NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

AGRICHEMICAL HANDLING FACILITY

(no.)
CODE 702 CA INTERIM

DEFINITION

An Agrichemical Handling Facility (AHF) is a permanent structure used in the mixing, loading, unloading, and rinsing operations involved in the handling of on-farm chemicals, such as pesticides and fertilizers.

PURPOSES

To provide for capture, collection, recovery, and storage of agrichemical spills and rinsate in order to minimize the potential for pollution.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where (1) current methods of mixing agrichemicals and rinsing of equipment are polluting or have the potential for polluting resources and (2) nutrient and/or pest management plans have been developed which include the reuse or disposal of materials resulting from operation of the AHF.

CRITERIA

General

The containment structure shall be comprised of a concrete pad, a depressed catchment sump, and storage tanks(s). It shall also include all necessary equipment for pumping, transferring and storing contaminated water that has been collected in the catchment sump. Roofing the facilities are not required but highly recommended.

Measures shall be included to divert runoff from adjacent areas resulting from a 100-year, 24 hour duration storm event.

The AHF shall not be located on floodplains unless it is protected from inundation or damage from a 100-year flood event and shall be located outside wetland areas.

Except for access, the surface perimeter of the concrete pad shall be a minimum of 6 inches above the surrounding ground surface. Access shall be a graveled or paved ramp with a maximum slope of 15 percent (6.5:1). All other areas around the pad shall be established with vegetation if practical.

All concrete materials shall comply with the requirements of ACI 318.

The containment volume for a roofed AHF shall be 125 percent of the volume of the largest spray equipment tank that will be used on the pad plus the volume of the 2-year 24-hour storm event on the surface of the concrete pad area.

The facility and components shall comply with applicable federal, state and local laws and regulations.

Concrete pad

The concrete pad shall be designed as a slab-on-grade with a positive slope of at least 2 percent (1/4 inch per foot) from all areas toward the catchment sump.

The concrete pad shall be curbed at its edges to prevent runoff and run-on.

The minimum dimensions of the concrete pad shall be sufficient to accommodate the existing or anticipated equipment.

The required thickness and reinforcement of the slab shall be designed for wheel loads of the existing or anticipated equipment. Design should be based on methods described in ACI 360R. "Design of Slabs on Grade" or other similar industry guides. The slab shall be designed to minimize cracking. Joints will be designed with appropriate water stops.

Catchment Sump

The catchment sump provides the facility a collection point for spillage, rinsate, sediment, and other debris. Its size should be kept to the minimum necessary to serve the purpose. The catchment sump shall be watertight and constructed of non-corrodible material such as monolithically-poured concrete, plastic, coated steel and fiberglass. It shall be covered with corrosion resistant grating of sufficient size to allow access for cleaning. Design loadings for the grate shall be the wheel loads used in design of the pad.

Roof. The roof, if provided, shall cover the entire AHF and shall extend sufficiently to prevent precipitation from accumulating on the concrete pad.

The minimum clearance between the lowest chord of the roof and highest area on the concrete pad shall provide clearance for the spray equipment and shall not be less than 10 feet.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard contact your Natural Resources Conservation Service State Office, or download it from the electronic Field Office Technical Guide for your state.

The roof shall be designed for the minimum loads contained in ASAE EP288.4, "Agricultural Building Snow and Wind Load."

Pump. The pump shall be properly anchored and be corrosion resistant.

Storage tank(s). Provision shall be made for storage containment volume of the AHF. This volume may be provided with storage tank(s) dedicated to this purpose used alone or in combination with spray equipment tanks or other farm tanks that are reliably available.

Dedicated storage tank(s) shall be permanently installed above the grade of the concrete pad or an adjacent concrete pad and shall be constructed of non-corrosive material(s).

Piping. Piping shall be made of corrosion resistant materials. Piping and pump(s) used for transfer of contaminated water shall be designed for ease of inspection and replacement. To this end, piping and pump(s) shall be located above the grade of the concrete pad and catchment basin to the greatest extent possible. Design shall also consider recovery leakage from piping should it occur by locating it within the boundaries of the concrete pad or by other means.

A principal backflow prevention valve that complies with local plumbing codes shall be installed as close to the pad as possible on the main clean water line serving the pad before cross connecting with contaminated sources or other non-potable water supplies. Backflow prevention devices shall also be installed between the pump and the storage tank(s) and between the storage tank(s) and spray equipment.

Piping and pumps(s) shall be designed to facilitate drainage for winter shutdown.

CONSIDERATIONS

Consideration shall be given to the following;

1. Availability of water and distance to water sources
2. On-farm traffic patterns and accessibility to chemical application areas and chemical storage.
3. Adjacent to land uses and visibility
4. Effects of chemical drift on surrounding areas due to prevailing winds.
5. Need for an emergency area with a faucet and a shower with a pull chain, for the washing to eyes, face and body in the event of an accidental exposure to chemicals.
6. Need for a loading platform to facilitate the filling and/or rinsing of spray equipment.
7. Compatibility of architecture and materials with surrounding buildings.
8. Proximity of wells, surface water, waterlines, property lines, roads, and populated buildings.
9. Impact on existing cultural resources.
10. Applicable Federal, State and local laws and regulations.

Water Quantity

This practice is considered to have no effect on the amount of water.

Water Quality

This practice principally reduces the availability of agrichemicals that could pollute surface water by providing a central location for handling and storage of chemicals.

Cultural Resources Considerations

NRCS’s objective is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice will have any effect on any cultural resources.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

GM 420, Part 401, the California Environmental Handbook and the California Environmental Assessment Worksheet provide guidance on how the NRCS must account for cultural resources. The Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

Endangered Species Considerations

Determine if installation of this practice, along with any others proposed, will have an effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern, or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates that the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and/or California

Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

Some species are year-round residents in some streams, such as, freshwater shrimp. Other species, such as steelhead and salmon, utilize streams during various seasons. Be aware that critical periods, such as spawning, eggs in gravels and rearing of young may preclude activities in the stream that may directly affect the stream habitat during those periods. For example, there should be no disturbance of stream gravel beds that may have eggs in them. That could include any equipment in the stream or even walking in the stream or work upstream that may result in sediment depositing in the gravel beds. Document any special considerations for endangered species in the Practice Requirements Worksheet.

PLANS AND SPECIFICATIONS

The construction drawings and specifications developed for AHF's shall comply with this standard. The following statement shall appear on the cover sheet of all construction drawings for AHF's:

"Management of chemicals is the responsibility of the owner/operator and will be done in accordance with applicable federal, state, and local laws and regulations."

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed that is consistent with the purposes of the AHF, its intended life, and the criteria for design. The plan shall address:

1. Emptying storage tank(s) to accommodate accidental spills and rinsate prior to mixing and rinsing events.
2. Emptying and cleaning the catchment sump and concrete slab after spills or rinsing events.
3. Proper disposal/use of rinsate, exterior washway accumulated sediment and spillage water in accordance with the chemical's label requirements and federal, state, and local laws and regulations.
4. Periodic inspection of piping, pump(s) and testing backflow prevention devices.
5. Inspection for repair of cracks in concrete slab and catchment sump.
6. Proper precautions to reduce worker exposure in operation of the AHF.
7. Emergency response instructions in case of an accidental chemical spill, exposure, fire or other incident that could adversely affect environmental health.
8. Posting of signs that warn that hazardous chemicals are present.
9. Posting a condensed version of proper operating procedures for the AHF that is weather proof and easily noticed.

U.S DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
CALIFORNIA

PRACTICE REQUIREMENTS
FOR

CALIFORNIA INTERIM
702 – AGRICHEMICAL HANDLING FACILITY

For: Business Name_____

Job Location_____

County_____ RCD_____ Farm/Tract No._____

Referral No._____Prepared By_____ Date_____

IT SHALL BE THE RESPONSIBILITY OF THE OWNER TO OBTAIN ALL NECESSARY PERMITS AND/OR RIGHTS, AND TO COMPLY WITH ALL ORDINANCES AND LAWS PERTAINING TO THIS INSTALLATION.

Installation shall be in accordance with the following drawings, specifications and special requirements. NO CHANGES ARE TO BE MADE IN THE DRAWINGS OR SPECIFICATIONS WITHOUT PRIOR APPROVAL OF THE NRCS TECHNICIAN.

1. Drawings, No._____ _____ _____

2. Practice Specifications_____,_____,_____

3. Special Requirements:_____

_____

_____

_____

_____

_____

4. Special Maintenance Requirements:_____

_____

_____

PRACTICE APPROVAL:

Job Classification: (Ref: Section 501 NEM)

Show the limiting elements for this job. This job is classified as, Class _____

Limiting elements:	Units
Tank Storage Volume _____	_____gal
_____	_____
_____	_____.
_____	_____

Design Approved by:_____ Date:_____

LANDOWNER'S/OPERATOR'S ACKNOWLEDGEMENT:

The landowner/operator acknowledges that:

a. He/she has received a copy of the drawings and specification, and that he/she has an understanding of the contents, and the requirements.

b. He/she has obtained all the necessary permits.

c. No changes will be made in the installation of the job without prior concurrence of the NRCS technician.

d. Maintenance of the installed work is necessary for proper performance during the project life.

Accepted by:_____ Date:_____

PRACTICE COMPLETION:

I have made an on site inspection of the site (or I am accepting owner/contractor documentation), and have determined that the job as installed does conform to the drawings and practice specifications.

Completion Certification by:

/s/_____ Date _____

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

702 – CA INTERIM
AGRICHEMICAL HANDLING FACILITY

OPERATION AND MAINTENANCE

Sponsor/Land user: _____ Date: _____

Address: _____

_____

Location GPS Coordinates Map Datum: _____ E _____ N _____

Quad Sheet Name _____ SEC _____ T _____ R _____

A properly operated and maintained agrichemical handling facility is an asset to your farm. This facility was designed and installed to capture, collect, recover, and to provide storage of agrichemical spills and rinsate in order to minimize the potential for pollution. The estimated life span of this installation is at least 10 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program.

This practice will require you to perform periodic operation and maintenance to maintain satisfactory performance. Here are some recommendations to help you develop a good operation and maintenance program.

GENERAL RECOMMENDATIONS

- Do not allow human entry to any enclosed structure without appropriate safety equipment. Maintain appropriate warning signs.
- Inspect safety items twice a year and repair or replace as necessary.
- Ensure that all warning signs and safety instructions are posted in a visible location and in readable condition. Repair or replace as necessary. (Signage may include the following but are not limited to this list.)
  - Proper precautions to reduce worker exposure in operation of the AHF
  - Emergency response instructions in case of an accidental chemical spill, exposure, fire or other incident that could adversely affect environmental health.
  - Signs that warn that hazardous chemicals are present.
  - Condensed version of proper operating procedures for the AHF that is weather proof and easily noticed.

- Empty storage tank(s) to accommodate accidental spills and rinsate prior to mixing and rinsing events.
- Empty and clean the catchment sump and concrete slab after spills or rinsing events.
- Dispose or use rinsate, exterior washway accumulated sediment and spillage water in accordance with the chemical's label requirements and federal, state, and local laws and regulations.
- Maintain all pumps, agitators, piping, valves and all other electrical and mechanical equipment in good operating condition by following the manufacturer's recommendations. Repair as necessary.
- Test backflow prevention devices. Repair or replace as necessary.
- Repair spells, cracks and weathered areas in concrete surfaces.
- Repair or replace rusted or damaged metal and apply paint as a protective coating.
- Maintain grounding rods and wiring for all electrical equipment in good condition.
- Inspect haul roads and approaches to and from the Agricultural Handling Facility frequently to determine the need for stabilizing materials.
- All fences, railings, and/or warning signs shall be maintained to prevent unauthorized human or livestock entry.
- Immediately repair any vandalism, vehicular, or livestock damage.
- Inspect for damage from rodents or burrowing animals. Repair any damage. Take appropriate corrective actions to alleviate further damage.

SPECIFIC RECOMMENDATIONS FOR YOUR AGRICULTURAL HANDLING FACILITY

CONTACT YOUR LOCAL NATURAL RESOURCES CONSERVATION SERVICE OFFICE FOR ANY ADDITIONAL TECHNICAL ASSISTANCE YOU MIGHT NEED FOR IMPLEMENTATION OF THIS OPERATION AND MAINTENANCE PLAN FOR YOUR AGRICULTURAL HANDLING FACILITY.

STATEMENT OF WORK
CA Interim
Agrichemical Handling Facility (702)

These deliverables apply to this individual practice. For other planned practice deliverables refer to those specific Statements of Work.

DESIGN

Deliverables:

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
    a. Practice purpose(s) as identified in the conservation plan.
    b. List of required permits to be obtained by the client.
    c. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06).
    d. List of facilitating practices
    e. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
        i. Geology and Soil Mechanics (NEM Subpart 531a).
        ii. Storage Volume and Maximum Operating Level.
        iii. Structural, Mechanical and Appurtenances.
        iv. Maximize Clean Water Diversion.
        v. Environmental Considerations (e.g. liner failure, location, breaching, air quality).
        vi. Safety Considerations (NEM Part 503- Safety, Subpart A, 503.06 through 503.12).
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
3. Design Report and Inspection Plan as appropriate (NEM Part 511, Subpart B Documentation, 511.11 and Part 512, Subpart D Quality Assurance Activities, 512.30 through 512.32).
4. Operation and Maintenance Plan
5. Certifications that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03(b)(2)).
6. Design modifications during installation as required.

INSTALLATION

Deliverables

1. Pre Installation conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to inspection plan as appropriate).
    a. Actual materials used.
    b. Inspection records
5. Facilitate and implement required design modifications with client and original designer.
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meet design and permit requirements.

STATEMENT OF WORK
CA Interim
Agrichemical Handling Facility (702)

CHECK OUT

Deliverables

1. As-Built documentation.
    a. Extent of practice units applied
    b. Drawings
    c. Final quantities
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03(c)(1)).
3. Progress reporting.

REFERENCES

- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard – CA Interim – Agrichemical Handling Facility, 702
- NRCS National Engineering Manual (NEM).
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

POND
(No.)
CODE 378

DEFINITION

A water impoundment made by constructing an embankment or by excavating a pit or dugout.

In this standard, ponds constructed by the first method are referred to as embankment ponds, and those constructed by the second method are referred to as excavated ponds. Ponds constructed by both the excavation and the embankment methods are classified as embankment ponds if the depth of water impounded against the embankment at the auxiliary spillway elevation is 3 feet or more.

PURPOSE

To provide water for livestock, fish and wildlife, recreation, fire control, and other related uses, and to maintain or improve water quality.

CONDITIONS WHERE PRACTICE APPLIES

This standard establishes the minimum acceptable quality for the design and construction of low-hazard ponds where:

1. Failure of the dam will not result in loss of life; damage to homes, commercial or industrial buildings, main highways, or railroads; or in interruption of the use or service of public utilities.
2. The product of the storage times the effective height of the dam is less than 3,000. Storage is the volume, in acre-feet, in the reservoir below the elevation of the crest of the auxiliary spillway. The effective height of the dam is the difference in elevation, in feet, between the auxiliary spillway crest and the lowest point in the cross section taken along the centerline of the dam. If there is no auxiliary spillway, the top of the dam is the upper limit.
3. The effective height of the dam is 35 feet or less, and the dam is hazard class (a).
4. For class "a" dams with a height-storage product greater than 3,000, and for class "b" and "c" dams, the design criteria shall be the more restrictive of the criteria set forth herein or as outlined in TR-60.
5. Hazard classification shall be documented by the procedures in NEM, Section 520.23(b), CA-Supplement.

GENERAL CRITERIA APPLICABLE TO ALL PONDS

All Federal, State and local requirements shall be addressed in the design.

A protective cover of vegetation shall be established on all exposed areas of embankments, spillways and borrow areas as climatic conditions allow, according to the guidelines in conservation practice standard 342, Critical Area Planting.

Site conditions. Site conditions shall be such that runoff from the design storm can be safely passed through (1) a natural or constructed auxiliary spillway, (2) a combination of a principal spillway and an auxiliary spillway, or (3) a principal spillway.

Drainage area. The drainage area above the pond must be protected against erosion to the extent that expected sedimentation will not shorten the planned effective life of the structure. The drainage area shall be large enough so that surface runoff and groundwater will provide an adequate supply of water for the intended purpose unless an alternate water source exists to serve this purpose. The quality shall be suitable for the water's intended use.

Reservoir area. The topography and geology of the site shall permit storage of water at a depth and volume that will ensure a dependable supply, considering beneficial use, sedimentation, season of use, and evaporation and seepage losses. If surface runoff is the primary source of water for a pond, the soils shall be impervious enough to prevent excessive seepage losses or shall be of a type that sealing is practicable.

Water Rights

It is imperative that any owner planning to construct a facility to store runoff water be advised that the state water code requires filing for a water right, regardless of the amount of that storage.

Such a filing is made to the Water Rights Division of the California Water Resources Control Board. The Board may require a conduit or other satisfactory means to enable water to pass through the embankment or other barrier creating the storage. The requirement for a conduit cannot be prejudged. It is determined by the Board based on the circumstances of each individual situation.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard contact your Natural Resources Conservation Service State Office, or download it from the electronic Field Office Technical Guide for your state.

It is the responsibility of the owner to file for the water rights and advise NRCS of the Board's decision on the requirements for a conduit. The owner should also be advised of the possible need for other local, state or federal permits.

DESIGN CRITERIA FOR EMBANKMENT PONDS

Geological Investigations. Pits, trenches, borings, review of existing data or other suitable means of investigation shall be conducted to characterize materials within the embankment foundation, auxiliary spillway and borrow areas. Soil materials shall be classified using the Unified Soil Classification System.

The embankment foundation shall be investigated, thoroughly and to the depth required, to determine the following:

1. Depth to competent impervious layer.
2. Ability of the foundation to withstand load.
3. Seepage potential through the abutments and foundation.

The emergency spillway shall be investigated to determine the following:

1. The suitability of the material as a borrow source.
2. The potential for the spillway to erode.
3. The difficulty of excavation.

The borrow areas shall be defined by at least three pits, trenches, or borings. Quantities of borrow volumes shall be computed based upon the site investigation. The minimum borrow volume, excluding waste, shall exceed the embankment volume by 1.5.

The borrow operation shall not be permitted closer than 50 feet from the upstream toe of the embankment except where the cutoff trench extends into firm impervious material for its entire length.

Since all of California is classified as a high seismic area, appropriate design measures shall be incorporated into the design of each embankment as a defensive measure for earthquakes (NEM 520.24(a) (1). Examples of such design measures that would help the embankment withstand seismic loads include:

1. Constructing the embankment of compacted clayey materials.
2. The addition of a berm (or berms).
3. Increase the embankment top width.
4. Include an embankment drain.

Foundation cutoff. A cutoff of relatively impervious material shall be provided under the dam if necessary to reduce seepage through the foundation. The cutoff shall be located at or upstream from the centerline of the dam. It shall extend up the abutments as required and be deep enough to extend into a relatively impervious layer or provide for a stable dam when combined with seepage control. The cutoff trench shall have a bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations. Side slopes shall not be steeper than one horizontal to one vertical.

Seepage control. Seepage control is to be included if (1) pervious layers are not intercepted by the cutoff, (2) seepage could create swamping downstream, (3) such control is needed to insure a stable embankment, or (4) special problems require drainage for a stable dam. Seepage may be controlled by (1) foundation, abutment, or embankment filters and drains; (2) reservoir blanketing; or (3) a combination of these measures.

Embankment. The minimum top width for a dam is shown in table 1. If the embankment top is to be used as a public road, the minimum width shall be 16 feet for one-way traffic and 26 feet for two-way traffic. Guardrails or other safety measures shall be used where necessary and shall meet the requirements of the responsible road authority. For dams less than 20 feet in height, maintenance considerations or construction equipment limitations may require increased top widths from the minimum shown in Table 1.

Table 1. Minimum top width for dams

Total height of embankment	Top width
feet	*feet*
Less than 10	8
10 – 14.9	10
15 – 19.9	10
20 – 24.9	12
25 – 34.9	14
35 or more	15

Side Slopes. The combined upstream and downstream side slopes of the settled embankments shall not be less than five horizontal to one vertical, and neither slope shall be steeper than two horizontal to one vertical. All slopes must be designed to be stable, even if flatter side slopes are required. Downstream or upstream berms can be used to help achieve stable embankment sections

Slope Protection. If needed to protect the slopes of the dam from erosion, special measures, such as berms, rock riprap, sand-gravel, soil cement, or special vegetation, shall be provided (Technical Releases 56, “A Guide for Design and

Layout of Vegetative Wave Protection for Earth Dam Embankments" and 69, "Riprap for Slope Protection Against Wave Action" contain design guidance).

Freeboard. The minimum elevation of the top of the settled embankment shall be 1 foot above the water surface in the reservoir with the auxiliary spillway flowing at design depth.

The minimum difference in elevation between the crest of the auxiliary spillway and the settled top of the dam shall be 2 feet for all dams having less than a 20-acre drainage area or less than 20 feet in effective height.

The minimum difference in elevation between the crest of the earth auxiliary spillway and the settled top of dam shall be either depth of design flow plus 1 foot or 3 feet whichever is greater for dams having more than a 20 acre drainage area or more than 20 feet in height.

For concrete chute spillways the minimum difference in elevation between the crest of the emergency spillway and the settled top of dam shall be either the depth of flow plus 1.0 feet or 2.0 feet whichever is greater.

Settlement. The design height of the dam shall be increased by the amount needed to insure that after settlement the height of the dam equals or exceeds the design height. This increase shall not be less than 5 percent of the height of the dam, except where detailed soil testing and laboratory analyses or experience in the area show that a lesser amount is adequate.

Principal spillway. A pipe conduit, with needed appurtenances, shall be placed under or through the dam, except where rock, concrete, or other types of lined spillways are used, or where the rate and duration of flow can be safely handled by a vegetated or earth spillway.

For dams with a drainage area of 20 acres or less, the principal spillway crest elevation shall not be less than 0.5 feet below the auxiliary spillway crest elevation. For dams with a drainage area over 20 acres, this difference shall not be less than 1.0 feet.

When design discharge of the principal spillway is considered in calculating peak outflow through the auxiliary spillway, the crest elevation of the inlet shall be such that the design discharge will be generated in the conduit before there is discharge through the auxiliary spillway.

Pipe conduits designed for pressure flow must have adequate anti-vortex devices. The inlets and outlets shall be designed to function satisfactorily for the full range of flow and hydraulic head anticipated.

The capacity of the pipe conduit shall be adequate to discharge long-duration, continuous, or frequent flows without flow through the auxiliary spillways. The diameter of the principal spillway pipe shall not be less than 4 inches. Pipe conduits used solely as a supply pipe through the dam for watering troughs and other appurtenances shall not be less than 1-1/4 inches in diameter.

If the pipe conduit diameter is 10 inches or greater, its design discharge may be considered when calculating the peak outflow rate through the auxiliary spillway.

Pipe conduits shall be ductile iron, welded steel, corrugated steel, corrugated aluminum, reinforced concrete (pre-cast or site-cast), or plastic. Pipe conduits through dams of less than 20 feet total height may also be cast iron or unreinforced concrete.

Pipe conduits shall be designed and installed to withstand all external and internal loads without yielding, buckling, or cracking. Rigid pipe shall be designed for a positive projecting condition. Flexible pipe shall be designed for a maximum deflection of 5 percent. The modulus of elasticity for PVC pipe shall be assumed as one-third of the amount designated by the compound cell classification to account for long-term reduction in modulus of elasticity. Different reductions in modulus may be appropriate for other plastic pipe materials.

The minimum thickness of flexible pipe shall be SDR 26, Schedule 40, Class 100, or 16 gage as appropriate for the particular pipe material. Connections of flexible pipe to rigid pipe or other structures shall be designed to accommodate differential movements and stress concentrations.

All pipe conduits shall be designed and installed to be water tight by means of couplings, gaskets, caulking, waterstops, or welding. Joints shall be designed to remain watertight under all internal and external loading including pipe elongation due to foundation settlement.

In lieu of a specific design for strength requirements for the pipe, specifications in Tables 2 and 3 are to be followed for polyvinyl chloride(PVC), steel and aluminum pipe.

Table 2. - Acceptable PVC pipe for use in earth dams[1]

Nominal pipe size *inches*	Schedule for standard dimension ratio (SDR)	Max. depth fill over pipe *feet*
4 or smaller	Schedule 40	15
	Schedule 80	20
	SDR 26	10
6, 8, 10, 12	Schedule 40	10
	Schedule 80	15
	SDR 26	10

[1]Polyvinyl chloride pipe, PVC 1120 or PVC 1220, conforming to ASTM-D-1785 or ASTM-D-2241.

Table 3. - Minimum gage for corrugated metal pipe (2-2/3in X 1/2 in corrugations)[1]

Fill height (ft)	Minimum gauge for steel pipe with diameter (in) of 21 and less	24	30	36	42	48	Minimum thickness of aluminum pipe[2] with diameter (in) of 21 and less	24	30	36
1-15	16	16	16	14	12	10	.06	.075	.075	.075
15-20	16	16	16	14	12	10	.06	.075	.075	.105
20-25	16	16	14	12	10	10	.06	.105	.135	[3]

[1]Pipe with 6-,8-, and 10-in diameters has 1-1/2 in x 1/4 in corrugations.
[2]Riveted or helical fabrication.
[3]Not permitted.

Pipe Conduits

Pipe conduits shall be placed through or under embankments where required for safety, for proper operation of the reservoir and spillway, or for water rights requirements.

Where a pipe conduit is to be installed, the following shall apply:

1. No valve shall be installed when the conduit serves the single purpose of carrying flow from a trickle tube riser. For secondary discharge systems, control valves shall be installed on the upstream end unless otherwise approved by the State Conservation Engineer.
2. The conduit shall be placed in a trench excavated in firm foundation or in compacted fill not more than three feet above firm foundation.
3. All pipe conduits through earth embankments shall be concrete bedded or encased in concrete as defined below:

Embankment Minimum Treatment Height:

A. Concrete Pipe with Round Rubber Gasket joints

10 feet or less	2-inch concrete bedding up 1/3 the O.D. on both sides of the pipe centerline.
10 to 25 feet	1/2 O.D. Concrete cradle
25 to 35 feet	1/2 O.D. Concrete cradle

B. Corrugated Metal Pipe and Plastic

25 feet	Complete encasement
25 feet or greater	CMP shall not be used

4. When a pipe conduit is to be encased with concrete, the trench shall be excavated to the neat lines and grades so that the bottom and two sides become suitable forms for the concrete.
5. Anti-seep collars are considered adequate for seepage control along conduits through embankments less than 20 feet in effective height. When used for seepage control they should be installed around the conduit within the normal saturation zone, the upstream two thirds of the conduit length or upstream of a positive embankment drainage system.

   These collars shall extend beyond the pipe or encasement not less than 18 inches in all directions except where a watertight seal can be obtained by tying the collar into firm rock.

   The maximum spacing shall not exceed 15 feet. Corrugated metal collars are not permitted.
6. The installation of trickle tubes are allowed provided the tube is buried in the embankment side slopes at a shallow depth of 1.0 feet to protect the pipe. Usually trickle tubes are installed to convey water to a trough for livestock use.
7. When cathodic protection is needed, the procedures of Design Note 12 shall be used.

Cantilever outlet sections, if used, shall be designed to withstand the cantilever load. Pipe supports shall be provided when needed. Other suitable devices such as a Saint Anthony Falls stilling basin or an impact basin may be used to provide a safe outlet.

All steel pipe and couplings shall have protective coatings in areas that have traditionally experienced pipe corrosion, or in embankments with saturated soil resistivity less than 4000 ohms-cm or soil pH less than 5. Protective coatings shall be asphalt, polymer over galvanizing, aluminized coating or coal tar enamel as appropriate for the pipe type. Plastic pipe that will be exposed to direct sunlight shall be ultraviolet-resistant and protected with a coating or shielding, or provisions provided for replacement as necessary

Cathodic Protection. Cathodic protection is to be provided for coated welded steel and galvanized corrugated metal pipe where soil and resistivity studies indicate that the pipe needs a protective coating, and where the need and importance of the structure warrant additional protection and longevity. If cathodic protection is not provided for in the original design and installation, electrical continuity in the form of joint-bridging straps should be considered on pipes that have

protective coatings. Cathodic protection should be added later if monitoring indicates the need.

Seepage Control. Seepage control along a pipe conduit spillway shall be provided if any of the following conditions exist:

1. The effective height of dam is greater than 15 feet.
2. The conduit is of smooth pipe larger than 8 inches in diameter.
3. The conduit is of corrugated pipe larger than 12 inches in diameter.

Seepage along pipes extending through the embankment shall be controlled by use of a drainage diaphragm, unless it is determined that anti-seep collars will adequately serve the purpose.

Drainage Diaphragm. The drainage diaphragm, when required, shall function both as a filter for adjacent base soils and a drain for seepage that it intercepts. The drainage diaphragm shall consist of sand meeting the requirements of ASTM C-33, for fine aggregate. If unusual soil conditions exist such that this material may not meet the required filter or capacity requirements, a special design analysis shall be made.

The drainage diaphragm shall be a minimum of 2 feet thick and extend vertically upward and horizontally at least three times the outside pipe diameter, and vertically downward at least 18 inches beneath the conduit invert. The drainage diaphragm shall be located immediately downstream of the cutoff trench, but downstream of the centerline of the dam if the cutoff is upstream of the centerline.

Water shall be transported safely from the drainage diaphragm, to a point downstream of the dam, in a pipe or series of pipes, called drainage diaphragm discharge pipe(s). A filter and drain system shall be provided around the pipe(s) to prevent movement or piping of drain, filter or embankment material. Protect the outlet for these pipes from surface erosion.

Anti-seep Collars. When anti-seep collars are used in lieu of a drainage diaphragm, they shall have a watertight connection to the pipe. Maximum spacing shall be approximately 14 times the minimum projection of the collar measured perpendicular to the pipe but not more than 25 feet. The minimum spacing shall be 10 feet. Collar material shall be compatible with pipe materials. The anti-seep collar(s) shall increase by at least 15 percent the seepage path along the pipe.

Trash Guard. To prevent clogging of the conduit, an appropriate trash guard shall be installed at the inlet or riser unless the watershed does not contain trash or debris that could clog the conduit.

Other Outlets. A pipe with a suitable valve shall be provided to drain the pool area if needed for proper pond management or if required by State law. The principal spillway conduit may be used as a pond drain if it is located where it can perform this function.

Auxiliary spillways. Auxiliary spillways convey large flood flows safely past earth embankments and have historically been referred to as “Emergency Spillways”.

An auxiliary spillway must be provided for each dam, unless the principal spillway is large enough to pass the peak discharge from the routed design hydrograph and the trash that comes to it without overtopping the dam. The following are minimum criteria for acceptable use of a closed conduit principal spillway without an auxiliary spillway: a conduit with a cross-sectional area of 3 ft^2 or more, an inlet that will not clog, and an elbow designed to facilitate the passage of trash.

The minimum capacity of a natural or constructed auxiliary spillway shall be that required to pass the peak flow expected from a design storm of the frequency and duration shown in Table 4, less any reduction creditable to conduit discharge and detention storage.

The auxiliary spillway shall safely pass the peak flow, or the storm runoff shall be routed through the reservoir. The routing shall start either with the water surface at the elevation of the crest of the principal spillway or at the water surface after 10 days’ drawdown, whichever is higher. The 10-day drawdown shall be computed from the crest of the auxiliary spillway or from the elevation that would be attained if the entire design storm were impounded, whichever is lower. Auxiliary spillways shall provide for passing the design flow at a safe velocity to a point downstream where the dam will not be endangered.

Constructed auxiliary spillways are open channels that usually consist of an inlet channel, a control section, and an exit channel. They shall be trapezoidal and shall be located in undisturbed or compacted earth or in-situ rock. The side slopes shall be stable for the material in which the spillway is to be constructed. For dams having an effective height exceeding 20 feet, the auxiliary spillway shall have a bottom width of not less than 10 feet.

Upstream from the control section, the inlet channel shall be level for the distance needed to protect and maintain the crest elevation of the spillway. The inlet channel may be curved to fit existing topography. The grade of the exit channel of a constructed auxiliary spillway shall fall within the range established by discharge requirements and permissible velocities.

Capacity

The minimum capacity of the natural or constructed emergency spillway shall be that required to pass the peak

outflow expected from a 50-year 24 hour frequency storm, less any reduction creditable to conduits or detention storage.

The minimum bottom width shall be 5 feet.

The minimum capacity of a closed emergency spillway shall be sufficient to pass the peak flow expected from a 100-year 24-hour frequency storm, less any reduction creditable to principal spillways or detention storage.

Where there are dams in series (NEM, 520.24(a) (1), the design of the downstream structure shall address what will happen should the upstream structure fail. Some precautions that could be considered are:

1. Adding additional freeboard to the embankment.
2. Larger capacity emergency spillway.
3. Address how overtopping will affect the structure being designed.

Erosion Protection

Earth or vegetated spillways shall be non-erosive for the runoff from a 50 year 24 hour frequency storm. Pipe spillways may be used to carry part or all of this flow where erosion will occur. If some erosion will occur during higher frequency storms, the quantity of sediment and its effect downstream shall be addressed.

Side Slopes

Where spillway levees or training dikes are required to protect the downstream toe of the fill, they shall have side slopes not steeper than 3:1.

The minimum top width for the spillway training dikes or levees shall be 12 feet.

Structural auxiliary spillways. If chutes or drops are used for principal spillways or auxiliary spillways, they shall be designed according to the principles set forth in the Part 650, Engineering Field Handbook and the National Engineering Handbook, Section 5, Hydraulics; Section 11, Drop Spillways; and Section 14, Chute Spillways. The minimum capacity of a structural spillway shall be that required to pass the peak flow expected from a design storm of the frequency and duration shown in table 4, less any reduction creditable to conduit discharge and detention storage.

Table 4. Minimum auxiliary spillway capacity

Drainage area (Ac.)	Effective height of dam[1/] (Ft.)	Storage (Ac-Ft)	Minimum design storm[2/]	
			Frequency (Years)	Minimum duration (Hours)
20 or less	20 or less	< than 50	10	24
20 or less	> than 20	< than 50	25	24
> than 20	20 or less	< than 50	25	24
All others			50	24

[1]/ As defined under “Conditions where Practice Applies”.

[2]/ Select rain distribution based on climatological region.

State Division of Dam Safety

Drawings and specifications for dams within the jurisdiction of the California Division of Safety of Dams shall also meet the requirements of that organization.

Dams within the State jurisdiction dams are:

1. Dams over 25 feet in height and with storage of 15 acre-feet or more.
2. Dams over 6 feet in height and with storage of 50 acre-feet or more.

In general the design for state-size dams will need to meet the minimum requirements for a "b" hazard structure as outlined in Technical Release 60.

Pipe conduits must be placed through or under all embankments that are of a size to be within the jurisdiction of the California Division of Safety of Dams.

CRITERIA FOR EXCAVATED PONDS

Geological Investigations. Pits, trenches, borings, review of existing data or other suitable means of investigation shall be conducted to characterize materials within the excavation. Soil materials shall be classified using the Unified Soil Classification System.

The area to be excavated for the pond shall be investigated, thoroughly and to the depth of at least 2 feet below the anticipated lowest expected grade, to determine the following:

1. Seepage potential through the pond.
2. The difficulty of excavation.

Clay or plastic pond liners should be used on excavated ponds where seepage losses are considered excessive.

Runoff. Provisions shall be made for a pipe and auxiliary spillway, if needed, that will meet the capacity requirements of Table 4. Runoff flow patterns shall be considered when locating the excavated pond and placing the spoil.

Side slopes. Side slopes of excavated ponds shall be stable and shall not be steeper than one horizontal to one vertical. If livestock will water directly from the pond, a watering ramp of ample width shall be provided. The ramp shall extend to the anticipated low water elevation at a slope no steeper than three horizontal to one vertical.

Inlet protection. If surface water enters the pond in a natural or excavated channel, the side slope of the pond shall be protected against erosion.

Excavated material. The material excavated from the pond shall be placed so that its weight will not endanger the stability of the pond side slopes and it will not be washed back into the pond by rainfall. It shall be disposed of in one of the following ways:

1. Uniformly spread to a height that does not exceed 3 feet, with the top graded to a continuous slope away from the pond.
2. Uniformly placed or shaped reasonably well, with side slopes assuming a natural angle of repose. The excavated material will be placed at a distance equal to the depth of the pond but not less than 12 feet from the edge of the pond.
3. Shaped to a designed form that blends visually with the landscape.
4. Used for low embankment construction and leveling of surrounding landscape.
5. Hauled away.

CONSIDERATIONS

On ponds lined with flexible membrane liners, the top width may need to be increased around the curves to facilitate construction of the anchor trench.

Visual resource design. The visual design of ponds should be carefully considered in areas of high public visibility and those associated with recreation. The underlying criterion for all visual design is appropriateness. The shape and form of ponds, excavated material, and plantings are to relate visually to their surroundings and to their function.

The embankment may be shaped to blend with the natural topography. The edge of the pond may be shaped so that it is generally curvilinear rather than rectangular. Excavated material can be shaped so that the final form is smooth, flowing, and fitting to the adjacent landscape rather than angular geometric mounds. If feasible, islands may be added for visual interest and to attract wildlife.

Cultural Resources. Consider existence of cultural resources in the project area and any project impacts on such resources. Consider conservation and stabilization of archeological, historic, structural, and traditional cultural properties when appropriate.

NRCS’s objective is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice will have any effect on any cultural resources.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

GM 420, Part 401, the California Environmental Handbook and the California Environmental Assessment Worksheet provide guidance on how the NRCS must account for cultural resources. The Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

Endangered Species Considerations

Determine if installation of this practice, along with any others proposed, will have an effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern, or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates that the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

Some species are year-round residents in some streams, such as, freshwater shrimp. Other species, such as steelhead and salmon, utilize streams during various seasons. Be aware that critical periods, such as spawning, eggs in gravels and rearing of young may preclude activities in the stream that may directly affect the stream habitat during those periods. For example, there should be no disturbance of stream gravel beds that may have eggs in them. That could include any equipment in the stream or even walking in the stream or work upstream that may result in sediment depositing in the gravel beds. Document any special considerations for endangered species in the Practice Requirements Worksheet.

Fish and Wildlife. Project location and construction should minimize the impacts to existing fish and wildlife habitat.

When feasible, structure should be retained, such as trees in the upper reaches of the pond and stumps in the pool area. Upper reaches of the pond can be shaped to provide shallow areas and wetland habitat.

If fish are to be stocked, consider criteria and guidance in conservation practice standard 399, Fishpond Management.

Vegetation. Stockpiling topsoil for placement on disturbed areas can facilitate revegetation.

Consider placement and selection of vegetation to improve fish and wildlife habitat and species diversity.

Water Quantity.

Consider effects upon components of the water budget, especially:

1. Effects on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and ground water recharge.
2. Variability of effects caused by seasonal or climatic changes.
3. Effects on downstream flows and impacts to environment such as wetlands, aquifers, and; social and economic impacts to downstream uses or users.
4. Potential for multiple purposes.

Water Quality

1. Consider effects on erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances that are carried by runoff.
2. Effects on the visual quality of onsite and downstream water resources.
3. Short-term and construction-related effects of this practice on the quality of downstream water courses.
4. Effects of water level control on the temperatures of downstream water to prevent undesired effects on aquatic and wildlife communities.
5. Effects on wetlands and water-related wildlife habitats.
6. Effects of water levels on soil nutrient processes such as plant nitrogen use or denitrification.
7. Effects of soil water level control on the salinity of soils, soil water, or downstream water.
8. Potential for earth moving to uncover or redistribute toxic materials such as saline soils.

PLANS AND SPECIFICATIONS

Plans and specifications for installing ponds shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed and reviewed with the landowner or individual responsible for operation and maintenance.

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

WASTE TREATMENT

(No.)

CODE 629

DEFINITION

The mechanical, chemical or biological treatment of agricultural waste.

PURPOSE

To use mechanical, chemical, or biological treatment facilities and/processes as part of an agricultural waste management system:

- To improve ground and surface water quality by reducing the nutrient content, organic strength, and/or pathogen levels of agricultural waste.
- To improve air quality by reducing odors and gaseous emissions
- To produce value added byproducts
- To facilitate desirable waste handling, storage, or land application alternatives.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where the form and characteristics of agricultural waste make it difficult to manage so as to prevent it from becoming a nuisance or hazard or where changing the form or composition provides additional utilization alternatives, and where conventional waste management alternatives are deemed ineffective. More specifically:

- Liquids and solids need to be separated for further processing or for effective transport and subsequent utilization.
- Raw agricultural waste contains excess nutrients for land application based on crop utilization requirements or nutrient ratios need to be modified to be more consistent with crop utilization requirements.
- There is a need to reduce the potential for leaching or runoff of nutrients.
- Odors and/or gaseous emissions from livestock production facilities and waste storage/treatment system components must be reduced.
- Value-added byproducts can be produced to offset treatment costs.
- Reduction of pathogens is required.

CRITERIA

General Criteria Applicable to All Waste Treatment Purposes.

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

Design. The system provider shall complete and supply to the land owner/operator a detailed design of the facility/process clearly outlining the objectives and anticipated outcomes of implementation.

The design documentation shall include a process diagram containing, at a minimum, the following information:

1. Volumetric flow rates including influent, effluent, and recycle streams.

2. Waste load projections including volume, mass, and characteristics of the waste important to the waste treatment facility or process.

3. Unit process volumes and hydraulic retention times where appropriate.

4. Air emissions projections from the system.

5. Nutrient fate projections within the system.

6. Process monitoring and control system requirements as described below in the Monitoring section of the criteria.

Independent, verifiable data demonstrating results of the use of the facility or process in other similar situations and locations shall be provided.

Where use of a waste treatment facility or process to improve one resource concern negatively impacts another, impacts and mitigation measures, if required by state or local agencies, are to be documented. The mitigation measures shall become a required component of this practice.

Plans and Specifications to document this practice shall be as described below.

Components. Waste treatment facilities and processes may consist of multiple components. Where criteria for individual components are described in existing NRCS practice standards, those practice standards and their specific criteria shall be used for planning, designing, and installation of that component.

Where components of a facility or process are not described in a current NRCS practice standard, the system provider shall furnish a one year warranty on all construction or applied processes. In addition, the manufacturer shall provide a warranty that describes the service life of each component and what the warranty covers.

The waste treatment facility or process shall have a minimum practice life of ten years. Where components have less than a ten year service life, their planned replacement during the life of the practice shall be clearly identified in the Operation and Maintenance Plan.

Expected System Performance. The expected system performance shall be clearly documented prior to system installation. At a minimum, the expected system volumetric flow rate, expected macro-nutrient reductions or change in form, expected pathogen reductions, gaseous ammonia and hydrogen sulfide emissions reductions (or increases) shall be documented.

Operating Costs. Where components of a facility or process are not described in a current NRCS Conservation Practice Standard, the system provider shall furnish an annual estimate of operating costs for the system. Operating costs not based on actual systems data shall be clearly identified as estimates.

Monitoring. Equipment needed to properly monitor and control the waste treatment facility or process shall be installed as part of the system. Process control parameters to be monitored shall include those parameters identified in the design documentation. Parameters considered critical to proper system operation shall be identified in the Operation and Maintenance Plan. Run status of critical equipment and unit processes shall be monitored.

Byproducts. Implementation of a waste treatment process or operation of a waste treatment facility shall not result in discharge of byproducts harmful to the environment.

All byproducts shall be handled and stored in such a manner as to prevent nuisances to neighbors or to the public at large.

Byproducts land applied to supply plant nutrients shall meet the criteria in NRCS Conservation Practice Standard 633, Waste Utilization and NRCS Conservation Practice Standard 590, Nutrient Management.

Any unmarketable or unused byproducts shall be handled and disposed of in accordance with all applicable federal, state, and local laws and regulations. A plan for dealing with such byproducts shall be prepared and approved by NRCS prior to utilization of the process or installation of the waste treatment facility, and shall include a listing of any permits or permissions required for the execution of the plan.

Byproducts shall be recycled to the extent possible without causing a hazard to the environment.

Safety. Design of the process or facility shall include safety features to minimize hazards. Guards and shields shall be provided for moving parts of the equipment used in the treatment process. Waste treatment facilities shall be fenced and warning signs shall be

posted where needed to prevent children and others from entering a hazardous area.

All treatment processes shall be carried out in accordance with all safety regulations. Protective clothing shall be utilized when handling potentially harmful chemicals that may be used in the process. Proper ventilation shall be provided.

CONSIDERATIONS

Location. The waste treatment facility should be located as near the source of manure or other waste as practicable and as far from neighboring dwellings or public areas as possible. Proper location should also consider slope, distance of manure and other waste transmission, vehicle access, wind direction, proximity of streams and flood plains, and visibility.

In determining the location of the facility, consider elevation and distance from various components to take advantage of gravity flow where possible.

Manure Characteristics. Waste treatment may require specific total solids and nutrient contents of the waste stream. Pretreatment options such as dilution or settling could be used to adjust the solids content before entering the waste treatment facility or process.

Visual Screening. The visual impact of the waste treatment facility or process should be evaluated within the overall landscape context. Screening with vegetative plantings, landforms, or other measures may be implemented to alleviate a negative impact or enhance the view.

PLANS AND SPECIFICATIONS

Plans shall include engineering drawings and supporting documentation as well as other plans required to manage the system; e.g. a nutrient management plan for proper land application of byproducts.

Plans and specifications for waste treatment facilities shall be prepared in accordance with the criteria of this standard and good engineering practice.

As a minimum, the plans and specifications shall provide the following:

1. Layout and installation details of livestock facilities, waste collection points, waste transfer components, waste treatment and storage facilities.
2. Location of all inflow and discharge pipelines, pipeline materials, diameter and slope.
3. Details of support systems for all components of the treatment facility.
4. Fencing and signage as appropriate for safety purposes.

OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan shall be developed and reviewed with the owner/operator prior to construction of a waste treatment facility or implementation of a waste treatment process. The O&M plan shall be consistent with the proper operation of all system components and shall contain requirements including but not limited to:

- Recommended loading rates of the waste treatment facility or process for hydraulic and critical pollutant parameters.
- Proper operating procedures for the waste treatment facility or process, including the amount and timing of any chemicals added.
- Operation and maintenance manuals for pumps, blowers, instrumentation and control devices, and other equipment used as components of the waste treatment facility or process.
- Description of the planned startup procedures, normal operation, safety issues, and normal maintenance items. This includes procedures for the planned replacement of components with less than a ten year service life.
- Alternative operation procedures in the event of equipment failure.
- Troubleshooting guide.
- Monitoring and reporting plan designed to demonstrate system performance on an ongoing basis.

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