**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 as a feed supplement or 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 (i.e. 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 facility.

**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 waste water volume and the total solids capture efficiency for the type of solid/liquid separation device selected. Where manufacturer 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 (i.e. offsite 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% open area.

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. 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.

**Additional Criteria for 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.

**Depth.** The total depth for settling basins that are to be cleaned out using conventional front end loading equipment shall be 5 feet or less. 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 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.

Where settling basins are not used for dewatering, an earthen bottom can be used (i.e. level diversion).

Settling basins used for dewatering shall be constructed of concrete and/or lined with a geosynthetic, compacted soil, or geomembrane liner meeting applicable local 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. A settling basin constructed according to these criteria shall also meet appropriate criteria in Conservation Practice Standard 313, Waste Storage Facility.

**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 2 horizontal to 1 vertical (2:1) or greater. For earthen embankments greater than 3 feet in height, the side slopes shall be no steeper than 3:1 on the outside and 2:1 on the inside of the embankment.

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 shall 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.

**Additional Criteria for Settling Basins Receiving Lot Runoff**

Settling basins used in conjunction with or without screening to remove waste solids from process generated liquid waste streams (i.e. flush water from covered freestall barns, or milking parlor waste water) that include significant external drainage fall into this category.

**Flow rate.** The design flow rate for 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 computed using a 10 year-1 hour storm frequency.

**Volume.** The design volume for settling basins receiving lot runoff shall be based on the total depth needed for liquid and solids storage and the minimum surface area required for the basin. Where no specific information is available on sludge accumulation rates from lot surfaces, use 0.05 cubic feet per square foot-Month for unpaved lots and 0.01 cubic feet per square foot-Month for paved lots. These values should be increased by 50% if lots are steep or poorly maintained.

**Additional Criteria for Settling Basins that Exclude Lot Runoff**

Settling basins used in conjunction with or without screening to remove waste solids from process generated liquid waste streams (i.e. flush water from covered freestall barns, or milking parlor waste water) and do not receive significant external drainage fall into this category.

**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 one-day.

## CONSIDERATIONS

**Location.** Locating solid/liquid separation facilities should consider elevation and 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 floodplains, and visibility.

**Weeping Walls.** To maximize drainage and solid/liquid separation, weeping walls should be used on the entire perimeter of the waste to be treated and drainage paths maintained to and through the walls. Ensure drainage is transferred to a liquid storage facility.

**Waste Water 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 waste water 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 waste water discharge into the long term storage facility. Covering of solids storage facilities should be considered in locations where high rainfall amounts occur.

**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 (O&M) required ensuring 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.
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 operation and maintenance requirements including but not limited to:

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.
5. Daily inspection of the following:

- Separation device and support structure.
- Screens and outlets.
- Remaining capacity in storage facilities.

**REFERENCES**

1. USDA/NRCS, National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook.1992, Last revised, June 1999.
2. Mid West Plan Services Handbook 18, Livestock Waste Facilities Handbook, Third Edition, 1993.
3. 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