$185	$6,230	$42	$78
Swine	Liquid	FF	Large 1	MA	3	H	13.3	$248,250	$0	$7,655	$0	$0
Swine	Liquid	FF	Large 1	MA	3	L	13.3	$247,248	$0	$7,282	$0	$0
Swine	Liquid	FF	Large 1	MA	3	M	26.7	$247,736	$0	$7,533	$0	$0
Swine	Liquid	FF	Large 1	MW	1	H	26.9	$158,628	$2,329	$4,438	$92	$1,369
Swine	Liquid	FF	Large 1	MW	1	L	26.9	$166,877	$0	$4,233	$73	$0
Swine	Liquid	FF	Large 1	MW	1	M	53.8	$157,710	$1,309	$4,291	$82	$770

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Liquid	FF	Large 1	MW	2	H	26.8	$138,748	$2,170	$5,703	$81	$1,210
Swine	Liquid	FF	Large 1	MW	2	L	26.8	$137,493	$0	$5,311	$64	$0
Swine	Liquid	FF	Large 1	MW	2	M	53.7	$137,870	$1,219	$5,560	$73	$680
Swine	Liquid	FF	Large 1	MW	3	H	22.5	$251,878	$0	$7,740	$0	$0
Swine	Liquid	FF	Large 1	MW	3	L	22.5	$250,869	$0	$7,366	$0	$0
Swine	Liquid	FF	Large 1	MW	3	M	45	$251,359	$0	$7,618	$0	$0
Swine	Liquid	FF	Large 2	MA	1	H	5.6	$391,692	$5,954	$9,164	$333	$4,994
Swine	Liquid	FF	Large 2	MA	1	L	5.6	$411,461	$0	$9,125	$266	$0
Swine	Liquid	FF	Large 2	MA	1	M	11.2	$390,428	$667	$8,946	$300	$560
Swine	Liquid	FF	Large 2	MA	2	H	32.7	$456,725	$3,026	$14,958	$138	$2,066
Swine	Liquid	FF	Large 2	MA	2	L	32.7	$454,826	$0	$14,451	$110	$0
Swine	Liquid	FF	Large 2	MA	2	M	65.4	$455,512	$339	$14,706	$124	$232
Swine	Liquid	FF	Large 2	MA	3	H	9.6	$730,275	$0	$20,715	$0	$0
Swine	Liquid	FF	Large 2	MA	3	L	9.6	$728,553	$0	$20,328	$0	$0
Swine	Liquid	FF	Large 2	MA	3	M	19.1	$729,400	$0	$20,587	$0	$0
Swine	Liquid	FF	Large 2	MW	1	H	19.3	$302,695	$3,893	$7,347	$195	$2,933
Swine	Liquid	FF	Large 2	MW	1	L	19.3	$315,420	$0	$7,204	$157	$0
Swine	Liquid	FF	Large 2	MW	1	M	38.6	$301,570	$2,188	$7,169	$176	$1,648
Swine	Liquid	FF	Large 2	MW	2	H	19.2	$359,689	$4,766	$13,948	$254	$3,806
Swine	Liquid	FF	Large 2	MW	2	L	19.2	$357,890	$0	$13,499	$203	$0
Swine	Liquid	FF	Large 2	MW	2	M	38.5	$358,500	$2,679	$13,753	$228	$2,139
Swine	Liquid	FF	Large 2	MW	3	H	16.1	$814,154	$0	$22,948	$0	$0
Swine	Liquid	FF	Large 2	MW	3	L	16.1	$812,338	$0	$22,559	$0	$0
Swine	Liquid	FF	Large 2	MW	3	M	32.3	$813,233	$0	$22,818	$0	$0
Swine	Liquid	FF	Medium 1	MA	1	H	5.5	$66,343	$1,783	$2,833	$55	$823
Swine	Liquid	FF	Medium 1	MA	1	L	5.5	$71,584	$89	$2,742	$44	$41
Swine	Liquid	FF	Medium 1	MA	1	M	10.9	$66,343	$1,741	$2,735	$49	$804
Swine	Liquid	FF	Medium 1	MA	2	H	3.5	$55,893	$1,559	$3,177	$40	$599

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Liquid	FF	Medium 1	MA	2	L	3.5	$55,893	$78	$2,718	$32	$30
Swine	Liquid	FF	Medium 1	MA	2	M	7	$55,893	$1,524	$2,816	$36	$586
Swine	Liquid	FF	Medium 1	MA	3	H	2.1	$69,664	$0	$2,813	$0	$0
Swine	Liquid	FF	Medium 1	MA	3	L	2.1	$69,664	$0	$2,617	$0	$0
Swine	Liquid	FF	Medium 1	MA	3	M	4.2	$69,664	$0	$2,715	$0	$0
Swine	Liquid	FF	Medium 1	MW	1	H	41.1	$65,151	$1,511	$2,687	$37	$551
Swine	Liquid	FF	Medium 1	MW	1	L	41.1	$69,567	$906	$2,579	$30	$330
Swine	Liquid	FF	Medium 1	MW	1	M	82.2	$65,151	$1,490	$2,589	$33	$543
Swine	Liquid	FF	Medium 1	MW	2	H	7.4	$54,141	$1,585	$2,950	$42	$625
Swine	Liquid	FF	Medium 1	MW	2	L	7.4	$54,141	$951	$2,754	$34	$375
Swine	Liquid	FF	Medium 1	MW	2	M	14.7	$54,141	$1,563	$2,852	$37	$616
Swine	Liquid	FF	Medium 1	MW	3	H	6.8	$69,648	$0	$2,818	$0	$0
Swine	Liquid	FF	Medium 1	MW	3	L	6.8	$69,648	$0	$2,622	$0	$0
Swine	Liquid	FF	Medium 1	MW	3	M	13.6	$69,648	$0	$2,720	$0	$0
Swine	Liquid	FF	Medium 2	MA	1	H	2.2	$89,764	$2,130	$3,457	$78	$1,170
Swine	Liquid	FF	Medium 2	MA	1	L	2.2	$97,026	$106	$3,406	$63	$58
Swine	Liquid	FF	Medium 2	MA	1	M	4.4	$89,764	$2,081	$3,359	$70	$1,143
Swine	Liquid	FF	Medium 2	MA	2	H	3.9	$74,207	$1,469	$3,895	$34	$509
Swine	Liquid	FF	Medium 2	MA	2	L	3.9	$74,207	$73	$3,212	$27	$25
Swine	Liquid	FF	Medium 2	MA	2	M	7.8	$74,207	$1,435	$3,311	$31	$497
Swine	Liquid	FF	Medium 2	MA	3	H	1.7	$94,072	$0	$3,462	$0	$0
Swine	Liquid	FF	Medium 2	MA	3	L	1.7	$94,072	$0	$3,266	$0	$0
Swine	Liquid	FF	Medium 2	MA	3	M	3.5	$94,072	$0	$3,364	$0	$0
Swine	Liquid	FF	Medium 2	MW	1	H	15.1	$87,643	$1,766	$3,252	$54	$806
Swine	Liquid	FF	Medium 2	MW	1	L	15.1	$93,487	$1,060	$3,172	$43	$484
Swine	Liquid	FF	Medium 2	MW	1	M	30.3	$87,643	$1,742	$3,154	$48	$796
Swine	Liquid	FF	Medium 2	MW	2	H	5.5	$71,411	$1,834	$3,728	$58	$874
Swine	Liquid	FF	Medium 2	MW	2	L	5.5	$71,411	$1,100	$3,532	$47	$524

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Liquid	FF	Medium 2	MW	2	M	11.1	$71,411	$1,808	$3,630	$53	$861
Swine	Liquid	FF	Medium 2	MW	3	H	3.7	$96,235	$0	$3,527	$0	$0
Swine	Liquid	FF	Medium 2	MW	3	L	3.7	$96,235	$0	$3,331	$0	$0
Swine	Liquid	FF	Medium 2	MW	3	M	7.3	$96,235	$0	$3,429	$0	$0
Swine	Liquid	FF	Medium 3	MA	1	H	1.1	$115,948	$2,596	$4,189	$109	$1,636
Swine	Liquid	FF	Medium 3	MA	1	L	1.1	$124,408	$130	$4,162	$88	$82
Swine	Liquid	FF	Medium 3	MA	1	M	2.1	$115,948	$2,536	$4,091	$98	$1,598
Swine	Liquid	FF	Medium 3	MA	2	H	1.9	$94,301	$1,667	$4,791	$47	$707
Swine	Liquid	FF	Medium 3	MA	2	L	1.9	$94,301	$84	$3,920	$37	$36
Swine	Liquid	FF	Medium 3	MA	2	M	3.8	$94,301	$1,628	$4,019	$42	$690
Swine	Liquid	FF	Medium 3	MA	3	H	0.8	$121,641	$0	$4,197	$0	$0
Swine	Liquid	FF	Medium 3	MA	3	L	0.8	$121,641	$0	$4,001	$0	$0
Swine	Liquid	FF	Medium 3	MA	3	M	1.7	$121,641	$0	$4,099	$0	$0
Swine	Liquid	FF	Medium 3	MW	1	H	7.4	$115,361	$2,117	$3,963	$77	$1,157
Swine	Liquid	FF	Medium 3	MW	1	L	7.4	$122,248	$1,270	$3,904	$62	$694
Swine	Liquid	FF	Medium 3	MW	1	M	14.7	$115,361	$2,087	$3,865	$69	$1,141
Swine	Liquid	FF	Medium 3	MW	2	H	2.7	$90,485	$2,174	$4,562	$81	$1,214
Swine	Liquid	FF	Medium 3	MW	2	L	2.7	$90,485	$1,305	$4,366	$64	$729
Swine	Liquid	FF	Medium 3	MW	2	M	5.4	$90,485	$2,143	$4,464	$73	$1,197
Swine	Liquid	FF	Medium 3	MW	3	H	1.8	$124,615	$0	$4,286	$0	$0
Swine	Liquid	FF	Medium 3	MW	3	L	1.8	$124,615	$0	$4,090	$0	$0
Swine	Liquid	FF	Medium 3	MW	3	M	3.6	$124,615	$0	$4,188	$0	$0
Swine	Liquid	GF	Large 1	MA	1	H	6.6	$164,523	$2,762	$4,563	$120	$1,802
Swine	Liquid	GF	Large 1	MA	1	L	6.6	$176,127	$0	$4,418	$96	$0
Swine	Liquid	GF	Large 1	MA	1	M	13.1	$163,583	$309	$4,409	$108	$202
Swine	Liquid	GF	Large 1	MA	2	H	38.4	$181,085	$1,650	$6,393	$46	$690
Swine	Liquid	GF	Large 1	MA	2	L	38.4	$179,733	$0	$5,980	$37	$0
Swine	Liquid	GF	Large 1	MA	2	M	76.7	$180,166	$185	$6,230	$42	$78

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Liquid	GF	Large 1	MA	3	H	11.2	$248,250	$0	$7,655	$0	$0
Swine	Liquid	GF	Large 1	MA	3	L	11.2	$247,248	$0	$7,282	$0	$0
Swine	Liquid	GF	Large 1	MA	3	M	22.5	$247,736	$0	$7,533	$0	$0
Swine	Liquid	GF	Large 1	MW	1	H	18.5	$158,628	$2,329	$4,438	$92	$1,369
Swine	Liquid	GF	Large 1	MW	1	L	18.5	$166,877	$0	$4,233	$73	$0
Swine	Liquid	GF	Large 1	MW	1	M	37.1	$157,710	$1,309	$4,291	$82	$770
Swine	Liquid	GF	Large 1	MW	2	H	18.5	$138,748	$2,170	$5,703	$81	$1,210
Swine	Liquid	GF	Large 1	MW	2	L	18.5	$137,493	$0	$5,311	$64	$0
Swine	Liquid	GF	Large 1	MW	2	M	36.9	$137,870	$1,219	$5,560	$73	$680
Swine	Liquid	GF	Large 1	MW	3	H	15.5	$251,878	$0	$7,740	$0	$0
Swine	Liquid	GF	Large 1	MW	3	L	15.5	$250,869	$0	$7,366	$0	$0
Swine	Liquid	GF	Large 1	MW	3	M	31	$251,359	$0	$7,618	$0	$0
Swine	Liquid	GF	Large 2	MA	1	H	4.7	$391,692	$5,954	$9,164	$333	$4,994
Swine	Liquid	GF	Large 2	MA	1	L	4.7	$411,461	$0	$9,125	$266	$0
Swine	Liquid	GF	Large 2	MA	1	M	9.4	$390,428	$667	$8,946	$300	$560
Swine	Liquid	GF	Large 2	MA	2	H	27.5	$456,725	$3,026	$14,958	$138	$2,066
Swine	Liquid	GF	Large 2	MA	2	L	27.5	$454,826	$0	$14,451	$110	$0
Swine	Liquid	GF	Large 2	MA	2	M	55	$455,512	$339	$14,706	$124	$232
Swine	Liquid	GF	Large 2	MA	3	H	8.1	$730,275	$0	$20,715	$0	$0
Swine	Liquid	GF	Large 2	MA	3	L	8.1	$728,553	$0	$20,328	$0	$0
Swine	Liquid	GF	Large 2	MA	3	M	16.1	$729,400	$0	$20,587	$0	$0
Swine	Liquid	GF	Large 2	MW	1	H	13.3	$302,695	$3,893	$7,347	$195	$2,933
Swine	Liquid	GF	Large 2	MW	1	L	13.3	$315,420	$0	$7,204	$157	$0
Swine	Liquid	GF	Large 2	MW	1	M	26.6	$301,570	$2,188	$7,169	$176	$1,648
Swine	Liquid	GF	Large 2	MW	2	H	13.2	$359,689	$4,766	$13,948	$254	$3,806
Swine	Liquid	GF	Large 2	MW	2	L	13.2	$357,890	$0	$13,499	$203	$0
Swine	Liquid	GF	Large 2	MW	2	M	26.5	$358,500	$2,679	$13,753	$228	$2,139
Swine	Liquid	GF	Large 2	MW	3	H	11.1	$814,154	$0	$22,948	$0	$0

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Liquid	GF	Large 2	MW	3	L	11.1	$812,338	$0	$22,559	$0	$0
Swine	Liquid	GF	Large 2	MW	3	M	22.2	$813,233	$0	$22,818	$0	$0
Swine	Liquid	GF	Medium 1	MA	1	H	2.5	$66,343	$1,783	$2,833	$55	$823
Swine	Liquid	GF	Medium 1	MA	1	L	2.5	$71,584	$89	$2,742	$44	$41
Swine	Liquid	GF	Medium 1	MA	1	M	5.1	$66,343	$1,741	$2,735	$49	$804
Swine	Liquid	GF	Medium 1	MA	2	H	1.6	$55,893	$1,559	$3,168	$40	$599
Swine	Liquid	GF	Medium 1	MA	2	L	1.6	$55,893	$78	$2,718	$32	$30
Swine	Liquid	GF	Medium 1	MA	2	M	3.2	$55,893	$1,524	$2,816	$36	$586
Swine	Liquid	GF	Medium 1	MA	3	H	1	$69,664	$0	$2,813	$0	$0
Swine	Liquid	GF	Medium 1	MA	3	L	1	$69,664	$0	$2,617	$0	$0
Swine	Liquid	GF	Medium 1	MA	3	M	1.9	$69,664	$0	$2,715	$0	$0
Swine	Liquid	GF	Medium 1	MW	1	H	15.8	$65,151	$1,511	$2,687	$37	$551
Swine	Liquid	GF	Medium 1	MW	1	L	15.8	$69,567	$906	$2,579	$30	$330
Swine	Liquid	GF	Medium 1	MW	1	M	31.7	$65,151	$1,490	$2,589	$33	$543
Swine	Liquid	GF	Medium 1	MW	2	H	2.8	$54,141	$1,585	$3,084	$42	$625
Swine	Liquid	GF	Medium 1	MW	2	L	2.8	$54,141	$951	$2,888	$34	$375
Swine	Liquid	GF	Medium 1	MW	2	M	5.7	$54,141	$1,563	$2,986	$37	$616
Swine	Liquid	GF	Medium 1	MW	3	H	2.6	$69,648	$0	$2,818	$0	$0
Swine	Liquid	GF	Medium 1	MW	3	L	2.6	$69,648	$0	$2,622	$0	$0
Swine	Liquid	GF	Medium 1	MW	3	M	5.2	$69,648	$0	$2,720	$0	$0
Swine	Liquid	GF	Medium 2	MA	1	H	1.3	$89,764	$2,130	$3,457	$78	$1,170
Swine	Liquid	GF	Medium 2	MA	1	L	1.3	$97,026	$106	$3,406	$63	$58
Swine	Liquid	GF	Medium 2	MA	1	M	2.6	$89,764	$2,081	$3,359	$70	$1,143
Swine	Liquid	GF	Medium 2	MA	2	H	2.3	$74,207	$1,469	$3,877	$34	$509
Swine	Liquid	GF	Medium 2	MA	2	L	2.3	$74,207	$73	$3,212	$27	$25
Swine	Liquid	GF	Medium 2	MA	2	M	4.6	$74,207	$1,435	$3,310	$31	$497
Swine	Liquid	GF	Medium 2	MA	3	H	1	$94,072	$0	$3,462	$0	$0
Swine	Liquid	GF	Medium 2	MA	3	L	1	$94,072	$0	$3,266	$0	$0

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Liquid	GF	Medium 2	MA	3	M	2.1	$94,072	$0	$3,364	$0	$0
Swine	Liquid	GF	Medium 2	MW	1	H	7.4	$87,643	$1,766	$3,252	$54	$806
Swine	Liquid	GF	Medium 2	MW	1	L	7.4	$93,487	$1,060	$3,172	$43	$484
Swine	Liquid	GF	Medium 2	MW	1	M	14.9	$87,643	$1,742	$3,154	$48	$796
Swine	Liquid	GF	Medium 2	MW	2	H	2.7	$71,411	$1,834	$3,931	$58	$874
Swine	Liquid	GF	Medium 2	MW	2	L	2.7	$71,411	$1,100	$3,735	$47	$524
Swine	Liquid	GF	Medium 2	MW	2	M	5.4	$71,411	$1,808	$3,833	$53	$861
Swine	Liquid	GF	Medium 2	MW	3	H	1.8	$96,235	$0	$3,527	$0	$0
Swine	Liquid	GF	Medium 2	MW	3	L	1.8	$96,235	$0	$3,331	$0	$0
Swine	Liquid	GF	Medium 2	MW	3	M	3.6	$96,235	$0	$3,429	$0	$0
Swine	Liquid	GF	Medium 3	MA	1	H	0.8	$115,948	$2,596	$4,189	$109	$1,636
Swine	Liquid	GF	Medium 3	MA	1	L	0.8	$124,408	$130	$4,162	$88	$82
Swine	Liquid	GF	Medium 3	MA	1	M	1.5	$115,948	$2,536	$4,091	$98	$1,598
Swine	Liquid	GF	Medium 3	MA	2	H	1.4	$94,301	$1,667	$4,767	$47	$707
Swine	Liquid	GF	Medium 3	MA	2	L	1.4	$94,301	$84	$3,920	$37	$36
Swine	Liquid	GF	Medium 3	MA	2	M	2.8	$94,301	$1,628	$4,018	$42	$690
Swine	Liquid	GF	Medium 3	MA	3	H	0.6	$121,641	$0	$4,197	$0	$0
Swine	Liquid	GF	Medium 3	MA	3	L	0.6	$121,641	$0	$4,001	$0	$0
Swine	Liquid	GF	Medium 3	MA	3	M	1.2	$121,641	$0	$4,099	$0	$0
Swine	Liquid	GF	Medium 3	MW	1	H	4.4	$115,361	$2,117	$3,963	$77	$1,157
Swine	Liquid	GF	Medium 3	MW	1	L	4.4	$122,248	$1,270	$3,904	$62	$694
Swine	Liquid	GF	Medium 3	MW	1	M	8.8	$115,361	$2,087	$3,865	$69	$1,141
Swine	Liquid	GF	Medium 3	MW	2	H	1.6	$90,485	$2,174	$4,844	$81	$1,214
Swine	Liquid	GF	Medium 3	MW	2	L	1.6	$90,485	$1,305	$4,648	$64	$729
Swine	Liquid	GF	Medium 3	MW	2	M	3.2	$90,485	$2,143	$4,746	$73	$1,197
Swine	Liquid	GF	Medium 3	MW	3	H	1.1	$124,615	$0	$4,286	$0	$0
Swine	Liquid	GF	Medium 3	MW	3	L	1.1	$124,615	$0	$4,090	$0	$0
Swine	Liquid	GF	Medium 3	MW	3	M	2.1	$124,615	$0	$4,188	$0	$0

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Pit	FF	Large 1	MA	1	H	2.5	$39,795	$2,259	$2,060	$86	$1,299
Swine	Pit	FF	Large 1	MA	1	L	2.5	$39,226	$0	$1,681	$69	$0
Swine	Pit	FF	Large 1	MA	1	M	4.9	$39,258	$253	$1,923	$78	$146
Swine	Pit	FF	Large 1	MA	2	H	14.3	$46,494	$1,650	$13,274	$46	$690
Swine	Pit	FF	Large 1	MA	2	L	14.3	$45,944	$0	$12,888	$37	$0
Swine	Pit	FF	Large 1	MA	2	M	28.6	$45,977	$185	$13,130	$42	$78
Swine	Pit	FF	Large 1	MA	3	H	4.2	$30	$0	$30,027	$0	$0
Swine	Pit	FF	Large 1	MA	3	L	4.2	$0	$0	$29,673	$0	$0
Swine	Pit	FF	Large 1	MA	3	M	8.4	$2	$0	$29,915	$0	$0
Swine	Pit	FF	Large 1	MW	1	H	34.8	$39,286	$2,110	$2,047	$77	$1,150
Swine	Pit	FF	Large 1	MW	1	L	34.8	$38,722	$0	$1,671	$62	$0
Swine	Pit	FF	Large 1	MW	1	M	69.6	$38,755	$1,186	$1,913	$69	$646
Swine	Pit	FF	Large 1	MW	2	H	34.7	$41,303	$2,166	$8,161	$80	$1,206
Swine	Pit	FF	Large 1	MW	2	L	34.7	$40,737	$0	$7,783	$64	$0
Swine	Pit	FF	Large 1	MW	2	M	69.4	$40,770	$1,217	$8,025	$73	$678
Swine	Pit	FF	Large 1	MW	3	H	29.1	$30	$0	$12,095	$0	$0
Swine	Pit	FF	Large 1	MW	3	L	29.1	$0	$0	$11,741	$0	$0
Swine	Pit	FF	Large 1	MW	3	M	58.2	$2	$0	$11,983	$0	$0
Swine	Pit	FF	Large 2	MA	1	H	1.8	$59,662	$4,473	$2,497	$235	$3,513
Swine	Pit	FF	Large 2	MA	1	L	1.8	$59,027	$0	$2,077	$187	$0
Swine	Pit	FF	Large 2	MA	1	M	3.5	$59,060	$501	$2,319	$211	$393
Swine	Pit	FF	Large 2	MA	2	H	10.3	$81,166	$3,026	$36,101	$138	$2,066
Swine	Pit	FF	Large 2	MA	2	L	10.3	$80,574	$0	$35,655	$110	$0
Swine	Pit	FF	Large 2	MA	2	M	20.5	$80,607	$339	$35,897	$124	$232
Swine	Pit	FF	Large 2	MA	3	H	3	$30	$0	$98,409	$0	$0
Swine	Pit	FF	Large 2	MA	3	L	3	$0	$0	$98,055	$0	$0
Swine	Pit	FF	Large 2	MA	3	M	6	$2	$0	$98,297	$0	$0
Swine	Pit	FF	Large 2	MW	1	H	25	$51,818	$3,375	$2,320	$161	$2,415

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Pit	FF	Large 2	MW	1	L	25	$51,215	$0	$1,920	$129	$0
Swine	Pit	FF	Large 2	MW	1	M	50	$51,248	$1,897	$2,162	$145	$1,357
Swine	Pit	FF	Large 2	MW	2	H	24.9	$68,936	$4,752	$8,875	$253	$3,792
Swine	Pit	FF	Large 2	MW	2	L	24.9	$68,292	$0	$8,449	$203	$0
Swine	Pit	FF	Large 2	MW	2	M	49.8	$68,325	$2,671	$8,691	$227	$2,131
Swine	Pit	FF	Large 2	MW	3	H	20.9	$30	$0	$41,710	$0	$0
Swine	Pit	FF	Large 2	MW	3	L	20.9	$0	$0	$41,356	$0	$0
Swine	Pit	FF	Large 2	MW	3	M	41.7	$2	$0	$41,598	$0	$0
Swine	Pit	FF	Medium 1	MA	1	H	0.9	$18,230	$1,670	$1,821	$47	$710
Swine	Pit	FF	Medium 1	MA	1	L	0.9	$18,230	$84	$1,625	$38	$36
Swine	Pit	FF	Medium 1	MA	1	M	1.8	$18,230	$1,631	$1,723	$42	$693
Swine	Pit	FF	Medium 1	MA	2	H	0.6	$18,532	$1,559	$3,879	$40	$599
Swine	Pit	FF	Medium 1	MA	2	L	0.6	$18,532	$78	$3,683	$32	$30
Swine	Pit	FF	Medium 1	MA	2	M	1.2	$18,532	$1,524	$3,781	$36	$586
Swine	Pit	FF	Medium 1	MA	3	H	0.4	$30	$0	$7,301	$0	$0
Swine	Pit	FF	Medium 1	MA	3	L	0.4	$30	$0	$7,105	$0	$0
Swine	Pit	FF	Medium 1	MA	3	M	0.7	$30	$0	$7,203	$0	$0
Swine	Pit	FF	Medium 1	MW	1	H	50	$17,987	$1,453	$1,720	$33	$493
Swine	Pit	FF	Medium 1	MW	1	L	50	$17,987	$872	$1,524	$27	$296
Swine	Pit	FF	Medium 1	MW	1	M	100	$17,987	$1,433	$1,622	$30	$487
Swine	Pit	FF	Medium 1	MW	2	H	9	$18,345	$1,585	$2,188	$42	$625
Swine	Pit	FF	Medium 1	MW	2	L	9	$18,345	$951	$1,992	$34	$375
Swine	Pit	FF	Medium 1	MW	2	M	17.9	$18,345	$1,563	$2,090	$37	$616
Swine	Pit	FF	Medium 1	MW	3	H	8.3	$30	$0	$3,463	$0	$0
Swine	Pit	FF	Medium 1	MW	3	L	8.3	$30	$0	$3,267	$0	$0
Swine	Pit	FF	Medium 1	MW	3	M	16.5	$30	$0	$3,365	$0	$0
Swine	Pit	FF	Medium 2	MA	1	H	0.4	$20,346	$1,933	$1,981	$65	$973
Swine	Pit	FF	Medium 2	MA	1	L	0.4	$20,346	$97	$1,785	$52	$49

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Pit	FF	Medium 2	MA	1	M	0.7	$20,346	$1,889	$1,883	$58	$951
Swine	Pit	FF	Medium 2	MA	2	H	0.7	$20,623	$1,469	$5,542	$34	$509
Swine	Pit	FF	Medium 2	MA	2	L	0.7	$20,623	$73	$5,212	$27	$25
Swine	Pit	FF	Medium 2	MA	2	M	1.3	$20,623	$1,435	$5,310	$31	$497
Swine	Pit	FF	Medium 2	MA	3	H	0.3	$30	$0	$10,521	$0	$0
Swine	Pit	FF	Medium 2	MA	3	L	0.3	$30	$0	$10,325	$0	$0
Swine	Pit	FF	Medium 2	MA	3	M	0.6	$30	$0	$10,423	$0	$0
Swine	Pit	FF	Medium 2	MW	1	H	18.4	$19,995	$1,671	$1,857	$47	$711
Swine	Pit	FF	Medium 2	MW	1	L	18.4	$19,995	$1,003	$1,661	$38	$427
Swine	Pit	FF	Medium 2	MW	1	M	36.9	$19,995	$1,648	$1,759	$43	$701
Swine	Pit	FF	Medium 2	MW	2	H	6.7	$20,531	$1,832	$2,549	$58	$872
Swine	Pit	FF	Medium 2	MW	2	L	6.7	$20,531	$1,099	$2,353	$46	$523
Swine	Pit	FF	Medium 2	MW	2	M	13.5	$20,531	$1,806	$2,451	$53	$859
Swine	Pit	FF	Medium 2	MW	3	H	4.5	$30	$0	$4,782	$0	$0
Swine	Pit	FF	Medium 2	MW	3	L	4.5	$30	$0	$4,586	$0	$0
Swine	Pit	FF	Medium 2	MW	3	M	8.9	$30	$0	$4,684	$0	$0
Swine	Pit	FF	Medium 3	MA	1	H	0.2	$22,814	$2,322	$2,204	$91	$1,362
Swine	Pit	FF	Medium 3	MA	1	L	0.2	$22,814	$116	$2,008	$73	$68
Swine	Pit	FF	Medium 3	MA	1	M	0.4	$22,814	$2,269	$2,106	$82	$1,331
Swine	Pit	FF	Medium 3	MA	2	H	0.3	$23,159	$1,667	$7,146	$47	$707
Swine	Pit	FF	Medium 3	MA	2	L	0.3	$23,159	$84	$6,763	$37	$36
Swine	Pit	FF	Medium 3	MA	2	M	0.6	$23,159	$1,628	$6,861	$42	$690
Swine	Pit	FF	Medium 3	MA	3	H	0.1	$30	$0	$14,190	$0	$0
Swine	Pit	FF	Medium 3	MA	3	L	0.1	$30	$0	$13,994	$0	$0
Swine	Pit	FF	Medium 3	MA	3	M	0.3	$30	$0	$14,092	$0	$0
Swine	Pit	FF	Medium 3	MW	1	H	9	$22,539	$1,981	$2,047	$68	$1,021
Swine	Pit	FF	Medium 3	MW	1	L	9	$22,539	$1,189	$1,851	$54	$613
Swine	Pit	FF	Medium 3	MW	1	M	17.9	$22,539	$1,954	$1,949	$61	$1,007

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Pit	FF	Medium 3	MW	2	H	3.3	$23,032	$2,171	$2,987	$81	$1,211
Swine	Pit	FF	Medium 3	MW	2	L	3.3	$23,032	$1,302	$2,791	$64	$726
Swine	Pit	FF	Medium 3	MW	2	M	6.6	$23,032	$2,140	$2,889	$73	$1,194
Swine	Pit	FF	Medium 3	MW	3	H	2.2	$30	$0	$6,216	$0	$0
Swine	Pit	FF	Medium 3	MW	3	L	2.2	$30	$0	$6,020	$0	$0
Swine	Pit	FF	Medium 3	MW	3	M	4.3	$30	$0	$6,118	$0	$0
Swine	Pit	GF	Large 1	MA	1	H	3.9	$39,795	$2,259	$2,060	$86	$1,299
Swine	Pit	GF	Large 1	MA	1	L	3.9	$39,226	$0	$1,681	$69	$0
Swine	Pit	GF	Large 1	MA	1	M	7.9	$39,258	$253	$1,923	$78	$146
Swine	Pit	GF	Large 1	MA	2	H	23	$46,494	$1,650	$16,668	$46	$690
Swine	Pit	GF	Large 1	MA	2	L	23	$45,944	$0	$16,281	$37	$0
Swine	Pit	GF	Large 1	MA	2	M	46	$45,977	$185	$16,523	$42	$78
Swine	Pit	GF	Large 1	MA	3	H	6.7	$30	$0	$30,027	$0	$0
Swine	Pit	GF	Large 1	MA	3	L	6.7	$0	$0	$29,673	$0	$0
Swine	Pit	GF	Large 1	MA	3	M	13.5	$2	$0	$29,915	$0	$0
Swine	Pit	GF	Large 1	MW	1	H	44.7	$39,286	$2,110	$2,047	$77	$1,150
Swine	Pit	GF	Large 1	MW	1	L	44.7	$38,722	$0	$1,671	$62	$0
Swine	Pit	GF	Large 1	MW	1	M	89.4	$38,755	$1,186	$1,913	$69	$646
Swine	Pit	GF	Large 1	MW	2	H	44.6	$41,303	$2,166	$9,939	$80	$1,206
Swine	Pit	GF	Large 1	MW	2	L	44.6	$40,737	$0	$9,560	$64	$0
Swine	Pit	GF	Large 1	MW	2	M	89.1	$40,770	$1,217	$9,802	$73	$678
Swine	Pit	GF	Large 1	MW	3	H	37.4	$30	$0	$12,095	$0	$0
Swine	Pit	GF	Large 1	MW	3	L	37.4	$0	$0	$11,741	$0	$0
Swine	Pit	GF	Large 1	MW	3	M	74.7	$2	$0	$11,983	$0	$0
Swine	Pit	GF	Large 2	MA	1	H	2.8	$59,662	$4,473	$2,497	$235	$3,513
Swine	Pit	GF	Large 2	MA	1	L	2.8	$59,027	$0	$2,077	$187	$0
Swine	Pit	GF	Large 2	MA	1	M	5.7	$59,060	$501	$2,319	$211	$393
Swine	Pit	GF	Large 2	MA	2	H	16.5	$81,166	$3,026	$46,259	$138	$2,066

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Pit	GF	Large 2	MA	2	L	16.5	$80,574	$0	$45,813	$110	$0
Swine	Pit	GF	Large 2	MA	2	M	33	$80,607	$339	$46,055	$124	$232
Swine	Pit	GF	Large 2	MA	3	H	4.8	$30	$0	$98,409	$0	$0
Swine	Pit	GF	Large 2	MA	3	L	4.8	$0	$0	$98,055	$0	$0
Swine	Pit	GF	Large 2	MA	3	M	9.7	$2	$0	$98,297	$0	$0
Swine	Pit	GF	Large 2	MW	1	H	32.1	$51,818	$3,375	$2,320	$161	$2,415
Swine	Pit	GF	Large 2	MW	1	L	32.1	$51,215	$0	$1,920	$129	$0
Swine	Pit	GF	Large 2	MW	1	M	64.1	$51,248	$1,897	$2,162	$145	$1,357
Swine	Pit	GF	Large 2	MW	2	H	32	$68,936	$4,752	$10,152	$253	$3,792
Swine	Pit	GF	Large 2	MW	2	L	32	$68,292	$0	$9,726	$203	$0
Swine	Pit	GF	Large 2	MW	2	M	63.9	$68,325	$2,671	$9,968	$227	$2,131
Swine	Pit	GF	Large 2	MW	3	H	26.8	$30	$0	$41,710	$0	$0
Swine	Pit	GF	Large 2	MW	3	L	26.8	$0	$0	$41,356	$0	$0
Swine	Pit	GF	Large 2	MW	3	M	53.6	$2	$0	$41,598	$0	$0
Swine	Pit	GF	Medium 1	MA	1	H	0.9	$18,230	$1,670	$1,821	$47	$710
Swine	Pit	GF	Medium 1	MA	1	L	0.9	$18,230	$84	$1,625	$38	$36
Swine	Pit	GF	Medium 1	MA	1	M	1.8	$18,230	$1,631	$1,723	$42	$693
Swine	Pit	GF	Medium 1	MA	2	H	0.6	$18,532	$1,559	$4,501	$40	$599
Swine	Pit	GF	Medium 1	MA	2	L	0.6	$18,532	$78	$4,305	$32	$30
Swine	Pit	GF	Medium 1	MA	2	M	1.2	$18,532	$1,524	$4,403	$36	$586
Swine	Pit	GF	Medium 1	MA	3	H	0.3	$30	$0	$7,301	$0	$0
Swine	Pit	GF	Medium 1	MA	3	L	0.3	$30	$0	$7,105	$0	$0
Swine	Pit	GF	Medium 1	MA	3	M	0.7	$30	$0	$7,203	$0	$0
Swine	Pit	GF	Medium 1	MW	1	H	33.2	$17,987	$1,453	$1,720	$33	$493
Swine	Pit	GF	Medium 1	MW	1	L	33.2	$17,987	$872	$1,524	$27	$296
Swine	Pit	GF	Medium 1	MW	1	M	66.4	$17,987	$1,433	$1,622	$30	$487
Swine	Pit	GF	Medium 1	MW	2	H	6	$18,345	$1,585	$2,323	$42	$625
Swine	Pit	GF	Medium 1	MW	2	L	6	$18,345	$951	$2,127	$34	$375

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Pit	GF	Medium 1	MW	2	M	11.9	$18,345	$1,563	$2,225	$37	$616
Swine	Pit	GF	Medium 1	MW	3	H	5.5	$30	$0	$3,463	$0	$0
Swine	Pit	GF	Medium 1	MW	3	L	5.5	$30	$0	$3,267	$0	$0
Swine	Pit	GF	Medium 1	MW	3	M	11	$30	$0	$3,365	$0	$0
Swine	Pit	GF	Medium 2	MA	1	H	0.5	$20,346	$1,933	$1,981	$65	$973
Swine	Pit	GF	Medium 2	MA	1	L	0.5	$20,346	$97	$1,785	$52	$49
Swine	Pit	GF	Medium 2	MA	1	M	0.9	$20,346	$1,889	$1,883	$58	$951
Swine	Pit	GF	Medium 2	MA	2	H	0.8	$20,623	$1,469	$6,636	$34	$509
Swine	Pit	GF	Medium 2	MA	2	L	0.8	$20,623	$73	$6,310	$27	$25
Swine	Pit	GF	Medium 2	MA	2	M	1.7	$20,623	$1,435	$6,408	$31	$497
Swine	Pit	GF	Medium 2	MA	3	H	0.4	$30	$0	$10,521	$0	$0
Swine	Pit	GF	Medium 2	MA	3	L	0.4	$30	$0	$10,325	$0	$0
Swine	Pit	GF	Medium 2	MA	3	M	0.7	$30	$0	$10,423	$0	$0
Swine	Pit	GF	Medium 2	MW	1	H	15.6	$19,995	$1,671	$1,857	$47	$711
Swine	Pit	GF	Medium 2	MW	1	L	15.6	$19,995	$1,003	$1,661	$38	$427
Swine	Pit	GF	Medium 2	MW	1	M	31.2	$19,995	$1,648	$1,759	$43	$701
Swine	Pit	GF	Medium 2	MW	2	H	5.7	$20,531	$1,832	$2,751	$58	$872
Swine	Pit	GF	Medium 2	MW	2	L	5.7	$20,531	$1,099	$2,555	$46	$523
Swine	Pit	GF	Medium 2	MW	2	M	11.4	$20,531	$1,806	$2,653	$53	$859
Swine	Pit	GF	Medium 2	MW	3	H	3.8	$30	$0	$4,782	$0	$0
Swine	Pit	GF	Medium 2	MW	3	L	3.8	$30	$0	$4,586	$0	$0
Swine	Pit	GF	Medium 2	MW	3	M	7.6	$30	$0	$4,684	$0	$0
Swine	Pit	GF	Medium 3	MA	1	H	0.3	$22,814	$2,322	$2,204	$91	$1,362
Swine	Pit	GF	Medium 3	MA	1	L	0.3	$22,814	$116	$2,008	$73	$68
Swine	Pit	GF	Medium 3	MA	1	M	0.5	$22,814	$2,269	$2,106	$82	$1,331
Swine	Pit	GF	Medium 3	MA	2	H	0.5	$23,159	$1,667	$8,664	$47	$707
Swine	Pit	GF	Medium 3	MA	2	L	0.5	$23,159	$84	$8,288	$37	$36
Swine	Pit	GF	Medium 3	MA	2	M	1	$23,159	$1,628	$8,386	$42	$690

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Swine	Pit	GF	Medium 3	MA	3	H	0.2	$30	$0	$14,190	$0	$0
Swine	Pit	GF	Medium 3	MA	3	L	0.2	$30	$0	$13,994	$0	$0
Swine	Pit	GF	Medium 3	MA	3	M	0.4	$30	$0	$14,092	$0	$0
Swine	Pit	GF	Medium 3	MW	1	H	9.3	$22,539	$1,981	$2,047	$68	$1,021
Swine	Pit	GF	Medium 3	MW	1	L	9.3	$22,539	$1,189	$1,851	$54	$613
Swine	Pit	GF	Medium 3	MW	1	M	18.5	$22,539	$1,954	$1,949	$61	$1,007
Swine	Pit	GF	Medium 3	MW	2	H	3.4	$23,032	$2,171	$3,268	$81	$1,211
Swine	Pit	GF	Medium 3	MW	2	L	3.4	$23,032	$1,302	$3,072	$64	$726
Swine	Pit	GF	Medium 3	MW	2	M	6.8	$23,032	$2,140	$3,170	$73	$1,194
Swine	Pit	GF	Medium 3	MW	3	H	2.2	$30	$0	$6,216	$0	$0
Swine	Pit	GF	Medium 3	MW	3	L	2.2	$30	$0	$6,020	$0	$0
Swine	Pit	GF	Medium 3	MW	3	M	4.5	$30	$0	$6,118	$0	$0
Turkey	Solid	SL	Large 1	MA	1	H	1.2	$151,930	$7,127	$5,851	$411	$6,167
Turkey	Solid	SL	Large 1	MA	1	L	1.2	$20,456	$6,770	$5,285	$329	$5,858
Turkey	Solid	SL	Large 1	MA	1	M	2.4	$78,903	$7,120	$5,569	$370	$6,161
Turkey	Solid	SL	Large 1	MA	2	H	23.8	$148,939	$3,147	$19,105	$146	$2,187
Turkey	Solid	SL	Large 1	MA	2	L	23.8	$17,465	$2,990	$3,448	$117	$2,078
Turkey	Solid	SL	Large 1	MA	2	M	47.6	$75,912	$3,144	$10,372	$131	$2,185
Turkey	Solid	SL	Large 1	MA	3	H	15.8	$146,794	$0	$14,657	$0	$0
Turkey	Solid	SL	Large 1	MA	3	L	15.8	$15,345	$0	$2,400	$0	$0
Turkey	Solid	SL	Large 1	MA	3	M	31.5	$73,768	$0	$7,827	$0	$0
Turkey	Solid	SL	Large 1	MW	1	H	1.7	$151,140	$6,076	$5,366	$341	$5,116
Turkey	Solid	SL	Large 1	MW	1	L	1.7	$19,481	$6,076	$4,786	$273	$5,116
Turkey	Solid	SL	Large 1	MW	1	M	3.4	$78,113	$6,076	$5,084	$307	$5,116
Turkey	Solid	SL	Large 1	MW	2	H	32.8	$148,939	$3,147	$10,028	$146	$2,187
Turkey	Solid	SL	Large 1	MW	2	L	32.8	$17,279	$3,147	$3,434	$117	$2,187
Turkey	Solid	SL	Large 1	MW	2	M	65.6	$75,911	$3,147	$6,378	$131	$2,187
Turkey	Solid	SL	Large 1	MW	3	H	21.7	$146,794	$0	$4,601	$0	$0

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Turkey	Solid	SL	Large 1	MW	3	L	21.7	$15,334	$0	$2,400	$0	$0
Turkey	Solid	SL	Large 1	MW	3	M	43.5	$73,767	$0	$3,403	$0	$0
Turkey	Solid	SL	Medium 1	MA	1	H	0.2	$28,009	$3,202	$2,446	$150	$2,242
Turkey	Solid	SL	Medium 1	MA	1	L	0.2	$5,050	$3,170	$2,199	$119	$2,220
Turkey	Solid	SL	Medium 1	MA	1	M	0.5	$15,256	$3,193	$2,322	$135	$2,236
Turkey	Solid	SL	Medium 1	MA	2	H	1.6	$26,968	$1,816	$4,086	$57	$856
Turkey	Solid	SL	Medium 1	MA	2	L	1.6	$4,008	$1,798	$1,558	$46	$848
Turkey	Solid	SL	Medium 1	MA	2	M	3.3	$14,214	$1,811	$2,730	$51	$854
Turkey	Solid	SL	Medium 1	MA	3	H	0.8	$25,824	$0	$3,412	$0	$0
Turkey	Solid	SL	Medium 1	MA	3	L	0.8	$2,870	$0	$1,124	$0	$0
Turkey	Solid	SL	Medium 1	MA	3	M	1.7	$13,071	$0	$2,145	$0	$0
Turkey	Solid	SL	Medium 1	MW	1	H	0.2	$28,199	$3,454	$2,562	$167	$2,494
Turkey	Solid	SL	Medium 1	MW	1	L	0.2	$4,715	$3,454	$2,275	$133	$2,494
Turkey	Solid	SL	Medium 1	MW	1	M	0.4	$15,306	$3,454	$2,428	$150	$2,494
Turkey	Solid	SL	Medium 1	MW	2	H	1.4	$26,968	$1,816	$2,694	$57	$856
Turkey	Solid	SL	Medium 1	MW	2	L	1.4	$3,484	$1,816	$1,519	$46	$856
Turkey	Solid	SL	Medium 1	MW	2	M	2.8	$14,074	$1,816	$2,063	$51	$856
Turkey	Solid	SL	Medium 1	MW	3	H	0.7	$25,824	$0	$1,657	$0	$0
Turkey	Solid	SL	Medium 1	MW	3	L	0.7	$2,840	$0	$1,124	$0	$0
Turkey	Solid	SL	Medium 1	MW	3	M	1.4	$13,064	$0	$1,373	$0	$0
Turkey	Solid	SL	Medium 2	MA	1	H	0.1	$43,207	$4,451	$3,194	$233	$3,491
Turkey	Solid	SL	Medium 2	MA	1	L	0.1	$7,460	$4,407	$2,913	$186	$3,456
Turkey	Solid	SL	Medium 2	MA	1	M	0.1	$23,349	$4,438	$3,053	$210	$3,481
Turkey	Solid	SL	Medium 2	MA	2	H	0.9	$41,256	$1,856	$5,846	$60	$896
Turkey	Solid	SL	Medium 2	MA	2	L	0.9	$5,509	$1,837	$1,714	$48	$887
Turkey	Solid	SL	Medium 2	MA	2	M	1.9	$21,398	$1,851	$3,549	$54	$894
Turkey	Solid	SL	Medium 2	MA	3	H	0.5	$40,082	$0	$4,720	$0	$0
Turkey	Solid	SL	Medium 2	MA	3	L	0.5	$4,340	$0	$1,261	$0	$0

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Turkey	Solid	SL	Medium 2	MA	3	M	0.9	$20,226	$0	$2,800	$0	$0
Turkey	Solid	SL	Medium 2	MW	1	H	0	$43,503	$4,844	$3,375	$259	$3,884
Turkey	Solid	SL	Medium 2	MW	1	L	0	$7,231	$4,844	$3,054	$207	$3,884
Turkey	Solid	SL	Medium 2	MW	1	M	0.1	$23,505	$4,844	$3,224	$233	$3,884
Turkey	Solid	SL	Medium 2	MW	2	H	0.8	$41,256	$1,856	$3,470	$60	$896
Turkey	Solid	SL	Medium 2	MW	2	L	0.8	$4,984	$1,856	$1,675	$48	$896
Turkey	Solid	SL	Medium 2	MW	2	M	1.6	$21,258	$1,856	$2,493	$54	$896
Turkey	Solid	SL	Medium 2	MW	3	H	0.4	$40,082	$0	$1,987	$0	$0
Turkey	Solid	SL	Medium 2	MW	3	L	0.4	$4,310	$0	$1,261	$0	$0
Turkey	Solid	SL	Medium 2	MW	3	M	0.8	$20,218	$0	$1,597	$0	$0
Turkey	Solid	SL	Medium 3	MA	1	H	0	$59,018	$5,751	$3,965	$319	$4,791
Turkey	Solid	SL	Medium 3	MA	1	L	0	$9,967	$5,693	$3,649	$256	$4,743
Turkey	Solid	SL	Medium 3	MA	1	M	0.1	$31,769	$5,733	$3,807	$287	$4,776
Turkey	Solid	SL	Medium 3	MA	2	H	0.5	$56,473	$2,366	$7,595	$93	$1,406
Turkey	Solid	SL	Medium 3	MA	2	L	0.5	$7,422	$2,342	$2,086	$75	$1,392
Turkey	Solid	SL	Medium 3	MA	2	M	0.9	$29,224	$2,359	$4,559	$84	$1,402
Turkey	Solid	SL	Medium 3	MA	3	H	0.3	$54,916	$0	$6,075	$0	$0
Turkey	Solid	SL	Medium 3	MA	3	L	0.3	$5,870	$0	$1,398	$0	$0
Turkey	Solid	SL	Medium 3	MA	3	M	0.6	$27,668	$0	$3,474	$0	$0
Turkey	Solid	SL	Medium 3	MW	1	H	0	$59,423	$6,290	$4,214	$355	$5,330
Turkey	Solid	SL	Medium 3	MW	1	L	0	$9,847	$6,290	$3,859	$284	$5,330
Turkey	Solid	SL	Medium 3	MW	1	M	0.1	$32,034	$6,290	$4,046	$320	$5,330
Turkey	Solid	SL	Medium 3	MW	2	H	0.4	$56,473	$2,366	$4,421	$93	$1,406
Turkey	Solid	SL	Medium 3	MW	2	L	0.4	$6,897	$2,366	$2,047	$75	$1,406
Turkey	Solid	SL	Medium 3	MW	2	M	0.8	$29,084	$2,366	$3,122	$84	$1,406
Turkey	Solid	SL	Medium 3	MW	3	H	0.3	$54,916	$0	$2,324	$0	$0
Turkey	Solid	SL	Medium 3	MW	3	L	0.3	$5,840	$0	$1,398	$0	$0
Turkey	Solid	SL	Medium 3	MW	3	M	0.5	$27,660	$0	$1,824	$0	$0

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 1	CE	1	H	0	$32,980	$1,930	$3,163	$120	$500
Veal	Flush	Liquid	Medium 1	CE	1	L	0	$32,980	$1,930	$3,163	$120	$500
Veal	Flush	Liquid	Medium 1	CE	1	M	0.1	$32,980	$1,930	$3,163	$120	$500
Veal	Flush	Liquid	Medium 1	CE	2	H	0	$32,980	$1,545	$2,939	$20	$500
Veal	Flush	Liquid	Medium 1	CE	2	L	0	$32,980	$1,545	$2,939	$20	$500
Veal	Flush	Liquid	Medium 1	CE	2	M	0	$32,980	$1,545	$2,939	$20	$500
Veal	Flush	Liquid	Medium 1	CE	3	H	0	$32,980	$1,045	$2,859	$20	$500
Veal	Flush	Liquid	Medium 1	CE	3	L	0	$32,980	$1,045	$2,859	$20	$500
Veal	Flush	Liquid	Medium 1	CE	3	M	0	$32,980	$1,045	$2,859	$20	$500
Veal	Flush	Liquid	Medium 1	MA	1	H	0	$39,992	$1,930	$3,514	$120	$500
Veal	Flush	Liquid	Medium 1	MA	1	L	0	$39,992	$1,930	$3,514	$120	$500
Veal	Flush	Liquid	Medium 1	MA	1	M	0.04	$39,992	$1,930	$3,514	$120	$500
Veal	Flush	Liquid	Medium 1	MA	2	H	0	$39,992	$1,545	$3,290	$20	$500
Veal	Flush	Liquid	Medium 1	MA	2	L	0	$39,992	$1,545	$3,290	$20	$500
Veal	Flush	Liquid	Medium 1	MA	2	M	0	$39,992	$1,545	$3,290	$20	$500
Veal	Flush	Liquid	Medium 1	MA	3	H	0	$39,992	$1,045	$3,210	$20	$500
Veal	Flush	Liquid	Medium 1	MA	3	L	0	$39,992	$1,045	$3,210	$20	$500
Veal	Flush	Liquid	Medium 1	MA	3	M	0	$39,992	$1,045	$3,210	$20	$500
Veal	Flush	Liquid	Medium 1	MW	1	H	0.48	$37,632	$1,930	$3,396	$120	$500
Veal	Flush	Liquid	Medium 1	MW	1	L	0.48	$37,632	$1,930	$3,396	$120	$500
Veal	Flush	Liquid	Medium 1	MW	1	M	1.02	$37,632	$1,930	$3,396	$120	$500
Veal	Flush	Liquid	Medium 1	MW	2	H	0	$37,632	$1,545	$3,172	$20	$500
Veal	Flush	Liquid	Medium 1	MW	2	L	0	$37,632	$1,545	$3,172	$20	$500
Veal	Flush	Liquid	Medium 1	MW	2	M	0	$37,632	$1,545	$3,172	$20	$500
Veal	Flush	Liquid	Medium 1	MW	3	H	0	$37,632	$1,045	$3,092	$20	$500
Veal	Flush	Liquid	Medium 1	MW	3	L	0	$37,632	$1,045	$3,092	$20	$500
Veal	Flush	Liquid	Medium 1	MW	3	M	0	$37,632	$1,045	$3,092	$20	$500
Veal	Flush	Liquid	Medium 1	PA	1	H	0	$39,683	$1,930	$3,498	$120	$500

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 1	PA	1	L	0	$39,683	$1,930	$3,498	$120	$500
Veal	Flush	Liquid	Medium 1	PA	1	M	0	$39,683	$1,930	$3,498	$120	$500
Veal	Flush	Liquid	Medium 1	PA	2	H	0	$39,683	$1,545	$3,274	$20	$500
Veal	Flush	Liquid	Medium 1	PA	2	L	0	$39,683	$1,545	$3,274	$20	$500
Veal	Flush	Liquid	Medium 1	PA	2	M	0	$39,683	$1,545	$3,274	$20	$500
Veal	Flush	Liquid	Medium 1	PA	3	H	0	$39,683	$1,045	$3,194	$20	$500
Veal	Flush	Liquid	Medium 1	PA	3	L	0	$39,683	$1,045	$3,194	$20	$500
Veal	Flush	Liquid	Medium 1	PA	3	M	0	$39,683	$1,045	$3,194	$20	$500
Veal	Flush	Liquid	Medium 1	SO	1	H	0	$34,025	$1,930	$3,215	$120	$500
Veal	Flush	Liquid	Medium 1	SO	1	L	0	$34,025	$1,930	$3,215	$120	$500
Veal	Flush	Liquid	Medium 1	SO	1	M	0	$34,025	$1,930	$3,215	$120	$500
Veal	Flush	Liquid	Medium 1	SO	2	H	0	$34,025	$1,545	$2,991	$20	$500
Veal	Flush	Liquid	Medium 1	SO	2	L	0	$34,025	$1,545	$2,991	$20	$500
Veal	Flush	Liquid	Medium 1	SO	2	M	0	$34,025	$1,545	$2,991	$20	$500
Veal	Flush	Liquid	Medium 1	SO	3	H	0	$34,025	$1,045	$2,911	$20	$500
Veal	Flush	Liquid	Medium 1	SO	3	L	0	$34,025	$1,045	$2,911	$20	$500
Veal	Flush	Liquid	Medium 1	SO	3	M	0	$34,025	$1,045	$2,911	$20	$500
Veal	Flush	Liquid	Medium 2	CE	1	H	0	$38,689	$1,930	$3,449	$120	$500
Veal	Flush	Liquid	Medium 2	CE	1	L	0	$38,689	$1,930	$3,449	$120	$500
Veal	Flush	Liquid	Medium 2	CE	1	M	0.1	$38,689	$1,930	$3,449	$120	$500
Veal	Flush	Liquid	Medium 2	CE	2	H	0	$38,689	$1,545	$3,225	$20	$500
Veal	Flush	Liquid	Medium 2	CE	2	L	0	$38,689	$1,545	$3,225	$20	$500
Veal	Flush	Liquid	Medium 2	CE	2	M	0	$38,689	$1,545	$3,225	$20	$500
Veal	Flush	Liquid	Medium 2	CE	3	H	0	$38,689	$1,045	$3,145	$20	$500
Veal	Flush	Liquid	Medium 2	CE	3	L	0	$38,689	$1,045	$3,145	$20	$500
Veal	Flush	Liquid	Medium 2	CE	3	M	0	$38,689	$1,045	$3,145	$20	$500
Veal	Flush	Liquid	Medium 2	MA	1	H	0	$44,631	$1,930	$3,746	$120	$500
Veal	Flush	Liquid	Medium 2	MA	1	L	0	$44,631	$1,930	$3,746	$120	$500

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 2	MA	1	M	0	$44,631	$1,930	$3,746	$120	$500
Veal	Flush	Liquid	Medium 2	MA	2	H	0	$44,631	$1,545	$3,522	$20	$500
Veal	Flush	Liquid	Medium 2	MA	2	L	0	$44,631	$1,545	$3,522	$20	$500
Veal	Flush	Liquid	Medium 2	MA	2	M	0	$44,631	$1,545	$3,522	$20	$500
Veal	Flush	Liquid	Medium 2	MA	3	H	0	$44,631	$1,045	$3,442	$20	$500
Veal	Flush	Liquid	Medium 2	MA	3	L	0	$44,631	$1,045	$3,442	$20	$500
Veal	Flush	Liquid	Medium 2	MA	3	M	0	$44,631	$1,045	$3,442	$20	$500
Veal	Flush	Liquid	Medium 2	MW	1	H	0.24	$41,584	$1,930	$3,593	$120	$500
Veal	Flush	Liquid	Medium 2	MW	1	L	0.24	$41,584	$1,930	$3,593	$120	$500
Veal	Flush	Liquid	Medium 2	MW	1	M	0.48	$41,584	$1,930	$3,593	$120	$500
Veal	Flush	Liquid	Medium 2	MW	2	H	0	$41,584	$1,545	$3,369	$20	$500
Veal	Flush	Liquid	Medium 2	MW	2	L	0	$41,584	$1,545	$3,369	$20	$500
Veal	Flush	Liquid	Medium 2	MW	2	M	0	$41,584	$1,545	$3,369	$20	$500
Veal	Flush	Liquid	Medium 2	MW	3	H	0	$41,584	$1,045	$3,289	$20	$500
Veal	Flush	Liquid	Medium 2	MW	3	L	0	$41,584	$1,045	$3,289	$20	$500
Veal	Flush	Liquid	Medium 2	MW	3	M	0	$41,584	$1,045	$3,289	$20	$500
Veal	Flush	Liquid	Medium 2	PA	1	H	0	$46,660	$1,930	$3,847	$120	$500
Veal	Flush	Liquid	Medium 2	PA	1	L	0	$46,660	$1,930	$3,847	$120	$500
Veal	Flush	Liquid	Medium 2	PA	1	M	0	$46,660	$1,930	$3,847	$120	$500
Veal	Flush	Liquid	Medium 2	PA	2	H	0	$46,660	$1,545	$3,623	$20	$500
Veal	Flush	Liquid	Medium 2	PA	2	L	0	$46,660	$1,545	$3,623	$20	$500
Veal	Flush	Liquid	Medium 2	PA	2	M	0	$46,660	$1,545	$3,623	$20	$500
Veal	Flush	Liquid	Medium 2	PA	3	H	0	$46,660	$1,045	$3,543	$20	$500
Veal	Flush	Liquid	Medium 2	PA	3	L	0	$46,660	$1,045	$3,543	$20	$500
Veal	Flush	Liquid	Medium 2	PA	3	M	0	$46,660	$1,045	$3,543	$20	$500
Veal	Flush	Liquid	Medium 2	SO	1	H	0	$44,794	$1,930	$3,754	$120	$500
Veal	Flush	Liquid	Medium 2	SO	1	L	0	$44,794	$1,930	$3,754	$120	$500
Veal	Flush	Liquid	Medium 2	SO	1	M	0	$44,794	$1,930	$3,754	$120	$500

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Performance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 2	SO	2	H	0	$44,794	$1,545	$3,530	$20	$500
Veal	Flush	Liquid	Medium 2	SO	2	L	0	$44,794	$1,545	$3,530	$20	$500
Veal	Flush	Liquid	Medium 2	SO	2	M	0	$44,794	$1,545	$3,530	$20	$500
Veal	Flush	Liquid	Medium 2	SO	3	H	0	$44,794	$1,045	$3,450	$20	$500
Veal	Flush	Liquid	Medium 2	SO	3	L	0	$44,794	$1,045	$3,450	$20	$500
Veal	Flush	Liquid	Medium 2	SO	3	M	0	$44,794	$1,045	$3,450	$20	$500
Veal	Flush	Liquid	Medium 3	CE	1	H	0	$50,383	$1,930	$4,033	$120	$500
Veal	Flush	Liquid	Medium 3	CE	1	L	0	$50,383	$1,930	$4,033	$120	$500
Veal	Flush	Liquid	Medium 3	CE	1	M	1	$50,383	$1,930	$4,033	$120	$500
Veal	Flush	Liquid	Medium 3	CE	2	H	0	$50,383	$1,545	$3,809	$20	$500
Veal	Flush	Liquid	Medium 3	CE	2	L	0	$50,383	$1,545	$3,809	$20	$500
Veal	Flush	Liquid	Medium 3	CE	2	M	0	$50,383	$1,545	$3,809	$20	$500
Veal	Flush	Liquid	Medium 3	CE	3	H	0	$50,383	$1,045	$3,729	$20	$500
Veal	Flush	Liquid	Medium 3	CE	3	L	0	$50,383	$1,045	$3,729	$20	$500
Veal	Flush	Liquid	Medium 3	CE	3	M	0	$50,383	$1,045	$3,729	$20	$500
Veal	Flush	Liquid	Medium 3	MA	1	H	0	$57,070	$1,930	$4,368	$120	$500
Veal	Flush	Liquid	Medium 3	MA	1	L	0	$57,070	$1,930	$4,368	$120	$500
Veal	Flush	Liquid	Medium 3	MA	1	M	0	$57,070	$1,930	$4,368	$120	$500
Veal	Flush	Liquid	Medium 3	MA	2	H	0	$57,070	$1,545	$4,144	$20	$500
Veal	Flush	Liquid	Medium 3	MA	2	L	0	$57,070	$1,545	$4,144	$20	$500
Veal	Flush	Liquid	Medium 3	MA	2	M	0	$57,070	$1,545	$4,144	$20	$500
Veal	Flush	Liquid	Medium 3	MA	3	H	0	$57,070	$1,045	$4,064	$20	$500
Veal	Flush	Liquid	Medium 3	MA	3	L	0	$57,070	$1,045	$4,064	$20	$500
Veal	Flush	Liquid	Medium 3	MA	3	M	0	$57,070	$1,045	$4,064	$20	$500
Veal	Flush	Liquid	Medium 3	MW	1	H	4	$53,902	$1,930	$4,209	$120	$500
Veal	Flush	Liquid	Medium 3	MW	1	L	4	$53,902	$1,930	$4,209	$120	$500
Veal	Flush	Liquid	Medium 3	MW	1	M	8	$53,902	$1,930	$4,209	$120	$500
Veal	Flush	Liquid	Medium 3	MW	2	H	0	$53,902	$1,545	$3,985	$20	$500

Table C-3b (Continued)

Animal	Farm Type	Manure Type	Size Class	Region	Category	Perform-ance Needs	Number of Facilities	Capital Costs	Fixed Costs	Annual O&M Costs	3-Year Recurring O&M Costs	5-Year Recurring O&M Costs
Veal	Flush	Liquid	Medium 3	MW	2	L	0	$53,902	$1,545	$3,985	$20	$500
Veal	Flush	Liquid	Medium 3	MW	2	M	0	$53,902	$1,545	$3,985	$20	$500
Veal	Flush	Liquid	Medium 3	MW	3	H	0	$53,902	$1,045	$3,905	$20	$500
Veal	Flush	Liquid	Medium 3	MW	3	L	0	$53,902	$1,045	$3,905	$20	$500
Veal	Flush	Liquid	Medium 3	MW	3	M	0	$53,902	$1,045	$3,905	$20	$500
Veal	Flush	Liquid	Medium 3	PA	1	H	0	$59,312	$1,930	$4,480	$120	$500
Veal	Flush	Liquid	Medium 3	PA	1	L	0	$59,312	$1,930	$4,480	$120	$500
Veal	Flush	Liquid	Medium 3	PA	1	M	0	$59,312	$1,930	$4,480	$120	$500
Veal	Flush	Liquid	Medium 3	PA	2	H	0	$59,312	$1,545	$4,256	$20	$500
Veal	Flush	Liquid	Medium 3	PA	2	L	0	$59,312	$1,545	$4,256	$20	$500
Veal	Flush	Liquid	Medium 3	PA	2	M	0	$59,312	$1,545	$4,256	$20	$500
Veal	Flush	Liquid	Medium 3	PA	3	H	0	$59,312	$1,045	$4,176	$20	$500
Veal	Flush	Liquid	Medium 3	PA	3	L	0	$59,312	$1,045	$4,176	$20	$500
Veal	Flush	Liquid	Medium 3	PA	3	M	0	$59,312	$1,045	$4,176	$20	$500
Veal	Flush	Liquid	Medium 3	SO	1	H	0	$57,099	$1,930	$4,369	$120	$500
Veal	Flush	Liquid	Medium 3	SO	1	L	0	$57,099	$1,930	$4,369	$120	$500
Veal	Flush	Liquid	Medium 3	SO	1	M	0	$57,099	$1,930	$4,369	$120	$500
Veal	Flush	Liquid	Medium 3	SO	2	H	0	$57,099	$1,545	$4,145	$20	$500
Veal	Flush	Liquid	Medium 3	SO	2	L	0	$57,099	$1,545	$4,145	$20	$500
Veal	Flush	Liquid	Medium 3	SO	2	M	0	$57,099	$1,545	$4,145	$20	$500
Veal	Flush	Liquid	Medium 3	SO	3	H	0	$57,099	$1,045	$4,065	$20	$500
Veal	Flush	Liquid	Medium 3	SO	3	L	0	$57,099	$1,045	$4,065	$20	$500
Veal	Flush	Liquid	Medium 3	SO	3	M	0	$57,099	$1,045	$4,065	$20	$500