NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

SOLID/LIQUID WASTE SEPARATION FACILITY

(No.)

CODE 632

DEFINITION

A filtration or screening device, settling tank, settling basin, or settling channel used to separate a portion of solids from a liquid waste stream

PURPOSE

To partition solids, liquids, and their associated nutrients as part of a conservation management system to:

- Improve or protect air quality
- Improve or protect water quality
- Improve or protect animal health
- Meet management objectives

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where solid/liquid separation will:

- Remove solids from the liquid waste stream as a primary treatment process and allow further treatment processes to be applied such as composting and anaerobic digestion
- Allow partly digested feed to be separated from the liquid waste stream so that it can be used for bedding
- Reduce problems associated with solids accumulation in liquid storage facilities
- Reduce solids in stored liquids so liquids can be recycled for other uses (for example, flush water)
- Reduce solids in stored liquids to better facilitate land application of liquids using irrigation techniques
- Assist with partitioning nutrients in the waste stream to improve nutrient management

CRITERIA

General Criteria Applicable to All Purposes

Laws and regulations. Waste treatment facilities must be planned, designed, and constructed to meet all federal, state, and local regulations.

Location. Solid/liquid separation facilities shall be located so that the waste stream can be safely routed to and from the facilities.

Solid/liquid separator selection. Table 1 provides guidance on the different types of solid/liquid separators available. Capture efficiency varies widely for each type of separator depending on the type and consistency of the waste to be treated. The type of solid/liquid separator selected shall be based on site-specific data for the liquid waste stream and management conditions where specific management objectives are to be met.

Solid/liquid separation efficiency. The volume of solids separated shall be based on estimates of daily wastewater volume and the total solids capture efficiency for the type of solid/liquid separation device selected. Where manufacturer's information or local data concerning total solids capture efficiencies are not available for the type of solid/liquid separation device selected, the efficiencies in Table 1 can be used to estimate the volume of separated solids generated.

Chemical amendments. Guidance for the addition of chemicals to the liquid waste stream for improving total solids capture efficiencies is given in Conservation Practice Standard 591, Amendments for Treatment of Agricultural Waste.

Table 1

Solid/Liquid Separators	Total Solids Capture Efficiency
Static Inclined Screen	10-20%
Inclined Screen with Drag Chain	10-30%
Vibratory Screen	15-30%
Rotating Screen	20-40%
Centrifuge	20-45%
Screw or Roller Press	30-50%
Settling Basin	40-65%
Weeping Wall	50-85%
Dry Scrape	50-90%
Geotextile Container	50-98%

Storage of separated solids. Adequate storage areas shall be provided for separated solids so they can be properly managed. Temporary storage areas shall be provided for separated solids unless they are transported directly from the separator to the final utilization location (for example, off-site composter). Storage facilities for separated solids shall be designed in accordance with requirements of Conservation Practice Standard 313, Waste Storage Facility. All seepage from solid storage facilities shall be directed to short- or long-term liquid storage facilities.

Outlets. The outlet capacity for a solid/liquid separation facility shall be capable of safely conveying the design capacity to a storage or utilization location.

Outlets may include pipelines, perforated or slotted pipe risers, porous plank walls or dams, or screened walls. Screening used to separate solids at the outlet of settling basins should provide at least 10 percent open area. Refer to Conservation Practice Standard 634, Manure Transfer for guidance in designing pipelines for wastewater transfer.

Emergency overflow appurtenances such as notched weirs or pipe bypasses can be used to control flows exceeding design capacity. Emergency overflow appurtenances shall be designed to pass the peak runoff from the drainage area of the facility for a 25-year, 24-hour storm frequency plus the normal waste stream discharge. Flood routing techniques can be used to determine the size of emergency overflow appurtenances needed to handle the peak runoff.

Any discharge from the solid/liquid separation facility must be captured in a waste storage or treatment structure unless it meets local, state, and federal regulations regarding discharge to surface and ground waters.

Structural design. Structural components such as walls and slabs shall be designed in accordance with applicable requirements of Conservation Practice Standard 313, Waste Storage Facility.

Additional Criteria for Prefabricated Filtration or Screening Devices

Flow rate. The design flow rate (combined flow of solid and liquid waste) for filtration and screening devices shall be in accordance with the manufacturer's recommendations.

Velocity. The liquid waste stream velocity through filtration and screening devices shall be in accordance with the manufacturer's recommendations.

Structural design. Structural supports for filtration and screening devices shall be designed in accordance with the requirements of Conservation Practice Standard 313, Waste Storage Facility.

General Criteria Applicable to Settling Basins

Velocity. The liquid waste stream velocity through settling basins shall not exceed 1.5 feet per second using the 25-year, 24-hour runoff event.

Depth. The total depth for settling basins that are to be cleaned out using conventional front-end loading equipment shall not exceed 5 feet. Safety concerns during cleanout shall be addressed where the total depth for settling basins will exceed 5 feet. The total depth of earthen settling basins shall be based on the sum of the depth needed for liquids and solids storage plus 1 foot of freeboard.

The total depth of concrete settling basins shall be based on the sum of the depth needed for liquids and solids storage.

The minimum liquid depth of settling basins shall be based on a minimum hydraulic retention time and the solids settling rate. A minimum hydraulic retention time of 30 minutes shall be used except where sand is a major component of the liquid waste stream. Where sand is a major component in the liquid waste stream, the hydraulic retention time shall be a minimum of 3 minutes and a maximum of 5 minutes.
The maximum solids settling rate (how fast the water level drops) that is used for design shall be 4 feet per hour for settling basins with a total storage depth greater than 2 feet and 2 feet per hour for settling basins with a total storage depth equal to or less than 2 feet.

Bottom width. The minimum bottom width for settling basins shall be 10 feet. Settling basins shall be designed to control seepage as necessary to protect water resources and meet applicable laws and regulations.

A settling basin not utilizing a concrete slab for the basin floor shall be designed to provide adequate support for clean out equipment.

Access. The minimum top width of earthen embankments for settling basins shall be 15 feet where equipment access is needed for clean out. Where no access is needed for clean out, the minimum top width shall be governed by the equipment used to construct the embankment or berm, but shall not be less than 4 feet.

The side slopes of earthen embankments shall be no steeper than 3 horizontal to 1 vertical (3:1).

Access ramps to allow entry into the basin for clean out by normal front end loading equipment shall be no steeper than 10:1. Steeper slopes may be allowed where special surfacing of the ramp is done for traction purposes and the equipment used can accommodate the steeper slope, but in no case, shall the access ramp be steeper than 4:1. The slope for ramps with special surfaces will be evaluated on a case by case basis.

Additional Criteria for Settling Basins Receiving Lot Runoff

Falling into this category are settling basins that include significant external drainage and are used in conjunction (with or without screening) to remove waste solids from process-generated liquid waste streams (for example, flush water from covered freestall barns or milking parlor wastewater).

Flow rate. The design flow rate into a settling basin that receives lot runoff shall be based on the normal liquid waste stream discharge from the operation plus the peak runoff from the drainage area of the basin using the 25-year, 24-hour storm event. The flow rate out of the settling basin shall be based on the detention time and the volume of the settling basin.

Volume. The design volume for settling basins receiving lot runoff shall be based on the volume needed for flood routing the runoff from the 25-year, 24-hour storm event plus the solids storage. The procedure in Colorado Engineering Technical Note 26, Feedlot Runoff Treatment System, can be use to estimate the volume for solids storage. Where no specific information is available on solids accumulation rates from lot surfaces, use 0.05 cubic foot per square foot per month for unpaved lots and 0.01 cubic foot per square foot per month for paved lots. These values should be increased by 50 percent if lots are steep or poorly maintained.

Where a diversion is used to settle solids from open lot runoff, an earthen bottom can be used. The diversion must function as a conveyance structure. Unlined conveyance structures shall meet the requirements in the Colorado Department of Public Health and Environment, Regulation 81.

Additional Criteria for Settling Basins That Exclude Lot Runoff

Falling into this category are settling basins that do not receive significant external drainage and are used in conjunction (with or without screening) to remove waste solids from process-generated liquid waste streams (for example, flush water from covered freestall barns or milking parlor wastewater).

Flow rate. The design capacity for a settling basin that excludes lot runoff shall be based on the normal liquid waste stream discharge from the operation.

Volume. The design volume for settling basins that exclude lot runoff shall be the volume needed to provide solids storage for a specified treatment period plus temporary liquid storage necessary during dewatering. Minimum temporary liquid storage shall be based on the volume of the liquid waste stream for 1 day.

CONSIDERATIONS

Location. When locating solid/liquid separation facilities, consider elevation changes and the distance from the source of material to be separated and the location of long-term liquid and solid waste storage facilities. Location of solid/liquid separation facilities should take advantage of gravity flow wherever possible. Other considerations for locating solid/liquid separation facilities include vehicle access, wind direction, neighboring dwellings, proximity of streams and flood plains, and visibility.

Solid Storage Depth. Limit solid storage depth to 2 feet in facilities where additional drying of solids is desired between clean out intervals.

Weeping walls. To maximize drainage and solid/liquid separation, weeping walls should be used on the entire perimeter of the waste to be treated. Drainage paths should be maintained to and through the walls. Ensure drainage is transferred to a liquid storage facility. The design of weeping walls should address structural concerns and durability issues.

Wastewater transfer piping. It is standard practice to route flow to and from a solid/liquid separation facility using underground and above ground pipe. Refer to Conservation Practice Standard 634, Manure Transfer, for guidance in designing pipelines for wastewater transfer.

Visual screening. Vegetative screens or other methods should be considered to shield solids separation facilities from public view and for more aesthetic conditions.

Rainfall. Rainfall falling on the solids storage areas associated with solid/liquid separation facilities can result in increased wastewater discharge into the long-term storage facility. Runoff from these open storage areas should be included in the volume of the reception pond. Covering of solids storage facilities should be considered in locations where rainfall will hinder the proposed function of the system.

Operation and maintenance. Where sand is a major component of the liquid waste stream, special emphasis should be given to abrasion-resistant, waste-transfer piping and pumps to reduce frequency of repairs.
The owner and operator should understand the level of operation and maintenance required to ensure that the type of separator selected will be operated as intended.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared in accordance with the criteria of this standard and good engineering practice. The plans and specifications shall include all details necessary for construction and completion of the solid/liquid separation facilities. As a minimum, the plans and specifications shall provide the following:

1. Layout of waste production facilities, waste, collection points, waste transfer pipelines, waste treatment and storage facilities
2. Location of all inflow and discharge pipelines and a description of pipeline materials, diameter, and slope;
3. Details of support systems for solid/liquid separation devices;
4. Fencing and signage as appropriate for safety purposes; and
5. Operating characteristics

Warranties. The contractor shall provide a one-year warranty on all construction. If a manufactured solid/liquid separation device is installed, the manufacturer shall provide a warranty that describes the design life of the device and what the warranty covers.

OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan shall be developed and reviewed with the owner and operator prior to constructing the solid/liquid separation facility. The O&M plan shall be consistent with the purposes of the solid/liquid separation device chosen, its intended life, safety requirements, and the criteria for its design.

The plan shall contain O&M requirements including but not limited to the following:

1. Documentation of design assumptions;
2. Design capacity for the facility;
3. A description of normal operation of the facility, safety issues, and normal maintenance items;
4. Alternative operation procedures in the event of equipment failure; and
5. Daily inspection of the following:
   - Separation device and support structure;
   - Screens and outlets;
   - Remaining capacity in storage facilities;

6. Maintenance requirements for all components;
7. Solid and liquid removal methods necessary to prevent damage to geosynthetic, compacted soil or geomembrane liners; and
8. Repair methods for geosynthetic, compacted soil or geomembrane liners in the event the material is damaged.

REFERENCES

1. Burns, R.T. and Moody, L.B.. 2003. Development of a Standard Method for Testing Mechanical Manure Solids Separators. ASAE-CIGR Meeting Paper No. 034131. St. Joseph, MI.: ASAE

2. Midwest Plan Service Handbook 18, Livestock Waste Facilities Handbook, Third Edition, 1993.

3. Colorado Department of Public Health and Environment, Regulation 81, Animal Feeding Operations control Regulation.

4. USDA/NRCS, National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook. 1992, last revised, June 1999.

5. USDA-NRCS, Colorado Engineering Technical Note 26, Feedlot Runoff Treatment System, January 2003.

6. USDA-NRCS, Colorado Field Office Technical Guide, Conservation Practice Standard 591, Amendments for Treatment of Agricultural Waste.

7. USDA-NRCS, Colorado Field Office Technical Guide, Conservation Practice Standard 313, Waste Storage Facility.

8. USDA-NRCS, Colorado Field Office Technical Guide, Conservation Practice Standard 634, Manure Transfer.

9. USDA-NRCS, Colorado Field Office Technical Guide, Conservation Practice Standard 350, Sediment Basin.