WORKSHEETS
FOR
PROVIDING NRCS TECHNICAL ASSISTANCE
on
ANIMAL FEEDING OPERATIONS (AFO)
Arizona

GENERAL

Type of Assistance Provided

As requested, NRCS may provide inventory, evaluation, planning, design, application, and follow up assistance on animal feeding operations (AFOs) including poultry operations.

General Information

General information provided per telephone, office visit or field visits may consist of:

A. Discussion of available NRCS technical assistance (e.g., inventory, Design Report, Animal Waste Management Plan, construction assistance, and follow up).

B. Discussion of NRCS concerns - soil, water, air, plants, animals, and human.

C. Discussion of Federal cost share available for existing operations (e.g., EQIP and PL-83-566 programs, where and when to sign up, FSA facility loans, and tax credits).

D. Overview of guidelines for using manure and polluted effluent as a resource in a manner that does not degrade air, soil, and water resources.

E. Overview of the U.S. Clean Water Act, as amended, and administrated by EPA. The Arizona Department of Environmental Quality (ADEQ) role and administration of the Arizona General Permit for AFOs, with owner/operator compliance by implementing Best Management Practices (BMPs). Need for an individual permit if a general permit is not used. Steps to secure and keep valid an individual permit. In general, avoid an individual permit if possible.

F. Discussion with the client on which permits are required prior to construction (404, 401, construction permit, temporary construction easement, blue stake, etc.).

G. Discussion with the client on the potential flood hazard. The client needs to obtain floodplain map from the appropriate agency. In general, do not build within the 100-year floodplain. Any existing facility within the floodplain might have to be relocated.

H. Discussion on why the client is requesting assistance. Why are we willing to help and why is NRCS/client confidentiality important?

Request for Assistance

The following information should be known prior to arriving at the AFO site:

Name of Operation _____

Address _____

Name of Owner(s)_____Phone: _____

Name of Manager_____Phone: _____

Best time of day to:

Contact Owner by Phone: _____

Contact Manager by Telephone: _____

Visit AFO site _____

Make field surveys with on site assistance: _____

G-1. Type of Operation_____

G-2. Size of Operation _____

G-3. Changes Proposed _____

G-4. Location of AFO _____

More specifically described as being within the _____ of the _____ of Section _____, Township _____, Range _____ of the _____ Meridian.

G-5. Problems:

_____

_____

_____

_____

_____

G-6. Opportunities:

_____

_____

_____

_____

_____

G-7. Request Resource Support Team assistance to:

_____Prepare Design Report and Waste Management Plan.
_____Review prepared Design Report and Waste Management Plan.
_____Assist state office staff to review and approve Design Report and Waste Management Plan.

G-8. Existing and Proposed Site Plan with Data Sheet(s)

a. General AFO layout: buildings, feedlots, liquid and solid storage areas, and disposal area(s), etc.

Show:

1. Farm boundaries applicable to agricultural waste plan.
2. Disposal area(s).
3. Feedlot area.
4. Storage area for solids and/or effluent.
5. Soil survey with key to soil series and textures.
6. Urban development.
7. Roads, map scale, north arrow, etc.
8. Distance from state or federal highway, nearest town, or other landmark

b. Detail AFO facility layout and site plan, using drawings and sketches on 8 1/2" x 11" or 11" x 17" paper, plus necessary data sheets showing:

1. Building size and use (e.g., milking parlor, holding area, feed storage, farrowing, nursery, feeder, finishing, broilers, laying, etc.).

2. Domestic and AFO well(s) with depth, capacity, and casing depth.

3. Feed lot/corrals showing surface drainage direction and slope in ft./ft. or ft./100 ft. (%), and dikes, ditches, or waterways to control surface runoff.

4. Solid waste storage areas not included in feedlot/corrals (show dimensions).

5. Liquid waste storage areas and type of facility, (e.g., underground concrete tank, excavated earth pond, excavated/embankment earth lagoon, etc.). Show dimensions.

6. Sumps, pumps, pipelines, open channels, and non-building facilities for collecting and transporting animal waste. Data sheet information should include:

   Sumps - type of construction, size, condition, maximum and minimum effluent (water) surface.

   Pumps - make, model number, impeller diameter, where pump was purchased, time to pump sump from maximum to minimum water surface.

   Pump motor - horsepower, shaft speed in rpm.

   Pipelines - material, size, head available or grade.

   Open channels - material, size, and grade.

7. Liquid/solid separating screen, screen tower, and temporary solids storage bunker site.

8. Use dashed line to show proposed changes on the above maps/drawings.

G-9. Surveys Needed

a. Type of field survey — Check if needed

1. Pipelines, pumps, etc. _____
2. Dikes for surface water control _____
3. Open channel for surface water control _____
4. Storage pond/lagoon(s) _____
5. Runoff control _____
6. Other _____

b. Appointment(s) to complete field surveys. _____

_____

_____

_____

_____

Date: _____

DAIRY

Site Visit Worksheet

Operation Represented by: _____

NRCS Represented by: _____

D-1. Confirm or Modify General Information: _____
_____
_____

a. Dairy water usage from water bills _____
_____

D-2. Cow Holding Area:

a. Number of cows milked in a group _____, breed _____ .

b. Average weight of cows being milked is _____ pounds.

c. Number of groups per milking _____.

d. Average time cows are in the holding area _____ minutes.

e. Size of holding area, length _____ ft., width _____ft.

f. Floor slope (if hydraulic flushed) _____ft/ft.

g. Are floor sprinklers used to wash udders? Yes ___ No ___; *If No, go to (h).*

1. Number of floor sprinklers _____.
2. Capacity of EACH sprinkler head _____ gallons/minute; or sprinkler nozzle size ____in., nozzle pressure _____ psi.
3. Total length of time floor sprinklers are operated per group _____ minutes/milking.

h. Are evaporative cooling mister nozzles used in holding area? Yes ___ No ___; *If No, go to (i).*

1. Number of mister nozzles used for cooling cows _____.
2. Capacity of mister nozzles _____ gallons/hour.
3. Hours per day operated _____.
4. Months and date of operation _____ to _____.
5. Estimate percent of water reaching floor _____%.

i. Cleaning cow holding area between milkings with high pressure hose and nozzle:

1. Cleaning _____ times per day, average time per cleaning is _____ minutes.
2. Capacity of hose and nozzle _____ gal/min; or hose valve (faucet) pressure _____psi, hose diameter _____ inches, hose length _____ feet; or nozzle diameter _____ inches and nozzle pressure _____ psi.

D-3. Milking parlor:

a. Size and configuration of milking parlor _____.

Example: Double 16 herringbone (32 stalls total).

b. Milkings per day:

_____ times/day _____ _____ through _____ _____
(number) (month) (day) (month) (day)

_____ times/day _____ _____ through _____ _____
(number) (month) (day) (month) (day)

c. Approximate time cows are in milking parlor: _____ minutes per milking.

d. Detail washing udders with warm water plus keeping milking equipment and floor areas clean while milking _____ gallons per cow per day.

e. Cleaning milking parlor between milkings with high-pressure hose:

Detail cleaning _____ times/day, average time per cleaning _____ minutes.

General cleaning _____ times/day, average time per cleaning _____ minutes.

f. Capacity of nozzle and hose _____ gallons/minute; or hose valve (faucet) pressure _____ psi, hose diameter _____ inches, hose length _____ feet; or nozzle diameter _____ inches and nozzle.

D-4. Milk room, miscellaneous, milking equipment, bulk tank, and pipeline cleaning

a. Volume of water used to wash and rinse pipeline: Wash _____ gal., Rinse _____ gal.

b. Frequency of pipeline washing _____ times per day.

c. Pipeline washing:

Number of washings with soapy water _____

Number of washings with disinfectant _____

Number of rinses with clean water _____

d. Stainless steel bulk milk storage tank(s) and capacity:

Number Of Tanks	Milk capacity in pounds or gallons
_____	_____or_____
_____	_____or_____

e. Bulk tank(s) washing:

Capacity of Tank in lbs. or Gallons	Gallons per wash Auto or Manual	Frequency of Bulk Milk Pickup and Tank Washing
_____or_____	_____or_____	_____
_____or_____	_____or_____	_____

f. Hand washing miscellaneous milking equipment usually in sink including rinse water _____ gallons/milking.

g. Washing milk room floors and walls, exterior of bulk tanks, loading slab, etc. _____ gallons/day or _____ inch nozzle diameter at _____ psi nozzle pressure; and _____ minutes washing time/day.

D-5. Estimating Effluent Volumes

Is sufficient information known to calculate (with reasonable accuracy) effluent volume produced?
_____Yes _____ No

If no, refer to Appendix: MEASURING EFFLUENT DISCHARGE FROM FACILITIES

D-6. Collection of Field Information for Site Plan

Collect information identified in *GENERAL Section G-8 and G-9* to prepare general and detail AFO facility sketches, site plans, maps, etc. Use NRCS-ENG 523a for recording details not shown on site plans.

SWINE

Site Visit Worksheet

Date: _____

Operation represented by: _____

NRCS represented by: _____

S-1. Confirm or modify general information: _____

_____

_____

_____

S-2. Farrowing Area:

a. Number of farrowing stalls or pens _____.

b. Average number of sows with/without piglets _____. Average sow weight _____lbs.

c. Average number of piglets less than 8-lbs. _____. Average piglet weight _____ lbs.

d. Detail cleaning with high pressure hose nozzle _____ gpm; or nozzle pressure _____ psi and nozzle size _____ inches; or hose valve (faucet) pressure _____ psi, hose length _____ feet, hose diameter _____ inches and nozzle size _____ inches.

e. Detail cleaning takes _____ minutes twice daily, daily, every other day, other _____.

f. General cleaning in farrowing area:

1. With high-pressure hose and nozzle _____ gal/minute for _____ minutes _____ per day, _____ every other day, other _____.

2. Hydraulic flushing alleys manual _____, automatic timer _____,
12 8 6 4 3 2 1 times daily. _____ not used.

a. Number of alleys flushed _____.

b. Volume per alley per flush _____ gal, or depth of flow _____ inches, for duration _____ minutes; average alley width _____, slope of alleys _____ ft/ft.

S-3. Nursery area

a. Average number of piglets less than 8-lbs. _____. Average piglet weight _____ lbs.

b. Detail cleaning with high pressure hose and nozzle _____ gpm; or nozzle pressure _____ and nozzle size _____ inches diameter; or hose valve (faucet) pressure _____ psi, hose length _____ feet, hose diameter _____ inches, and nozzle diameter _____ inches.

c. Detail cleaning with hose and nozzle takes _____ minutes 3 2 1 times daily.

S-4. Feeder area

a. Average number of weaner pigs 8-40 lbs _____. Average weaner pig weight _____ lbs.

b. Average number of feeders 40-125 lbs. _____. Average feeder pig weight ____ lbs.

c. Cleaning with high pressure hose and nozzle _____ gpm; or nozzle pressure _____ and nozzle size _____ inches diameter; or hose valve (faucet) pressure _____ psi, hose length _____ feet, hose diameter _____ inches, and nozzle diameter _____ inches. Other _____.

d. Cleaning takes _____ minutes ___ per day, ____ every other day, other _____.

e. Hydraulic alley flushing manual ____, automatic timer _____, 12 8 6 4 3 2 1 times daily, _____ every other day.

1. Number of alleys flushed per building _____. Number of buildings _____.

2. Volume/alley/flush _____ gallons, or depth of flow _____ inches, duration _____ minutes; average width of alley _____, slope of alley _____.

3. Other sources of waste water (e.g., pig waterers, faucets, hoses, evap coolers, etc.) _____ gal/min, or _____ gal./day.

S-5. Finishing area

a. Average number of finisher pigs 125-250 lbs. ____. Average finisher pig weight ____ lbs.

b. Open earth lot ____, or concrete slab or floor ____. *(If earth lot, go to FEED LOTS.)*

c. Cleaning with high pressure hose and nozzle _____ gpm; or nozzle pressure _____ and nozzle size _____ inches diameter; or hose valve (faucet) pressure _____ psi, hose length _____ feet, hose diameter _____ inches, and nozzle diameter _____ inches. Other _____.

d. Cleaning takes _____ minutes _____ per day, _____ every other day, _____ other _____.

e. Hydraulic alley flushing manual ____, automatic timer _____, 12 8 6 4 3 2 1 times daily, _____ every other day.

1. Number of alleys flushed per building _____. Number of buildings _____.

2. Volume/alley/flush _____ gallons, or depth of flow _____ inches, duration _____ minutes; average width of alley _____, slope of alley _____.

3. Does hydraulic flush operations use recycled water? YES _____ NO _____.

S-6. Gestation area

a. Number of sows _____, average sow weight _____ lbs.

b. Open earth lot _____ or concrete slab _____. *(If open earth lot, go to FEED LOT.)*

c. Cleaning with high-pressure hose and nozzle _____ gpm, or nozzle pressure _____ nozzle size _____ inches diameter.

d. Cleaning takes _____ minutes _____ per day, _____ every other day.

e. Hydraulic alley flushing manual _____ automatic timer _____ 12 8 6 4 3 2 1 times daily.

1. Number of alleys flushed per building _____. Number of buildings _____.

2. Volume/alley/flush _____ gallons, or depth of flow _____ inches, duration _____ minutes; average width of alley _____, slope of alley _____.

3. Does hydraulic flush operations use recycled water? YES _____ NO _____.

f. Other sources of waste water (e.g., leaky pig waterers, faucets, hoses, evap coolers, etc.) _____ gal/min, or _____ gal./day.

S-7. Boar area

a. Number of sows _____, average sow weight _____ lbs.

b. Open earth lot _____ or concrete slab _____. *(If open earth lot, go to FEED LOT.)*

c. Cleaning with high-pressure hose and nozzle _____ gpm, or nozzle pressure _____ nozzle size _____ inches diameter.

d. Cleaning takes _____ minutes _____ per day, _____ every other day.

e. Hydraulic alley flushing manual _____ automatic timer _____ 12 8 6 4 3 2 1 times daily.

1. Number of alleys flushed per building _____. Number of buildings _____.

2. Volume/alley/flush _____ gallons, or depth of flow _____ inches, duration _____ minutes; average width of alley _____, slope of alley _____.

3. Does hydraulic flush operations use recycled water? YES _____ NO _____.

f. Other sources of waste water (e.g., leaky pig waterers, faucets, hoses, evap coolers, etc.) _____ gal/min, or _____ gal/day.

Date: _____

FEED LOTS

(All livestock including poultry)

Site Visit Worksheet

F-1 Feed lot area

a. Number, kind, and average weight of livestock:

_____	Diary calves	_____	lbs.	_____	Swine sows	_____	lbs.
_____	Diary heifers	_____	lbs.	_____	Swine boars	_____	lbs.
_____	Dairy cows	_____	lbs.	_____	Swine finishers	_____	lbs.
_____	Beef calves	_____	lbs.	_____	Lambs	_____	lbs.
_____	Beef feeders	_____	lbs.	_____	Sheep	_____	lbs.
_____	Horses	_____	lbs.	_____	Turkey broilers	_____	lbs.
_____	_____	_____	lbs.	_____	_____	_____	lbs.

b. Feedlot surface area _____ acres.

c. Surface drainage direction & slope _____.

d. Are concrete pads installed on the livestock of feeders or managers? Yes ____ No ____.
If yes, what is the number, length, and width of each size pad? _____
Is the area included in b above? Yes _____ No _____

e. Percent (or area in acres) and type of feed lot surface: concrete __, asphalt __, earth ___.

f. Occupation period(s) ___ all months of year or _____ _____ to _____ _____.
(month) (day) (month) (day)

g. Is unpolluted storm runoff up to the 25 year-24 hour event excluded from the feedlot by dikes, ditches, natural slope, or other physical barrier? Yes _____ No _____.

If no, what is the additional watershed area _____ acres, watershed soil(s) _____, watershed cover _____?

h. Total watershed area contributing to polluted runoff is _____ acres.

i. Is surface drainage from feed lot areas controlled? Yes _____ No _____. If yes, how? Waterways _____, ditches _____, dikes _____, berms _____, storage pond or lagoon _____.

j. Solid waste from feedlots is removed continuously? _____, monthly _____, bi-monthly _____, semi-annually _____, at least annually _____.

k. Are the feed lanes flushed? All lanes _____ or some lanes _____? If yes, gallons per flush _____ gal. Number of flushes per day _____. Is the flush water fresh _____, wastewater from milking area _____, or wastewater from storage pond _____?

Date: _____

SOLID WASTE COLLECTION AND STORAGE

(all livestock including poultry)

Site Visit Worksheet

W-1. Solid Waste Storage Facilities

a. Are solid waste collection and storage areas considered part of the feed lot surface? Yes _____ No _____. *(If yes, go to EFFLUENT COLLECTION AND STORAGE.)*

b. Dimensions of existing solid waste storage area _____. Proposed _____. Length _____ ft., width _____ ft., or describe _____ _____.

c. Is unpolluted storm runoff up to the 25 year-24 hour event excluded from the feedlot by dikes, ditches, natural slope, or other physical barrier? Yes _____ No _____.

If no, what is the additional watershed area _____ acres, watershed soil(s) _____, watershed cover _____?

d. Is surface drainage from the solid waste storage area controlled? Yes _____ No _____. If yes, how? _____ _____

e. Solid waste is removed continuously _____, monthly _____, bi-monthly _____, semi-annually _____, at least annually _____.

f. Solids are ultimately disposed by spreading on irrigated cropland ___, off farm sales ____, fed to livestock ____.

Date: _____

EFFLUENT COLLECTION AND STORAGE

(all livestock including poultry)

Site Visit Worksheet

Effluent (liquid waste) from AFOs includes: animal urine, facility wash water, processing water, feed lot and solid waste storage area runoff. This section applies to the collection and storage of effluent outside of buildings. Effluent may contain up to 4% solids.

E-1. Effluent collection facilities

a. Effluent exits buildings in _____ ft. open ditch, _____ ft. of _____ diameter pipeline. Is a manifold configuration used? Yes _____ No _____. If Yes, use sketch to show layout, sizes and lengths.

b. Is a temporary storage sump and pump used? Yes ____ No_____ *(If No, proceed to Section E-1(d); if Yes, see below.)*

1. Sump dimensions are ____ ft. length and ____ ft. width, or ____ ft. diameter. Sump is constructed of _____.
2. Minimum effluent surface is ____ ft. below top of sump.
3. Maximum effluent surface is ____ ft. below top of sump.
4. Sump pump specs: Motor horsepower _____, make _____, model number _____. Effluent discharge elevation is _____ ft. above the lowest effluent surface in the sump.

c. Average time sump pump runs per cycle is _____ minutes.

d. Existing effluent discharges via _____ ft. open ditch, _____ ft. of _____ inch diameter pipeline, _____ ft. of _____ inch diameter pipeline and separating screen, wild flooding _____, other _____.

E-2. Effluent storage facilities (does not include sump and pump facilities in Section E-1.)

a. Storage facilities contain effluent: less than 30 days _____, more than 30 days, but less than 12 months _____, year round _____.

b. Normal depth of effluent storage is 0-3 ft. (aerobic), 3-5 ft. _____ (aerobic and mixed), more than 5 ft. _____ (aerobic, mixed and anaerobic).

c. Dimensions of concrete storage tank(s) if used:

Length (ft.)	Width (ft.)	Diameter (ft.)	Depth (ft.)
_____	_____	_____	_____
_____	_____	_____	_____

d. Method of construction, age, and size of earth storage pond(s) or lagoon(s): Method of construction: excavated _____, excavated and embankment _____, embankment only _____. Year of construction _____.

Length (ft.)	Width (ft.)	Diameter (ft.)	Depth (ft.)
_____	_____	_____	_____
_____	_____	_____	_____

e. Ultimate disposal of effluent is:

1. Retention on feed lot surface and evaporated _____.
2. Stored in a sealed holding pond that may be dry part of the year _____, and
3. Stored in a sealed year-round pond or lagoon containing at least 24" of effluent any given month of the year, and applied on irrigated cropland with IWM _____ or evaporated _____.
4. Other (describe):
_____
_____
_____

f. Is solid separation used? Screen _____ basin _____ or other _____

1. If screen, manufacturer _____ model # _____ size _____ capacity _____ gpm. Size of solids storage area _____. How often cleaned? _____
2. If basin, type of construction: concrete _____. Block _____, other _____. Size of cells _____. Number of cells _____. Depth of cells _____. Is drying pad used? Yes _____ No _____. Type of drying pad _____. Size of drying pad _____. How often are the cells cleaned? _____

GENERAL

APPENDIX

G-1 Type of operation - e.g., Holstein Diary, beef feed lot, veal calf, farrow to finish swine, finisher swine, chicken broiler, chicken layer, turkey broiler, etc.

G-2 Size of operation – e.g., 800 cow-dairy, 12,500 beef feeder, 300 sows, 100,000 laying hens, etc.

G-3 Changes proposed - e.g., expansion to XXXX within five years, abandon facilities by year 2000, install liquid/solid separator screen, expand storage ponds, expand lagoons, etc.

G-4 Location of AFO:

General description - e.g., NE corner of Southern Avenue and Palo Verde Road, approximately 5 3/4 miles west by northwest of Buckeye, Arizona. i.e., Six miles southeast of Buckeye, Arizona on the west side of Airport Road, 4 miles south of Highway AZ 85.

Legal description - e.g., SW 1/4 of the SW 1/4 Section 28, Township I North, Range 4 west of the Gila-Salt River Meridian. e.g., E 1/2 of the E 1/2 Section 25, Township 1 S, Range 3 W of the Gila-Salt River Meridian.

G-5 Problems: Problems may be perceived (suspect but no proof) or identified (usually visually) by the owner, manager, ADEQ, NRCS, neighbor, passer by etc. Check whether perceived or identified by whom, and briefly state the problem. It is important that all problems, known or perceived, be considered early in the planning process. Redesign and construction delays result when new problems are discovered in an untimely manner. Who perceived or identified a problem indicates who is concerned (operator or public) and perhaps a time frame to correct the situation. This section is a recognition by the owner/manager that changes need to be made to meet personal and/or environmental goals.

G-6 Opportunities: Typically, at least one solution is known for every problem. Check whether a perceived or identified solution is known at this time. Whether or not it is the best or most feasible solution can only be determined by the planning process for a Waste Management System. Associated effects (soil, plants, air, water quality, etc.) often are not addressed. This section identifies solutions already under consideration by the owner/manager, NRCS, or others.

G-7. Approval to be per National Engineering Manual (NEM) and Arizona Planning Policy for AFO.

G-8 Existing and Proposed Site Plan: During the site visit, identify suggested items so they may be placed on a site plan prepared in the office.

a. Prepare reproducible approximate scale maps, drawings, and sketches on 8 1/2 x 11 or 11 x 17-inch paper for the design report or agricultural waste management plan. Construction drawings require more detail. Blank soil survey aerial photo maps work well where available.

b. Using drawings or sketches, 1" = 100' or larger, and 8 1/2 x 11 or 11 x 17 inch paper, show a detailed layout of buildings, pipelines, wells, corrals, waste storage areas, pumps, sumps, and other facilities.

c. Use additional data sheets on NRCS-ENG-523a computation paper as needed to clearly display information,(e.g., pump data, dimensions of buildings, holding areas, sumps, pipelines, etc.).

d. Use dashed lines or other suitable symbols to show proposed facility changes, modifications, or new construction.

G-9 Surveys needed: This section identifies field surveys needed so they may be accomplished during the visit or at a later time. It is preferred that future appointments be set prior to leaving the site.

DAIRY

APPENDIX

D-1 Confirm or modify general information - often times new information becomes available between the time general information and site information are collected. Also, planning changes may result from discussions and site reassessment. Change information on the GENERAL worksheet to reflect current thinking and make note of changes in this section.

D-2 Cow holding area - the area where groups of cows are held preparatory to entering the milking parlor. Typically, udders, legs, and the underside of cows are washed using impact, rotary, or spray floor sprinklers. The number of cycles and operating time per cycle sprinklers are used for each group of cows varies from dairy to dairy. Control may be manual or by using a preset timer. All wastewater volumes eventually need to be expressed in gallons/day, so multiple sources can be added for, a total waste volume.

a. The average number of cows in a group is used to calculate the amount of wastewater used in the holding area. Cows per group vary from 40 - 100 depending on the size of the milking parlor. Breed will be: Holstein, Guernsey, Jersey, Ayrshire, etc.

b. The average weight of cows being milked is used to estimate the amount of feces and urine deposited in the holding and milk parlor areas.

Typical weights are:	Holstein 1400 pounds
	Guernsey 1100 pounds
	Jersey 1000 pounds
	Ayrshire 1200 pounds

c. The number of groups milked each milking times the average number of cows per group, will be approximately equal to the total cows being milked. Newly freshened cows (cows having calves within the past ten days) are milked last.

d. The average time cows are held in the holding area indicates the amount of feces and urine deposited in the holding area. Total confinement time in the milking area will be used to calculate the percent of daily urine and feces to be handled by the waste disposal system.

e. The size of a holding area helps identify one dairy from another and provides a check on the number of floor sprinklers. Width is used when designing or evaluating hydraulic flush floor cleaning systems.

f. All holding area floors have some slope for surface drainage. If hydraulic flush floor cleaning is used slope may control depth of flow.

g. Floor sprinklers for washing cow udders, legs, etc.

1. Use number of floor sprinklers, capacity per sprinkler and total time of operation to determine volume of wash water in the holding area. WASH WATER VOLUME IN THE HOLDING AREA CONTROLS MOST DESIGNS.

2. See 1 above.

3. See 1 above.

h. Evaporative cooling mister nozzles

1. Many Arizona dairies use overhead mister nozzles to assist cow cooling in the holding area. Capacities vary from 2-4 gallons per hour with 10-30% of the water reaching the floor. Typically, mister nozzles are operated daylight hours in summer months. Convert water reaching the floor to gallons/day.

2. See 1 above.

3. See 1 above.
4. See 1 above.
5. See 1 above.

i. Cow holding areas may be cleaned one, two, or with three milkings, three times a day. Some dairy operations detail clean once each day with a more general cleaning between other milkings. Typically a 50 ft. hose and a 1/2 or 3/4 inch nozzle is used, with cleaning time varying from 10-30 minutes each cleaning.

Water used for cleaning holding areas may be estimated by multiplying a known flow rate time.

To determine flow rate:
--time how long it takes to fill a five gallon bucket,
--calculate discharge knowing nozzle pressure and nozzle size,
--use the following table knowing dynamic line pressure available at the hose valve or faucet, hose diameter, and nozzle size. Interpret table values for hose lengths other than 50 foot and nozzle pressures different from 40 and 55 psi.

ESTIMATING HOSE AND NOZZLE CAPACITY

AND VELOCITY

		Pressure	Available	To	Hose 2/
		40 psi		55 psi	
Hose Inside Diameter (in.) 1/	Nozzle Inside Diameter (in.)	Capacity gal/min	Velocity ft/sec	Capacity gal/min	Velocity ft/sec
5/8”	¼”	10	64	12	77
	3/8”	16	46	18	52
¾”	3/8”	20	58	25	73
	½”	30	48	35	56
1”	3/8”	25	72	30	87
	½”	40	64	45	72
1 ¼”	½”	45	72	50	80
	¾”	70	51	80	58
1 ½”	½’	45	72	50	80
	¾”	80	58	95	69
2”	¾”	80	58	95	69
	1”	100	41	125	51

1/ 50 foot length

2/ Hose valve or faucet pressure with water flowing

D-3. Milking Parlor

a. Examples of size and configuration of a milking parlor are: Double 24 Parallel (Total 48 Stalls)

Double 16 Herringbone (Total 32 Stalls)

Double 8 Side Opener (Total 16 Stalls)

40 Stall Polygon (Total 40 Stalls)

30 Stall Trigon (Total 30 Stalls)

Herringbone - cows stand with hindquarters and udders facing milker. If feed is provided, feeders are on the outside. Cows enter and exit in groups. Layout may be long and narrow or diamond shaped. This configuration is by far the most popular.

Parallel - cows stand perpendicular to milkers side by side, milking cups are attached to udders between the hind legs. Layout may be long and narrow or diamond shaped. New and remodeled milking parlors use this configuration to milk more cows in a given area.

Side Opener -cows stand head to tail parallel with the milking pit area. Cow access is through a side-opening gate. A moving carousel may be used to expand the number of cows being milked. Side opener stalls were popular in the 50's and 60's.

Trigon - cows stand perpendicular or herringbone style along a three sided milking area. Many new milking parlors use this configuration.

Polygon - cows stand perpendicular or herringbone style along a five sided milking area. Many new milking parlors use this configuration.

b. Milkings per day - many Arizona dairy operations milk two times per day throughout the year. Others milk two times per day during summer months, and three times per day fall, winter, and spring; increasing the time cows are in the holding and milk parlor areas.

c. The average time cows stay in the milk parlor area contributes to the amount of feces and urine deposited in the milk parlor. Total time (holding and milking) will vary between 45 minutes and 80 minutes per milking for most dairies.

d. Many dairies detail wash teat and udder areas with warm water and paper towel dry before milking cups are connected. Water use varies from selected spot cleaning 1-3 gallons/cow/day to as high as 45 or 50 gallons/cow/day where each piece of feces or spilled feed is chased to a drain. In both cases, the floor and external surfaces of milking equipment are kept clean.

e. Milking parlors are cleaned one, two, or with three milkings per day, three times each day. Some dairy operations detail clean once each day with a more general cleaning between other milkings. Typically a 50 ft. hose and a 1/2-in. nozzle is used, with cleaning time varying from 10-30 minutes each cleaning.

f. Water used for cleaning the milking parlor may be estimated by multiplying time by a known flow rate. To determine flow rate: time how long it takes to fill a five gallon bucket or calculate discharge knowing nozzle pressure and nozzle size. If the latter method is used, be sure to measure nozzle pressure, not line pressure. Nozzle pressure can be measured using a pilot tube and gauge. Hose and nozzle discharge may be estimated using the above table and pressure at the hose valve (faucet) with water flowing.

D-4. Milkroom Equipment, Bulk Tank, and Pipeline Cleaning

a. Stainless steel or glass lined steel pipelines carry milk from each milking position direct to the bulk tank for cooling and storage. Pipelines are cleaned following each milking, using soapy water, disinfectant and clear water rinses. Calculate the volume of water held in pipelines, multiply by the number of washes and rinses, then add 10 to 20% for flow through (changing from one cycle to another).

b. See a above.

c. See a above.

d. Bulk tanks are sized by the pounds of milk (8 ½ lbs./gal.) or by the gallons of milk they hold. Stainless steel bulk storage tanks cool and store milk until it can be picked up by semi truck for transport to a milk processing facility.

e. Milk pickup may be daily, every day and a half, or every other day. Following milk pickup, bulk tank(s) are cleaned using soapy water, water with disinfectant, and clear water. Washing is generally automated but may be done manually.

Bulk Tanks	Total Gallons
Automatic, 3-cycle wash	50-110

Show capacity of tank(s) and unit of measure, total gallons of water used, and frequency of bulk milk pickup or tank washing.

f. Miscellaneous milking equipment is hand washed in a sink after every milking. Water used will be about 25-50 gallons per milking.

g. Milk room walls and floor, bulk tank exterior surfaces, and outside loading slab cleaning usually takes place once each day, or following each milk pickup. Measure or calculate volume of wash water used. Express amount in gallons per day.

D-5. Estimating Effluent Volume

Self-explanatory.

D-6. Collection of Field Information for Site Plan

Refer to *GENERAL Sections G-8 and G-9* for information needed when preparing general and detail AFO facility site plans. Use NRCS-522 or NRCS-523 sheets for recording information inconvenient to show on a site plan.

SWINE

APPENDIX

S-1 . Confirm or Modify General Information - New information often becomes available between the time general information and more site-specific information are collected. Planning changes may result from discussions and site reassessment. Change information on the general worksheet to reflect current thinking and make note of changes in this section.

S-2. Furrowing areas are compartmentalized metal or wood stalls or pens often with wood floors where sows have their litters. Typically the sow has access to only one half of the 35 - 65 square foot area. Heat lamps are used to warm piglets during cool months. BE ESPECIALLY QUIET WHEN ENTERING THIS AREA.

a. - c. Used to determine amount of feces and urine deposited in farrowing area

d. - f. Determine flow rate by the time required to fill a five gallon bucket or measure nozzle pressure and diameter, or use hose and nozzle capacity table in the dairy appendix. In section e. and f. circle, cross out, or check the appropriate time period and number of times per day alleys are flushed. Recycled water should not be used in the farrowing and nursery areas.

S-3. Nursery areas are perhaps the cleanest of furrow to finish areas. Fill in the blanks and circle the number of times daily cleaning takes place.

S-4. Feeder areas may contain weaner pigs and feeders. Weaners and feeders are usually separated from finishers due to difference in feed ration.

S-5. Finishing areas in Arizona are typically open sided buildings with concrete floors and flush alleys. Some swine producers use open feed lot or field grazing.

S-6. Gestation area may be within a building with a concrete floor, an open shelter and concrete slab, or entirely open feed lot. Pregnant sows are separated into small groups to reduce fighting and for management purposes.

S-7. Boar-areas in Arizona are typically individual pens on open earth feedlots. An open sided building provides shade and shelter. If sows are brought to the boars for breeding, boar feces and urine contributes very little, if any to the waste management system. Polluted feed lot runoff must be controlled and disposed of properly.

FEED LOT

APPENDIX

Feed lots are used for many purposes and for all types of livestock (including poultry). In all cases the soil surface is absent of vegetation. Soil surface compaction and a biological seal 14-18" below the soil surface develops to limit the movement of polluted water downward. Polluted surface runoff resulting from precipitation up to the 25 year - 24 hour event should be controlled and disposed of properly. When estimating runoff use curve number 97 for concrete or asphalt areas, and curve number 90 for earth feed lots.

Minimize polluted water volumes by excluding irrigation tailwater and clean surface runoff from entering feed lot areas. Wide low elevation dikes or berms and wide shallow waterways can be very effective. Often times the same area can contain sight and sound barrier plantings and/or roadways. Safe disposal of diverted or intercepted water is essential.

When removing dry manure from feed lot surfaces, leave 1/2 to 1 inch of dry manure to minimize disturbing the highly organic compacted earth surface seal. Coupled with a biological seal that develops under anaerobic conditions under feed lots 14 - 18" below the surface, downward movement of polluted effluent is virtually eliminated.

Uncontrolled polluted surface runoff from feed lots can be a prime source of ground water nitrates. Collection and storage facilities should be designed, constructed and operated in a manner to minimize seepage. Store polluted runoff in or on sealed areas only. Disposal should be by irrigation with IWM or evaporation. Temporary storage on lower elevation feed lot areas using wide low elevation berms or dikes may be most economical.

F-1. Feed Lot Area

a. Number, kind, and weight of livestock controls the amount of feces and urine deposited on the feed lot area.

b. Feed lot area is used to calculate polluted surface runoff.

c. Record or show on sketch feed lot surface drainage direction and slope in ft/ft or ft per 100 ft (%).

d. Some feed lots have concrete or asphalt pads in front of feed managers to improve livestock traffic ability and save feed. If so, surface runoff will be slightly higher. Use runoff curve Number 90 for unsurfaced areas and runoff Curve Number 97 for surfaced area.

e. Use percent concrete plus asphalt and percent earth to establish a weighted curve number for estimating feed lot runoff.

f. Occupation period is used to estimate feces and urine deposited on the feed lot area.

g. Non diverted clean water becomes polluted upon entering feed lot areas. To minimize the amount of polluted runoff to be handled use dikes, berms, ditches, waterways and natural slope to intercept and divert clean runoff. Minimum design capacity of polluted and clean runoff facilities (ditches, dikes, storage ponds, etc.) is runoff expected from 25 year - 24 hour storm event.

h. Total watershed area contributing to polluted runoff is the sum of item (b.) and (g.) above.

i. Feed lot surface drainage is controlled only if collection, transport, and storage facilities are confined and include seepage control.

j. Solid waste in feed lot areas should be removed at least annually. Livestock health and fire may be the biggest hazard.

k. Some feed alleys are flushed with water to clean them instead of mechanical scraping. Usually the water used is wastewater.

SOLID WASTE COLLECTION AND STORAGE

APPENDIX

W-1. Solid waste collection and storage facilities consist of conveyance and storage facilities having sealed surface areas where polluted runoff is controlled. Solids consisting of livestock manure, wasted feed, urine, and bedding (if used) may contain up to 85% moisture, and be handled with normal front loading equipment. Angle of repose for dry stacked solids may vary from 1:1 to 1½ :1 (horizontal : vertical). Wet solids and slurries may be as flat as 10:1. Rapid surface drying minimizes fly propagation.

a. Environmentally, feed lot areas are best for solid storage. Downward water movement is limited and polluted surface runoff can be included with feed lot runoff facilities. Maximum drying and nitrogen reduction may also take place. Fly propagation is minimized. Polluted runoff collection facilities may consist of broad low elevation dikes or berms and broad shallow waterways, a part of the feedlot surface.

b. Solid waste storage areas should be a defined area constructed to minimize environmental degradation.

c. National criteria (EPA and NRCS) require clean and polluted water (effluent) runoff facilities be designed and constructed to control runoff expected from at least a 25 year - 24 hour storm event. (Runoff events with equal or greater than a 4% chance of occurrence in any given year). In most cases it is highly cost effective to exclude clean water from entering a waste management area where it too becomes polluted. Use runoff Curve Number 90 for unsurfaced areas and runoff Curve Number 97 for surfaced feedlot areas.

d. Surface drainage facilities consist of grading surface areas and using ditches, dikes or berms, waterways, pipelines, sumps, etc. to collect, confine and dispose polluted surface runoff.

e. Solid wastes should be removed at least annually to minimize dust, fire, and livestock health problems. SOLID WASTE IS A RESOURCE and maybe used as a soil amendment or fertilizer. With management, screened solids may be feed to other livestock.

f. When removing solid wastes leave 1/2 to 1 inch of waste on the surface of earth lots to avoid disturbing the high organic compacted earth seal that develops at the soil surface. This surface seal coupled with the biological seal that develops under anaerobic condition 14-18" below the surface, virtually eliminates downward movement of polluted water.

EFFLUENT COLLECTION AND STORAGE

(All Livestock Including Poultry)

APPENDIX

Effluent liquids containing up to 4% solids and slurries containing 4-15% solids, result from many confined animal (and poultry) feeding operations (AFO's). Environmentally sound collection, transport, storage, and disposal of effluent (liquid waste) are essential to minimize ground water nitrate loading, odor, and flies. EFFLUENT IS A RESOURCE consisting of water, nutrients, and organic matter; all valuable commodities in Arizona.

E-1. Effluent Collection Facilities

a. Record total length of ditch or pipeline. If manifold, show layout with length and sizes on sketch. Control of effluent begins at the source.

b. Often times a concrete sump or tank is used to collect and store effluent for subsequent pumping to a higher or distant point. By knowing the sump dimensions and the difference between maximum and minimum water surface, the volume pumped per cycle is known. Pump information recorded can be used to obtain a Pump Characteristic Curve or table from the dealer or manufacturer, identifying the operation characteristics (head/capacity) of the pump in use.

c. By knowing the average time to pump the volume of water in b. l. through b.3., a pumping rate can be calculated. Total pumping time per day times this rate will measure effluent discharge. Use a dial type electric clock or AC hour meter wired to the motor or switch side of the electrical circuit to record pumping time for a 7-10 day period; average to the nearest two hour period (0.1 day) for a daily effluent yield.

d. Identify how effluent presently moves from collection to storage.

E-2. Effluent Storage Facilities

a. To create an organic and/or biological seal at and below the soil surface, depth of effluent should be at least two feet. Thus pond liners (i.e., compacted silty clay loam or clay loam blankets or impermeable membranes) should be considered where storage facilities may dry between use cycles. Temporary effluent storage on feed lot surfaces are an exception.

b. This entry is intended to identify the principle type of bacteria involved in the digestion process. Aerobic bacteria use oxygen while anaerobic bacterial activity is reduced in the presence of oxygen. A properly designed and operated aerobic lagoon is odorless. A properly designed and operated anerobic lagoon will usually have some odor but not be objectionable most of the year. All lagoons (or ponds) are aerobic in the top 0-3 feet. Rapid change in effluent depth release the most odor.

c. Some facilities have existing concrete storage tanks. Except for fluctuating water surfaces and very sandy soils, large concrete storage tanks are usually not necessary. Arizona AFOs are large, thus reducing tank storage time to just a few days. A large, open, less than 4 ft. deep concrete tank may be a source of aerobic effluent for hydraulic floor and alley flush system water. With proper design, aerobic water can be pumped from a pond or lagoon surface.

d. The method of earth construction, date of construction, and size are indicative of structure stability. Size is used to calculate surface area for evaporation and precipitation; and volume for biological oxygen demand loading rate, and annual storage. Occasionally ponds and lagoons are not geometrical. Record size in narrative or show on sketch.

e. To complete the RMS, disposal of effluent must be considered. In Arizona, the three listed methods of disposal are the only accepted alternatives.

f. Most dairies use solid separation to remove some of the solid waste from the wastewater coming from the milk parlor/holding area. The solids are usually applied with the solids scraped from the feed lots.

MEASURING EFFLUENT DISCHARGE FROM FACILITIES

APPENDIX

A. Continuous Discharge: Continuous and steady effluent discharge rates may be measured:

1. In open channels or partially filled pipelines by:
   a. Modified Broadcrested Weir (Replogle) measuring flume or other appropriate flow-measuring device.
   b. Five gallon bucket (or other know capacity container) and watch.
2. In full pipe flow by:
   a. Orifice Plates
   b. Venturi flow meters.
   c. Sonic flow meters.

B. Intermittent Discharge

Intermittent or cyclic discharge measurements are a combination of volume and frequency; or flow rate, time, and frequency.

1. Measuring volume for intermittent discharge:
   a. Measure receiving sump length and width or diameter and multiply by the change in water surface (maximum minus minimum water surface elevation).
   b. If the sump is irregular in shape, average maximum and minimum water surface areas and multiply by the change in water surface elevation.
2. Measuring frequency for intermittent discharge:
   a. Often the manager has an estimate of frequency (i.e., how many cycles occur while cleaning, such as average two cycles every three hours, etc.).
   b. Frequency may be calculated using total pump operation time per day divided by the time it takes to pump effluent each cycle.
3. Flow rate for each cycle can be measured in open channels or partially filled pipelines by:
   a. Modified Broadcrested weir (Replogle) measuring flume or other appropriate flow measuring devices.
   b. Five gallon bucket (or other known capacity container) and watch.
   c. Portable flow measuring devices (i.e., sparling flow meters, or face plates, or current meter).
   d. If the discharge flow rate can not be measured, a discharge estimate can be made using pump characteristic curves and Total Dynamic Head (TDH). Pump operational characteristics (or performance) is shown by curves or tables prepared by the manufacturer. Pump make, model number, kind or type, shaft rpm, and impeller diameter create a head/discharge relationship characteristic of only one pump. Thus by calculating TDH, including pump friction loss, pump/system discharge may be known. Request pump characteristic curves or tables from the pump dealer or manufacturer.
4. Pump time can be measured using a dial type electric clock or AC hour meter wired into the switch side of the pump motor electric circuit. When the pump motor runs, the clock runs. Measure operation for a 7-10 day period, then average for daily operation time. A QUALIFIED PERSON MUST MAKE ALL ELECTRIC CONNECTIONS.

5. A less accurate, but conservative, method to estimate effluent discharge from facilities is to estimate the volume of water pumped by the supply well(s). Some AFO facilities have a flow meter on the water supply.

   Knowing the supply pump kind, make, model number, number of impellers, impeller diameter, shaft rpm and Total Dynamic Head (THD); supply pump discharge may be estimated. Discharge rate times the hours per day pump operation gives a gross volume of water used. A dial-type electric clock, AC hour meter, or a separate electric kilowatt-hour meter may be used to estimate time of pump operation. Take measurements for 7-10 days to calculate a reasonable daily average.

   Using nameplate pump discharge is not recommended. Water table elevation, plumbing to and from the pump, and impeller wear are variables affecting pump discharge.

   Deduct water lost by evaporation and non-AFO uses (i.e., domestic use, landscape irrigation, etc.). Deduct livestock drinking water if total manure (feces and urine) production is estimated.