

MANURE TRANSFER

(No.)
Code 634

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

A manure conveyance system using structures, conduits, or equipment.

II. Purposes

To transfer animal manure (bedding material, spilled feed, process and wash water, *wastewater*¹, *contaminated runoff*, *leachate* and other fluids and residues associated with animal production may be included) in a manner which safeguards the environment. It includes transfer through a hopper, reception structure or tank, a pump, *channel*, or conduit to:

- A manure storage/treatment facility,
- A wastewater treatment strip,
- A loading area,
- Cropland or satellite storage facilities using permanent conduits or pipelines.

III. Conditions Where Practice Applies

The manure transfer component is part of a planned agricultural waste management or comprehensive nutrient management system.

This standard applies where manure and other waste is generated by livestock production or processing, and a conveyance system is necessary to transfer material from the source to a storage facility, treatment facility, loading area, cropland, or satellite storage facilities using permanent conduits or pipelines.

This standard does not apply to conveyance systems using equipment or mechanisms such as barn cleaners, alley scrapers, or belts for moving manure in the housing facility to the manure transfer system (reception structure, pump, channel, or conduit).

This standard does not apply to transfer by vehicles or temporary surface pipelines from the storage facility, treatment facility, or loading area to the field or another storage facility.

IV. Federal, Tribal, State and Local Laws

Users of this standard should be aware of potentially applicable federal, tribal, state and local laws, rules or regulations or permit requirements governing manure transfer. This standard does not contain the text of the federal, tribal, state or local laws.

V. Criteria

The following **minimum** criteria shall apply to all transfer designs.

A. General Criteria

1. Management Assessment

A management assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed with the owner/operator to explore options and to determine the purpose of transfer components, available resources, manure handling practices, and waste characterizations. Pertinent items in the Management Assessment criteria in V. A. 1. of Wisconsin NRCS Field Office Technical Guide (FOTG) Section IV, Standard 313, Waste Storage Facility, shall be followed.

2. Site Assessment

A site assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed manure transfer system. Pertinent items in the Site Assessment criteria in V. A. 2. of NRCS FOTG Section IV, Standard 313, Waste Storage Facility, shall be followed.

The minimum number of test pits for reception structures or tanks shall be one per tank length of 40 feet or less and one more for each additional 80 feet of tank. Test pits used to meet this criteria shall be located no more than 100 feet from the *footprint*.

¹ Words in the standard that are shown in italics are described in IX. Definitions. The words are italicized the first time they are used in the text.

3. Structures

All structures shall be designed to withstand the anticipated static and dynamic loading.

4. Safety

The system design shall identify and minimize the hazards to animals and people during construction and operation. Manure transfer designs may create *confined spaces*, which can pose significant hazards to people. At a minimum, a design shall include the following.

- a. Open structures shall be provided with covers or barriers such as gates, fences, etc., to restrict access of animals or people. Include warning signs as necessary.
- b. Barriers shall be placed on push-off ramps to prevent tractors or other equipment from slipping into reception structures or tanks.
- c. Ventilation and warning signs shall be provided for manure transfer systems as necessary to warn of the danger of entry and to reduce the risk of explosion, poisoning, or asphyxiation.
- d. Pipelines from enclosed buildings shall be provided with a water-sealed trap and vent or similar devices where necessary to control gas entry into buildings.
- e. A minimum of one in-line manual valve in the transfer pipe where the *maximum operating level* of the storage facility is higher than the top of the transfer structure.
- f. Confined spaces where human entry may occur shall be designed and operated in compliance with the provisions contained in ASABE EP470, Manure Storage Safety.

5. Operation and Maintenance

An operation and maintenance plan shall be developed that is consistent with the purpose of this practice, intended life of the components, safety requirements, criteria for design, and the Operation and Maintenance plan in NRCS FOTG Section IV, Standard 313, Waste Storage Facility.

B. Specific Criteria

1. Reception Structures or Tanks, Pumps, and Channels

Reception structures or tanks, pumps, and channels shall meet the following criteria.

- a. They shall be liquid tight.
- b. They shall meet the separation distance criteria in Table 1 of this standard.
- c. Lateral seepage from *confined lenses and perched water* shall be controlled as needed for the structural integrity of reception structures or tanks and channels.
- d. Excavation of *bedrock* is permitted.
- e. Cast in place concrete reception structures or tanks and channels shall be designed according to the structural and soil criteria in NRCS FOTG Section IV, Standard 313, Waste Storage Facility.
- f. Prefabricated tanks used to transfer wastes that are predominately manure shall be designed according to the structural and soil criteria in NRCS FOTG Section IV, Standard 313, Waste Storage Facility.
- g. Prefabricated tanks used to transfer process and wash water, wastewater, contaminated runoff, and leachate shall meet the following requirements:
 - (1) The tank shall be currently listed on the Wisconsin Department of Commerce Plumbing Product Approvals or Alternate Product Approvals List.
 - (2) The tank shall comply with all stipulations listed in the Wisconsin Department of Commerce approval that relate to liquid tightness and/or structural strength.
 - (3) The tank shall be located a minimum of 15 feet from established or planned roadways.
- h. Pumps shall be sized to transfer manure at the required system head and flow rate. The type of pump shall be based on the consistency of the manure and the type of bedding used. Requirements for pump installations shall be based on manufacturer's recommendations.
- i. Channels going through in-place soils or through liners, such as clay, concrete, polyethylene, or geosynthetic clay, shall be installed so that the performance and integrity of the in-place soil or the liner is maintained.

Table 1 - Separation Distances for Reception Structures or Tanks, Pumps, and Channels^{Note 1}

Transfer Components	Floor Surface or Bottom of Pump Relative to Bedrock	Floor Surface or Bottom of Pump Relative to <i>Regional Water Table</i> (RWT)	Well Separation Distance ^{Note 2}
Piston Pumps			
Pumps encased in concrete	≥ 6 inches (bottom of pump)	Bottom of pump maximum depth into RWT shall be 2 feet	≥ 50 feet
Pumps housed in tank	≥ 1 foot (floor of tank)	Floor may be at the level of the RWT	≥ 50 feet
Reception Structures or Tanks			
Small Pits where the footprint is ≤ 100 square feet	≥ 1 foot	Floor may be at the level of the RWT	≥ 50 feet
Large Reception Structures or Tanks	≥ 2 feet	≥ 2 feet (≥1 foot for sumps)	≥ 100 feet
Channels			
(≥ 2 foot depth)	≥ 2 feet	≥ 2 feet (≥1 foot for sumps)	≥ 100 feet

^{Note 1} The separation is determined to be the closest distance from any point on the inside surface (bottom and sides) of the pumps, reception structures, channels and tanks to the feature from which separation is required.

^{Note 2} Well separation distances are in accordance with NR 812, Well Construction and Pump Installation.

2. Transfer Pipe

Transfer pipes to waste storage/treatment facility shall meet the following criteria:

- a. Joints shall be liquid tight. Pipes shall be bedded according to NRCS Wisconsin Construction Specification 15, Plastic Pipe Conduits, and backfilled according to NRCS Wisconsin Construction Specification 204, Earthfill for Waste Storage Facilities.
- b. Pipes shall meet the criteria in Table 2. Pipes of equivalent strength, durability, and liquid tightness are acceptable. All joints and couplings shall be liquid tight in accordance with the manufacturer's specifications. Standard manufactured pieces shall be used for angles needed to make direction changes. Thrust blocks for pipes 4 inches or greater in diameter shall be at least 0.5 cubic yards of concrete or designed in accordance with standard engineering practice and installed at all angles for pumped systems. The pipe selection shall be compatible with the pump characteristics.
- c. Pipes going through in-place soils or through liners such as clay, concrete, polyethylene, or geosynthetic clay shall be installed so that the performance and integrity of the in-place soil or the liner is maintained.
- d. Pipes shall be at least 6 inches above bedrock. Excavation of bedrock is acceptable. There is no separation required from the *regional water table*.
- e. Pipes shall be protected from frost with a minimum of 4 feet of soil cover or an equivalent amount of soil and insulation. This criteria does not apply to pipes that are empty following transfer.

3. Pipelines

Pipelines to cropland or satellite storage facilities shall meet the following criteria.

- a. Design of pipelines shall be in accordance with sound engineering principles considering the load on the pipe, exposure, required capacity etc.
- b. Pipelines used for transferring waste to an irrigation system, either spray or injection, or to another waste storage facility shall meet the requirements of National Handbook of Conservation Practices (NHCP), Standard 430DD, Irrigation Water Conveyance, High Pressure, Underground, Plastic Pipeline. Other pipe materials and design procedures may be used if designed and sealed by a Professional Engineer registered in Wisconsin.
- c. All pipelines shall be designed based on the type of material and total solids content and shall convey the required flow without plugging. Flow velocities shall be sufficient to minimize settling of solids in the pipeline.
- d. Pipelines shall be installed with appropriate connection devices to prevent contamination of private or public water supply distribution systems and ground water.

4. Gravity Transfer

This applies to systems using pipes or channels to carry manure between reception structures or tanks and storage facilities, treatment facilities, or loading areas. Gravity transfer pipes and structures shall meet the following criteria.

- a. There shall be no gravity outlets from the waste storage facility.
- b. *Reception structures or tanks with a gravity pipe outlet* shall follow all previous reception structure criteria (V.B.1.a-i) plus the following additional criteria.
 - (1) Reception structures built with pre-manufactured manholes shall conform to the criteria in ASTM C-478.

- (2) The top elevation and volume of the reception structure or tank shall meet the following criteria.

- Slower Flowing Manure. For manure which tends to be slower flowing due to bedding, feed, or dryness (typically stanchion barns), the maximum operating level of the waste storage facility (see criteria in V.A.5 of NRCS FOTG Section IV, Standard 313, Waste Storage Facility) shall be a minimum of four feet below the bottom of the barn cleaner, scrape alley, etc. The volume of the reception structure or tank between the maximum operating level and the barn cleaner or scrape alley must be at least one-half of the daily manure production.
- Faster Flowing Manure. For manure which tends to be faster flowing due to lack of bedding or additional liquids (typically free stall barns, veal or hog facilities), the maximum operating level of the waste storage facility shall be a minimum of two feet below the scrape alley, barn cleaner, channel, etc., plus an additional height equal to 1% of the transfer pipe length. There is no minimum volume for the reception structure or tank with this type of manure.

- c. Gravity transfer pipes shall follow all previous transfer pipe criteria (V.B.2.a-e) plus the following additional criteria.
 - (1) The pipe length shall be a maximum of 150 feet for slower flowing manure and a maximum of 400 feet for faster flowing manure.
 - (2) The pipe diameter shall be a minimum of 24 inches for slower flowing manure.
 - (3) For pipes carrying slower flowing manure or for reception structures using knife valves, a vent pipe (4-inch diameter minimum) shall be installed within 4 feet of the reception structure.

Table 2 - Transfer Pipes

Material	Materials Components and ASTM Specifications	Well Separation Distance ^{Note 1}
Pipes Carrying Pumped Manure		
Piston Pumps		
PVC	D-3034 (SDR 35) (4"-15"), F-679 (18"-27")	≥ 50 feet
	----- D-2241 (SDR 26) or D-1785 (Sch. 40)	----- ≥ 25 feet
Pressure Pumps		
Other than Chopper Pumps		
PVC	D-2241 (SDR 26) or D-1785 (Schedule 40) or AWWA C-900 (DR 25)	>25 feet
PE	F 714 (DR 17)	>25 feet
Chopper Pumps		
PVC	D-2241 (SDR 21) or D-1785 (Sch. 80) or AWWA C-900 (DR 18)	≥ 25 feet
PE	F 714 (DR 11)	≥25 feet
Pipes Carrying Gravity Flow Manure		
PVC	F-679, F-794, D-3034 (SDR 35), D-2241(SDR 32.5), or D-1785 (Sch. 40 or 80)	≥ 25 feet
PE	ASTM F-667 (smooth inside wall) or AASHTO M252 (4"-10") or AASHTO M294 (12"- 48") Joints for all pipes according to ASTM D-3212 (10.8 psi)	≥ 25 feet

^{Note 1} Based on NR 812 - Well Construction and Pump Installation.

VI. Considerations

Additional recommendations relating to design which may enhance the use of, or avoid problems with, this practice but are not required to ensure its basic conservation function are as follows:

- A. Use appropriate check valves, anti-siphon protection, and open air breaks.
- B. Operation and maintenance of gravity pipes carrying faster flowing manure may be enhanced by using venting and clean-out access pipes.
- C. Flow through the transfer pipe of a gravity system may be enhanced by using knife valves at the outlet of the reception structure.
- D. Flow characteristics may be enhanced by adding dilute waste water to gravity flow systems that do not contain sand bedding.
- E. Addition of very liquid wastewater to manure containing sand bedding enhances sand settling. Add water when sand settling is desired.
- F. A wet sump may be useful for gravity reception structures.
- G. Gravity pipes should be as straight as possible. Risers, such as pre-manufactured manholes, can be used to change direction.
- H. Consider restraining the last section of concrete pipes used for gravity transfer.
- I. Evaluate the need for frost protection to reduce plugging in transfer gutters and channels.

VII. Plans and Specifications

Plans and specifications for installing manure transfer systems shall be in accordance with this standard and shall describe the requirements for applying the

practice to achieve its intended purpose. An inspection plan is required. The plans and specifications must be compatible with and can often be combined with the plans and specifications for the waste storage facility.

VIII. References

USDA, NRCS, Agricultural Waste Management Field Handbook, Part 651, 1992.

Wisconsin Administrative Code, Department of Natural Resources, Chapter NR 812.

USDA, NRCS, National Handbook of Conservation Practices.

USDA, NRCS Wisconsin Field Office Technical Guide (FOTG), Section IV, Practice Standards and Specifications.

American Society of Agricultural and Biological Engineers (ASABE), Standard EP470, Manure Storage Safety.

IX. Definitions

Bedrock (V.B.1.d) – Consolidated rock material and weathered in-place material with > 50%, by volume, larger than 2 mm in size.

Channel (II) – Structures used to convey manure to reception structures, tanks, or waste storage facilities. They generally are made from concrete and range up to 12 feet wide and from 2 feet to 12 feet deep.

Confined Lenses and Perched Water (V.B.1.c) – Water bearing deposits of stratified lacustrine material or material laid down by glaciers between deposits of less permeable till. Perched water is saturation found above and separated from the regional high water table.

Confined Space (V.A.11) – Confined Space is a space that 1) contains or has the potential to contain a hazardous atmosphere; 2) is large enough and so configured that a person can bodily enter; 3) has limited or restricted means for entry or exit; and 4) is not designed for continuous human occupancy.
Contaminated Runoff (II) – Runoff that has come through or across a barnyard or animal lot or feed storage area. It generally includes the runoff and any manure, sediment, feed, or other material carried in the runoff. It contains lower concentrations of contaminants than leachate from feed or manure.

Footprint (V.A.2) – This is the area defined by the outside edge of the top surface of the waste when the facility is completely full. This is the top edge of the outside edge of the waste in a reception structure or tank.

Leachate (II) – Concentrated liquid waste which has percolated through or drained by gravity from a pile of manure, manure processing derivative, or animal feed. It contains much higher concentrations of contaminants than contaminated runoff.

Maximum Operating Level (V.A.4.e) – The maximum operating level for waste storage facilities shall be the storage level that provides for the design storage volume as shown in section V.A.5. of FOTG Standard 313 less the volume of precipitation and runoff from the 25-year, 24-hour storm event. See Figure 1 in NRCS FOTG Section IV, Standard 313, Waste Storage Facility. The maximum operating level does not include the Extra Depth for Safety; see FOTG Standard 313 section V.A.7.

Reception structures or tanks with a gravity pipe outlet (V.B.4.b.) – Any manure containment structure having a gravity pipe outlet to the waste storage facility.

Regional Water Table (V.B.2.d) – The seasonal high, free water surface of a large body of groundwater covering a region. All soil below the regional water table is saturated. Soil mottling (redoximorphic features) is not necessarily an indicator of the regional high water table, but is an indication of soil saturation.

Wastewater (II) – Milking center waste, flush water, leachate from feed holding areas, and similar waste materials.