

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**MANURE TRANSFER**

(Each)

**CODE 634**

**DEFINITION**

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

**PURPOSE**

To transfer animal manure (bedding material, spilled feed, process and wash water, and other residues associated with animal production may be included) through a hopper or reception pit, a pump (if applicable), a conduit, or hauling equipment to:

- A manure storage/treatment facility,
- A loading area, and
- Agricultural land for final utilization.

**CONDITIONS WHERE PRACTICE APPLIES**

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

Where manure is generated by livestock production or processing and a conveyance system is necessary to transfer manure from the source to a storage/treatment facility and/or a loading area, and/or from storage/treatment to an area for utilization. This includes hauling manure from one geographical area with excess manure to a geographical area that can utilize the manure in an acceptable manner.

This practice does not include land application or other use of manure. Criteria for land application of manure are included in NRCS conservation practice standard Nutrient

Management, Code 590 or Waste Utilization, Code 633.

**CRITERIA**

**General Criteria Applicable to All Purposes**

**Regulations.** Manure transfer components shall comply with all federal, state, and local laws, rules and regulations.

**Location.** Reception pits, hoppers, manure pumps, gravity drop structures, and conduits shall be located a minimum of 100 feet from a potable water well, spring or reservoir and installed a minimum of one foot above bedrock and seasonal high water table. The design shall consider the safety of humans and animals during construction and operation. Excavation depths near or under building foundations shall be the minimum required. Shoring and support for the foundation may be necessary to protect the building and workers during construction.

**Structures.** All structures, including those that provide a work area around pumps, shall be designed to withstand the anticipated static and dynamic loading. Structures shall be designed to withstand earth and hydrostatic loading in accordance with practice standard Waste Storage Facility, Code 313. Covers, when needed, shall be designed to support the anticipated dead and live loads.

Reception pits shall be sized to contain a minimum of one full day's manure production. For reception pits collecting runoff, the reception pit shall be sized to also contain at least the volume of runoff from the 25-year, 24-hour storm. Additional capacity shall be added as needed for freeboard and emergency storage.

<p>Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.</p>
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Openings to structures to receive manure from alley scrape collection shall be a minimum of 9 square feet with one dimension no smaller than 4 feet. The opening shall be equipped with a grate designed to support the anticipated loads.

When curbs are needed in conjunction with structures, they shall be constructed of either concrete or wood. Curbs shall be of sufficient height to ensure total manure flow into the structure and be adequately reinforced and anchored.

**Reception Pits.** Reception pit is a temporary storage facility that will store manure for 3 to 14 days. The manure in a reception pit is generally transferred to the storage facility by means of PTO or electric pump.

Openings in the top or side of reception pit shall be sized and designed to accommodate both manure loading and unloading pumps and other systems. Covers, grates and other protective devices shall be installed over reception pit openings. Covers and grates shall be designed to withstand anticipated live and dead loads. Warning signs shall be posted at reception pit to indicate the potential dangers of toxic gases.

**Gravity Drop Structures.** A gravity drop structure is a vertical chute or hopper, which conveys waste into a large diameter transfer pipe. The structure shall be constructed of durable, corrosion-resistant material, and be liquid tight. Pre-cast concrete structures shall comply with ASTM C-478 Precast Reinforce Concrete Manhole Sections.

The volume of the gravity drop structure above the maximum effective storage elevation shall be equal to or greater than the anticipated daily volume of manure produced. The inlet or loading opening to the drop structure shall be compatible with the scraping and cleaning equipment. When manure is scraped with a front-end loader or an alley scraper system, a grate to provide the necessary opening for manure flow into the structure shall be provided.

A cover shall be provided for the drop structure. The cover shall be designed to support the anticipated live and dead loads and provide safety for animals and/or humans. Permanent barriers such as gates, fences, etc., may be installed in lieu of a cover if such barriers insure adequate safety for human and animal traffic. Warning signs shall be posted at the drop

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structure to indicate the potential dangers of toxic gases.

Curbing, which is at least 12 inches high and constructed of concrete, wood, or other durable materials, may be installed across from the loading side of the grate to insure total manure flow into the drop structure. The curbing must be adequately anchored and designed against over turning forces by the scraping equipment. The drop structure inlet shall be flush with or slightly lower than the barn floor level.

The top of the drop structure shall be a minimum of five feet above the effective top elevation (top of storage minus freeboard) of the storage facility when the pipe length is less than 100 feet. The top of the drop structure shall be a minimum of six feet above the effective top elevation of the storage facility when the pipe length is greater than 100 feet.

The outlet of the drop structure shall be constructed to minimize the head loss at the inlet of the transfer pipe. The floor of the drop structure shall slope in the direction of the outlet to provide a smooth transition from the drop structure into the conduit. Fillets to reduce sharp corners and significant losses at the pipe inlet are recommended.

The drop structure should be located in the building or enclosed to minimize freezing and drying problems. The area around the drop structure may have to be heated during cold weather to prevent manure from freezing.

**Pipelines.** Design of pipelines shall be in accordance with sound engineering principles considering the type of load on the pipe, exposure, etc. The minimum pipeline capacity from collection facilities to storage/treatment facilities shall be the maximum peak flow anticipated on a daily basis.

The minimum pipeline capacity from storage/treatment facilities to utilization areas shall ensure the storage/treatment facilities can be emptied within the time limits stated in the management plan for manure utilization.

Pipelines used for transferring waste to an irrigation system shall meet the requirements of NRCS conservation practice standard, Irrigation Water Conveyance, Pipeline, Code 430.

All pipes 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.

Pipelines shall be installed with appropriate connection devices to prevent contamination of private or public water supply distribution systems and ground water.

The size, type, strength and pressure rating of pipe shall meet or exceed the pump manufacturer's recommendations. Heavier and stronger pipe shall be considered in areas where unusually high surcharges are anticipated over the pipe.

In all systems where the top of the reception pit is below the maximum operating level of the storage facilities, manually operated valves or other devices shall be installed to prevent the reverse flow of manure through the pipe and pump. Also, a corrosion resistant flap gate shall be installed at the outlet of the pipe, unless the pipe will be used for both loading and unloading of the manure storage facility. The flap gate shall be able to open more than 90 degrees and close by gravity. This shall be in addition to the check valve normally installed as an integral part of the loading pump. Valves and other devices should also be considered on all systems to allow for maintenance and repair of the reception pit, pump and other appurtenances.

**Gravity Transfer Pipes.** The transfer pipe is a conduit used to transfer manure and liquid waste by gravity from the source to a waste storage facility. The pipe must meet or exceed the requirements of the applicable standard specifications as follows:

<u>Pipe Material</u>	<u>Specification</u>
Polyvinyl Chloride (PVC)	ASTM D 3754 or ASTM F 679
Concrete	ASTM C 76
Steel	ASTM A 53, or ASTM A 134, or ASTM A 135, ASTM A 139

All pipe shall be new, unless otherwise approved by the State Conservation Engineer. Pipe with corrugated or similar interior and asphalt coated pipe shall not be used. All pipe must have watertight couplings for the maximum anticipated head over the pipe.

Elastomeric seals or gaskets are required for PVC, steel with bell and spigot ends and concrete pipe. Gaskets shall be the type recommended by the manufacturer of the pipe. Steel pipe without bell and spigot ends shall be welded.

All pipe must withstand the earth, live-load, and dead-load pressures. The minimum earth cover over the pipe shall be four feet or insulation provided to protect against freezing.

For dairy manure, the maximum pipe length shall be 250 feet for manure with no bedding added. The maximum pipe length for manure with chopped hay or saw dust bedding shall be 150 feet. The length of the pipe can be increased to 200 feet if water is added to the manure at the inlet of the pipe. Chopped hay or sawdust bedding must be kept to a minimum to avoid plugging of the pipe. Gravity flow pipe systems are not recommended for manure with long hay or sand bedding. Where possible, the gravity pipe shall be installed on five percent slope or flatter. The maximum length of the pipe shall be reduced by 50 feet if gravity pipes are installed on slopes steeper than five percent. The maximum pipe slope shall be 12 percent.

Gravity pipelines shall not have horizontal curves or bends except minor deflections (less than 10 degrees) in the pipe joints unless special design considerations are used.

Clean-out access shall be provided for gravity pipelines at a maximum interval of 200 feet for lines carrying non-bedded manure. For pipelines carrying bedded manure the maximum interval shall be 150 feet.

The pipe outlet invert elevation shall be at or slightly above the storage bottom. Undulation in the pipe grade shall be kept to a minimum. In locations where the pipe grade changes, the pipe shall be vented to prevent vapor lock. The outlet end of the pipe shall have sufficient cover of manure to prevent freezing during cold weather. The end section of the pipe shall be sufficiently anchored to prevent movement of the section into the storage facility. A headwall or deadman anchors may be required.

For dairy manure, the minimum pipe diameter shall be 24 or 30 inches for systems with the minimum head greater than six feet. Smaller diameter pipes may be considered if water is

added and manure is agitated at the inlet of the pipe.

For swine and veal manure with no bedding, a "flush-type" system is recommended to prevent the build up of solids. The minimum diameter pipe shall be 6 inches for pipe slopes greater than 1.0 percent and ten inches for pipe slopes between 0.5 to 1.0 percent. The minimum pipe diameter for scraper type systems shall be 12 inches. The pipe should enter the manure storage facility at approximately two feet above the bottom. The maximum grade shall be 12 percent.

For milkhouse and parlor wastewater, the minimum pipe diameter shall be 4 inches for pipe slopes greater than 1.0 percent and 6 inches for pipe slopes between 0.5 and 1.0 percent. A settling tank (grease trap) is recommended near the inlet of the pipe to settle out solids.

**Gravity Outlet Pipes.** The outlet pipe is a conduit used to convey manure from the storage facility to a spreader or other hauling unit for application of manure to the field. Due to the potential hazard and management requirements, **gravity outlet pipes are not generally recommended.**

The outlet pipe shall be pressure rated. The minimum diameter shall be 18 inches. The minimum head difference (bottom of storage facility to invert of outlet end) shall be four feet. The bottom of the storage facility shall be sloped a minimum of two percent toward the inlet of the pipe. An additional depression of one foot is also recommended.

The outlet pipe shall have a minimum grade of one percent. The outlet pipe shall have a minimum of two gates or valves; one at the outlet end and one which is located below the frost line between the outlet end and the storage facility. One valve shall be operated manually and the other by another power source (ie. hydraulic). The valves must be dual acting and capable of applying pressure in both directions.

The end section of the outlet pipe shall be welded steel and shall be designed to support the anticipated horizontal and vertical loads. The outlet end of the pipe shall be high enough to load hauling equipment. A loading platform shall be constructed below the outlet and design to support the anticipated spreading equipment.

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A two-foot earthen berm shall be installed around the loading platform to contain any manure spilled during normal unloading operations. A pipe with a shut off valve shall be installed through the berm as an outlet.

**Other Conduits.** Concrete lined ditches shall be designed in accordance with NRCS conservation practice standard Lined Waterway or Outlet, Code 468. A minimum design velocity of 1.5 feet per second shall be used.

**Pumps.** Pumps installed for manure transfer shall meet the requirements of NRCS conservation practice standard Pumping Plant, Code 533. Pumps shall be sized to transfer manure at the required system head and volume. 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.

The outlet from the pump shall provide a smooth transition to the transfer pipe. Pumps and their appurtenances shall be enclosed to protect against rain and cold weather. The enclosure may also have to be heated to protect equipment from freezing. The pump enclosure shall be designed and installed in accordance to practice standard 313 - Waste Storage Facility and manufacturer's recommendations.

**Pump Station.** A pump station is a tank, pump and other appurtenance used to collect milk house and parlor wastewater and other wastewater and transfer to a storage or treatment facility.

The minimum size tank for dairy operations with milking parlors shall be 1000 gallons. Tanks shall be installed in ground below frost elevation. If a tank cannot be installed in ground, other provisions such as insulation and supplementary heat shall be provided to prevent freezing in the tank. Tanks shall be pre-cast concrete septic type that complies with ASTM C-1227 Precast Concrete Septic Tanks. Provisions shall be made to install tanks above the seasonal high water table or designed to withstand the buoyant and other forces. Existing in place septic tanks may be used provided they are sound, in tact and meet the size requirements of the operation.

Pumps shall be submersible electric solid sewage handling type that will pump a minimum of two-inch solids. Sump pumps and effluent or

chopper type sewage pumps shall not be used. Pumps and appurtenances shall be installed in accordance to manufacturer's recommendation. Pumps shall be able to turn on and off by both float and manual switches. Pumps shall be installed to allow for easy access for maintenance and repair. Transfer pipes shall be installed in ground below frost elevation. If transfer pipe is installed above ground, the pipe shall be installed so the wastewater left in the pipe after the pump shuts off is allowed to drain freely out of the pipe. Where possible, above ground transfer pipes shall be installed through barns or other buildings. Above ground pipes should not be directly exposed to cold weather. Insulation of above ground pipes may be necessary to prevent freezing.

**Manure Stacker.** The manure stacker is an elevator that transports solid and semi-solid manure and bedding from the barn (gutter cleaner) to the storage facility. Manure stackers are not designed to handle liquid manure. The stacker shall be installed as recommended by the manufacturer. The discharge end of the manure stacker shall be suspended over the storage facility approximately one-third to one-half the total length of the facility. The support structure for the manure stacker shall be designed and installed in accordance to practice standard 313 - Waste Storage Facility and manufacturer's recommendations.

**Push Off Ramp.** A push off ramp allows manure to be loaded directly into the manure storage facility by means of front end loader or other scraping equipment.

Push off ramps shall be constructed of concrete, masonry, wood, or other approved materials. Push off ramps shall be design to withstand all anticipated static, hydrostatic, dynamic and earth loads and in accordance to practice standard 313 - Waste Storage Facility. Gates, fences, barriers, and other devices shall be installed to provide safety to humans and animals. Warning signs shall be posted at the pushoff ramp.

**Safety.** The system design shall consider the safety of humans and animals during construction and operation.

Open structures shall be provided with covers or barriers such as gates, fences, etc. 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.

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.

Barriers shall be placed on push-off ramps to prevent tractors or other equipment from slipping into waste collection, storage, or treatment facilities.

**Biosecurity.** Manure from diseased animals shall be handled in accordance with the recommendations of the state veterinarian.

Equipment leaving the farm shall be sanitized as appropriate to prevent the spread of disease.

#### **Additional Criteria in Support of Agricultural Land for Final Utilization**

**Waste utilization.** Manure shall be applied to the utilization area in amounts, uniformity, rates, and at a time consistent with the requirements of NRCS conservation practice standard Nutrient Management Code 590 or Waste Utilization, Code 633 as appropriate.

Liquid or slurry manure shall be adequately agitated prior to transfer for the purpose of land application both on and off the farm.

Where manure is to be spread on land not owned or controlled by the producer, the nutrient management plan, as a minimum, shall document the amount of manure to be transferred, the nutrient content of the manure, the date of transfer, and who will be responsible for the environmentally acceptable use of the waste. Provisions shall be made to inform the receiver of the manure of the proper storage and/or utilization requirements.

**Hauling equipment.** Equipment used for hauling manure from one geographical area to another area shall be capable of hauling the manure without spillage, leakage, or wind-blown losses during transport. Hauling equipment shall meet all applicable local, state, and federal laws regarding highway transportation.

Weight limits of roads used for hauling waste shall be followed.

**Irrigation.** The irrigation of manure or wastewater shall include the pumping from the storage facility or reception pit to the field or filter area where it is applied to the land by sprinklers. Sprinkler applied manure contaminated water should normally contain less than four percent solids.

Irrigation pumps, conduits, sprinklers, and other appurtenances shall be designed, installed, maintained and operated in accordance to manufacturer's recommendation. The application of manure and wastewater shall not exceed the infiltration capacity and nutrient requirements of the soil and vegetation.

## CONSIDERATIONS

### General

Consider economics (including design life), overall manure management system plans, and health and safety factors.

### On Farm Transfer

In locating structures, utilize existing topography to the greatest extent possible to generate head on structures and reduce pumping requirements.

Consider the operating space requirements of loading and unloading of equipment in the vicinity of the manure transfer components.

Consider the subsurface conditions, i.e., depth to bedrock, water table, etc., when locating and designing structures.

Pipelines used for transferring manure should be flushed with clean water after use.

When applicable and compatible, consider the joint use of manure transfer pipelines with irrigation system design requirements.

The pipe pressure rating required may need adjustment based on manure temperature.

Consider corrosion resistance and water tightness in the selection of pipe material and joints.

Consider the potential for salt (struvite) deposits in smaller diameter pipes.

Consider the need for appropriate check valves, anti-siphon protection and open air breaks in all pipelines.

Provisions should be made for removing solids from conveyance conduits such as concrete lined ditches, etc

### Off Farm Transfer/Transport

Consider route selection and timing of manure transfer to minimize impact of nuisance odors on others.

Consider equipment type and covering of manure to minimize particulate matter generation during transport of manure.

Vehicles used to transfer manure should be sized to reduce the danger of rollover.

## 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.

## OPERATION AND MAINTENANCE

An Operation and Maintenance (O&M) Plan must be prepared and reviewed with the landowner or operator responsible for the application of this practice. The O&M Plan shall provide specific instructions for proper operation and maintenance of each component of this practice and shall detail the level of repairs needed to maintain the effectiveness and useful life of the practice.

The operation and maintenance plan shall describe what actions will be taken to minimize flies and other insects during the transfer of manure.

For the hauling of manure from one geographical area to another, record keeping by the producer or his/her designated representative will be required and may include such items as:

- the type, nutrient content, and amount of manure transferred,
- the solids percentage of the manure,
- the date of the transfer,
- the name and address of the source and destination of the manure, and
- the condition of the manure as left at the destination (spread, stockpiled and covered, etc.).

The protective cover or barrier for the hopper or drop structure inlet shall be maintained to provide safety for animal and human traffic. The cover or barrier shall be replaced immediately after each cleaning.

Frozen or dried manure can cause plugging of the transfer system. Frozen manure should be piled or stacked until thawed before loading into transfer system.

Shields and other safety devices on gutter cleaners, manure pumps, and other equipment shall be maintained.

Equipment operators should exercise care when loading the transfer system and unloading the storage structure to prevent damage to the system. Any damage to the system should be repaired as soon as practical. The landowner should train all persons involved in the operation of the gravity outlet system. All control valves shall be closed at the end of each day.