United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

WASTE TRANSFER

CODE 634

(no)

DEFINITION

A system using structures, pipes, or other conduits installed to convey wastes or waste byproducts from an agricultural source to a storage facility, treatment facility, or land application site.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Prevent nutrient transport to surface or ground water
- Prevent transport of pathogens to surface or ground water

CONDITIONS WHERE PRACTICE APPLIES

The waste transfer system is included as a component of the agricultural production area, storage facility, treatment facility, and land application areas of the agricultural operation.

The practice applies where it is necessary to transfer waste material generated by livestock production or agricultural product processing between the generation site, storage facility, treatment facility, handling area, loading area, or land for agronomic application.

This practice standard does not apply to mechanical equipment such as barn cleaners, alley scrapers, augers, or belts for moving manure in the housing facility to gather waste.

This practice does not apply to hauling waste material with equipment or vehicles *or transfer by temporary surface pipe or hoses.*

CRITERIA

General Criteria Applicable to All Purposes

Laws and regulations

Notify landowner and/or contractor of responsibility to locate all buried utilities in the project area, including drainage tile and other structural measures. The landowner is required to obtain all necessary permits for project installation prior to construction. Plan, design, and construct the waste transfer system to meet all Federal, State, Tribal, and local laws and regulations.

Safety

Include appropriate safety features to minimize the hazards of the facility. Provide warning signs, fences*(Fence, Code 382)*, ladders, ropes, bars, rails, and other devices, as appropriate, to ensure the safety of humans and livestock. Ensure that proper ventilation and adequate warning signage is provided for waste transfer structures in an enclosed facility or confined area, as necessary, to prevent explosion, poisoning, or asphyxiation.

Include a water-sealed trap and vent or similar devices where necessary to control gases from a pipeline entering an enclosed building or reception pit.

Prevent tractors and other equipment from slipping into waste collection, storage, or treatment facilities by placing barriers on push-off ramps.

Provide covers or barriers, such as gates, fences, grates, etc., at openings to waste transfer components and manure storage structures. Secure to prevent accidental entry by humans and livestock.*Tank covers shall be designed to withstand both dead and live loads. Use the live load values for covers contained in ASAE EP378.4, Floor and Suspended Loads on Agricultural Structures Due to Use, and in ASAE EP393.3, Manure Storages. For vehicles or equipment in excess of 20,000 pounds gross vehicle weight, use the actual axle load.*

Protect pipes at risk of being damaged by equipment or livestock by placing fences or markers along the pipe*, or protective bollards at loadout areas.*

Provide a secure cover or otherwise restrict access to any manually operated in-line valves of a discharge pipe from a waste storage structure to prevent unauthorized release of effluent.*To prevent backflow, install an in-line manual valve in the transfer pipe, located as close to the storage facility as practical, when the top of the storage facility is higher than the top of the transfer structure. An in-line valve is not required if the transfer pipe terminates at an elevation above the top of the storage facility, thus providing an air gap.*

Design and operate<u>confined spaces</u>[i.] where human entry may occur in accordance with ASABE EP470, Manure Storage Safety. Covered <u>channels</u> and <u>reception structures</u> that require human entry are not allowed.

Management Assessment
Conduct a management assessment of the existing and proposed transfer system with the owner/operator to determine the purpose of the transfer components, manure handling practices, waste characteristics, and available resources. Document and incorporate the assessment findings in the design. Include the following:

1. *Waste Characterization*
    a. *Sources, volumes and consistency of manure, <u>contaminated runoff</u>, <u>manure processing derivatives</u>, <u>leachate</u>, <u>wastewater</u>, and other inputs to the waste transfer system.*
    b. *Animal types.*
    c. *Bedding types and quantity.*
2. *Waste handling, transfer methods and duration.*
3. *Facility waste removal methods.*
4. *Access needs and limitations.*
5. *Safety needs.*
6. *Labor and equipment needs.*
7. *Odor production concerns and control strategies.*
8. *Aesthetics and animal health.*
9. *Provisions for facility expansion.*

Site Assessment
Conduct a site assessment to describe the physical site characteristics that will influence the construction, maintenance, and environmental integrity of a waste transfer system. Document and incorporate the assessment findings in the design. Include the following:

[i.] *<u>Words in the standard that are shown in italics are described in the Glossary section. The words are italicized the first time they are used in the text.</u>*

1. *Determine the locations and elevations of buildings, roads, lanes, soil test pits, property lines, setbacks, easements, wells, springs, floodplains, surface waters, surface drains, drain tile, utilities, overhead lines, cultural resources, and wetlands.*
2. *Determine the location of sinkholes and other karst features and conduits to groundwater within 1,000 feet of the facilities in the animal production area.*
3. *Locate subsurface investigations for reception structures, channels and transfer pipes in the animal production area such that no portion of the structure, channel or pipe is greater than 100 feet from a subsurface investigation point. Extend the investigation to a minimum depth to ensure required separation distances for the proposed component are achieved.*
4. *Complete a subsurface investigation for all waste transfer facilities in sufficient detail and analysis to support the design in accordance with EFH, Chapter 4, WI supplement, Exhibit A. Describe the soil material encountered, location of any seeps, depth to subsurface saturation, and depth to bedrock (Note: Exhibit A follows NRCS NEM Part 531, Geology, by utilizing ASTM D2488 procedures).*
5. *Provide a narrative description of design limitations derived from the soils data.*

Separation from Subsurface Saturation or Bedrock
The separation is the closest distance from any point on the inside surface of the component to the feature from which separation is required. Refer to Table 1.

Table 1 Separation Distances for Reception Structures, Hoppers, Channels, Pumps, and Pipes

Transfer Components	***Bottom of Pump, Floor Surface, or Pipe Invert Relative to Bedrock***	***Bottom of Pump, Floor Surface, or Pipe Invert Relative to Subsurface Saturation***	***Well, Spring, and Reservoir Separation Distance*** Note1
Pumps			
Pumps encased in concrete	*≥ 6 inches*	*Bottom of pump maximum depth into saturation shall be 2 feet*	*≥ 50 feet*
Pumps housed in a drywell Note2	*≥ 6 inches*	*Floor may be at the subsurface saturation level*	*≥50 feet*
Reception Structures and Hoppers			
Hopper (< 6,000 gallons)	*≥ 1 foot*	*Floor may be at the subsurface saturation level* Note3	*≥ 50 feet*
Reception tank (≥ 6,000 gallons)	*≥ 2 feet*	*≥ 2 feet (≥1 foot for sumps)* Note3	*≥ 100 feet*
Channels			
All	*≥ 2 feet*	*≥ 2 feet (≥1 foot for sumps)* Note3	*≥ 100 feet*
Pipes			
All	*≥ 6 inches*	*No restrictions*Note 4	*≥ 25 feet*

Note 1: Well, spring, and reservoir separation distances are in accordance with NR 812, Well Construction and Pump Installation. Items not listed in the table shall also be in accordance with NR 812. DNR-permitted animal feeding operations need to follow the 250-foot well separation distance requirements of NR 243.

Note 2: Drywells contain pump hardware and are not intended to contain waste.

Note 3: Separation distances from subsurface saturation is not required if the reception structure, hopper, or channel is designed to withstand anticipated hydrostatic loads and uplift (buoyancy).

Note 4: Ensure adequate cover to prevent floatation in saturated soils

Separation to subsurface saturation is intended to protect components from hydrostatic pressure.

1. *Use the following factors to identify subsurface saturation: gleyed soil, gray mottles, and soil color in conjunction with nearby surface water features. Use the following soil properties to determine the highest subsurface saturation elevation identified in a test pit/soil boring:*
   a. *Free water or wet soil identified by glistening, due to the slow release of water.*
   b. *Gleyed soil, that may extend uninterrupted from an observed free water surface.*
   c. *The presence of distinct gray redoximorphic features with a chroma of 2 or less based on Munsell color charts.*
   d. *Depleted matrices having a value of 4 or more and chroma 2 or less based on Munsell color charts. In some cases, soil parent materials have a natural color of 2 chroma or less or gleyed color that is not due to saturation. In these cases, other indicators may be used: landscape position, elevation, or soils in relation to nearby water features.*
2. *In soils not conducive to mottling, such as sand, establish the subsurface saturation elevation with piezometer observations, or by evaluating the soil morphology and landscape position relative to streams, wetlands and drainage ditches.*
3. *Do not drain subsurface saturation, (or have water- bearing layers removed) except as described for perched conditions. Perched conditions may be drained to achieve separation distances in Table 1 and relieve hydrostatic loads. Document that subsurface saturation is perched and of drainable extent. All drainage systems shall drain by gravity. Evaluate the effect of tailwater on drainage outlets. Locate drainage systems around the outside perimeter of the structural footprint and drain to a free outlet.*
4. *If the site assessment indicates artesian features, complete a hydrogeologic and geotechnical evaluation site suitability of in-ground components.*
5. *Excavation of bedrock is permitted to achieve the required separation distance as specified in the tables. Bedrock shall not be removed by blasting. The exposed bedrock surface shall be evaluated to ensure a structurally sound base. Fractures or voids shall be treated to prevent migration of soil material. The surface of excavated bedrock shall have a positive grade, minimum of 1 percent, under and away from the component, as to prevent any significant ponding on the rock surface. If bedrock is excavated, the material placed between the component and the bedrock shall have a minimum of 20% passing the #200 sieve.*

Flood Prone Areas
Protect reception tanks, channels and hoppers located in flood prone areas from inundation, structural damage and instability. Local zoning regulations may require a higher level of evaluation or protection.

Design waste transfer components to be protected from inundation or damage from a 25-year flood event.

Evaluate hydrostatic pressures and buoyancy/uplift on these systems. Evaluate these systems for additional protections such as automatic shutoff systems, backflow prevention valves or check valves, watertight connections, main power disconnects, submersible type splices on electrical lines, etc. Locate vents, power supplies, and automatic or manual shutoff controls above the 25-year floodplain so that access is possible.

Failure Analysis
Evaluate the overall functionality of the waste transfer system for possible malfunctions that could lead to a release of the waste transfer system contents outside the normal operational confines of the waste management system. Identified potential failures should be addressed in the design phase, the operation and maintenance plan, and the emergency response plan.

Structural design
Design structures with reinforced concrete, steel, wood, or masonry materials in accordance with NRCS National Engineering Manual (NEM) (Title 210), Part 536, "Structural Engineering." Account for all items that will influence the performance of the structure, including load assumptions, durability, serviceability, material properties, and construction quality. Ensure that the material used for a fabricated structure is compatible with the waste product being transferred.

Design structures for the loading conditions criteria in Waste Storage Facility (Code 313). Use Table 1 in Pond Sealing or Lining – Concrete (Code 522) to design reinforcement and spacing between control joints.

Verify that precast concrete manholes conform to the criteria in ASTM C478. Ensure the riser wall and base slab are cast monolithically as a single unit and the pipe joints sealant meet ASTM C-990.

Verify that manufactured structures (precast concrete, fiberglass, or plastic) are watertight and structurally sound as determined by structural analysis (calculation) or performance test. Acceptance criteria are found in the Wisconsin Supplement to the Ag Waste Management Field Handbook, Chapter 10, "Acceptance of Manufactured Tanks."

Use Roofs and Covers (Code 367) to design roofs or covers where needed for structures.

Reception Tanks and Hoppers
Size reception tanks and hoppers to contain a minimum volume of one full day's waste production, *residual waste after pumping, and an additional 6 inches of freeboard*.

Design floor openings with structures that receive manure from scrape alley collection to ensure unrestricted access for the material being scraped. Design the floor opening with a minimum area of 9 square feet, having one dimension of that opening 4 feet or larger. Equip floor grate with openings wide enough to pass the waste and engineered to support the anticipated live loads. Provide safety features to prevent accidental entry to the waste reception pit.

Design curbs, intended to convey waste, to be of sufficient height to ensure all waste flows into the transfer structure. Design curbs to be anchored to withstand working loads.

Provide additional capacity for reception tanks receiving stormwater runoff to contain the volume of precipitation and runoff from the 25-year, 24-hour storm plus *one foot of freeboard*.

Ensure reception tanks, channels, hoppers, and pumps shall meet the separation distances criteria in Table 1.

Pipelines and conduits — General
Design pipes considering the waste material properties, management operations, pipe exposure, *external* static and dynamic loads on the pipe,*static and* <u>*working pressure, pipe*</u><u>*pressure rating*</u>, required capacity and all applicable design factors. Pipe <u>*pressure rating*</u> required may need adjustment based on effluent*and ambient* temperatures.

Design plastic conduits for appropriate burial and loading conditions according to NEH Part 636, Chapter 52 "Structural Design of Flexible Conduits," or Uni-Bell Handbook of PVC Pipe Design and Construction, or PPI Handbook of Polyethylene Pipe.

Use watertight or sewer grade pipes and connection devices for waste transfer pipes.*Install pipe materials and fittings that are liquid tight in accordance with the manufacturer's specifications and Wisconsin Specification 634.*

Provide <u>*cleanout access*</u> for all pipes transferring waste material to allow for removal of settled solids or obstructions. Space pipe cleanouts at a maximum interval of 150 feet along the pipe length, or a maximum interval of 300 feet along the pipe length if bidirectional cleanouts are used. A pipeline

intervention device, such as a foam cleanout ball, is an acceptable method of cleaning out pipes instead of a cleanout access. Incorporate pipe cleanout methods into the design and describe the methods in the operation and maintenance plan.

Cleanout access is not required for pipes transferring wastewater, contaminated runoff, and similar wastes with a low solids content or pipes used for transfer to cropland for application. Incorporate into the design a method to clean these pipes in the event of plugging and describe method in the Operation and Maintenance Plan.

Design the pipe or conduit from the collection facility to have a minimum flow rate equal to the maximum anticipated design flow. Design flow should be a 25-year, 24-hour event to prevent discharge from the system, otherwise, use a design flow that is required for system operation.

Design the pipe to empty the storage or treatment facility in accordance with the planned application rates outlined in the comprehensive nutrient management plan.

Protect pipes exposed to sunlight from ultraviolet (UV) deterioration by selecting UV-resistant pipe materials.

Install pipe properly at all locations to accommodate any traffic crossing, farming operations, frost depth, subsurface saturation, or bedrock elevations. Protect pipe from uplift if subjected to hydrostatic forces. Separate pipe installed near bedrock with at least 6 inches of bedding material. Excavation and removal of bedrock is acceptable to provide bedding depth.

Design transfer pipe to be insulated, heated, buried below anticipated frost depth, constructed of freeze-resistant material, or installed such that it can be drained after each use by gravity or compressed air when cold weather operation is planned. *Protect buried pipe from freezing with either a minimum of 4 feet of soil cover or as specified in WI Administrative Rules, Safety and Professional Services (SPS), Chapter 382 or an equivalent amount of soil and insulation unless the pipe is drained after each use.*

Install pipes with appropriate backflow prevention devices, when applicable.

Install air vents and vacuum relief valves where necessary to eliminate air locks, as well as to protect the pipe against negative pressures.

Pipelines — Pressure

Select pipeline and appurtenance material that meet t*he static and* working pressure criteria of the system. Include in the analysis air and water pressures used to clear the pipeline. *Place a warning sign on all risers indicating the transfer system pressure rating. Match pipe pressure rating to the pump*.

Ensure pressure pipes that transfer waste to storage facilities in Sensitive Environmental Settings,as defined by Waste Storage Facility (Code 313),meet the criteria contained in the severe service transfer pipelines.

Provide thrust control designed in accordance with NRCS National Engineering Handbook (NEH) (Title 210), Part 636, Chapter 52, “Structural Design of Flexible Conduits,” for all pressure pipelines 4 inches and larger in diameter and for fittings and valves. Mechanical joint restraint may be used and must be certified by the manufacturer as adequate to withstand the unbalanced thrust forces in the system, as computed in 210-NEH-636-52.

Maintain the integrity of a wall or liner at pipe penetrations of waste storage structures, reception tanks, and channels. *Do not allow pipe joints within 10 feet of a waste storage facility liner.Install a mechanical and/or concrete restraint for all joints within 25 feet of where the pipe penetrates the inside surface of the waste storage facility (measured along the length of the pipe). Use WI Construction Specification 634, Waste Transfer for all pipeline penetrations and restraints.*

When operating at design capacity, do not exceed 5 feet per second in pipelines with valves placed within the pipeline. Ensure that static and working pressure do not exceed 72 percent of the pressure rating of the pipe. If either of these limits is exceeded, evaluate the pipeline for waterhammer or transient (surge) pressures. Design considerations for surge are contained in the Uni-Bell Handbook of PVC Pipe Design and Construction, or the PPI Handbook of Polyethylene Pipe.

Maintain at least 3 feet per second for cleanout velocity except for ram plunger or piston type pump applications.

Install a check valve near the outlet of each pump except where backflow is incorporated into the design.

Provide a pressure relief valve after the check valve, near the pump, to protect the pipeline against the pump shutoff head if the pipeline *becomes obstructed. If the pressure rating of the pipeline and appurtenances is sufficient to contain the pump shutoff head, a pump shutoff switch activated by a minimum and maximum pressure setting can be used in lieu of a pressure relief valve.*

Size pressure relief valves to be no smaller than one-fourth inch for each inch of the pipe diameter. Set pressure relief valves to open at a pressure no greater than 5 pounds per square inch above the transfer system working pressure.

Pipeline - Severe Service
Severe service transfer pipelines include those supplying flush water to dosing systems and cropland under pressure. Test the pipe for leaks in accordance with Waste Transfer Pipe (WI Spec. 634). Include the test protocol and results in the as-built documentation. Pipeline used for transferring material to an irrigation system shall meet the requirements of Irrigation Pipeline (Code 430).

Pipelines — Gravity
Meet the criteria in Table 2 for gravity flow pipes.

Table 2 Summary of Criteria for Gravity Transfer Systems

	Slower Flowing Wastes	***Faster Flowing Wastes***
Description	*For wastes that tend to be slower flowing due to bedding, feed, or dryness (typically stanchion barns or thick slurries with higher viscosities).*	*For wastes that tend to be faster flowing due to additional liquids or lack of bedding (typically free stall barns, veal or hog facilities, and contaminated runoff with lower viscosities).*
Minimum Pipe Diameter	*24 inches*	*No minimum diameter*
Minimum Head in Gravity Flow Systems (as measured from the Maximum Operating Level (MOL) of the Waste Storage Facility)	*Shall be a minimum of 4 feet below the bottom of the lowest point of entry from the barn cleaner, scrape alley, etc.* *For pipe over 100 feet in length an additional height equal to 1% of the transfer pipe length shall be included.*	*Liquid or semi-solid wastes shall have a minimum of:* • *2 feet below the lowest point of entry from the scrape alley, barn cleaner, channel, etc., and* • *An additional height equal to 1% of the transfer pipe length* *Diluted wastes shall have a minimum of:* • *1 foot below the lowest point of entry from the scrape alley, barn cleaner, channel, etc., and* *An additional height equal to 1% of the transfer pipe length*
Minimum Volume of Reception Structure	*One full day's manure production. A minimum of one-half a day's manure volume must be between the MOL of the waste storage facility and the bottom of the barn cleaner or scrape alley.*	*One full day's manure production.*
Vent Pipe	*A 6-inch diameter minimum vent pipe is required. Install within 10 feet of the reception structure.*	*A 6-inch diameter minimum vent pipe installed within 10 feet of the reception structure is required for reception structures with knife valves.*

Design for a minimum velocity of 3 feet per second to prev*ent sedimentation*.

Convey waste into and through the pipe to minimize ponding in the production area. Design the gravity pipe to follow as direct a route as possible. Horizontal curves or bends in the pipe joints of a gravity pipe require special design considerations except for minor deflections of less than 10 degrees.

Account for the process of sand settling out of the waste stream in a gravity flow design that transfers sand-laden manure. The minimum gravity pipe flow velocity for sand-laden manure is 5 feet per second. Design transfer systems to handle abrasionfor a flow velocity exceeding 6 feet per second.

For a flume system with slurry manure, limit the design depth of flow in the pipe to 50 percent of the pipe depth to maintain the scouring effect of the flow.

Install a minimum of two manually operated in-line valves, with one located as close to the storage facility as practical, for a pipeline designed to gravity discharge liquid waste from a waste storage or treatment facility. If an automatic valve is used for gravity loading or transfer, the automatic valve will be in addition to the two manually operated in-line valves.

Do not use gravity outlets to empty waste storage facilities.

Gravity discharge pipe used for transferring waste from one storage facility to another shall have a minimum of two shut off valves if one facility can release a volume that would exceed the maximum operating level of the receiving facility. Locate the valves as close to each of the storage facilities as practical. One valve shall be manually operated.

Other conduits
The minimum design velocity for waste transfer in open ditches and channels is 1.5 feet per second.

A minimum concrete thickness of 5 inches is required for a reinforced cast-in-place concrete-lined ditch or channel for waste transfer.

Pumps
Use Pumping Plant (Code 533) for a waste transfer pump where needed.

Select the pump to transfer the waste material at the system pressure head and rate required. Determine the type of pump by the consistency of the material and the type of solids. Use pump manufacturer's recommendations for the installation requirements.

Correct the total dynamic head for viscosity and specific gravity of the liquid waste used in pump selection. Reference 210-NEH, Part 651, Chapter 11, "Waste Utilization," for increased friction losses caused by higher fluid viscosity, and 210-NEH-651, Chapter 12, "Waste Management Equipment," for pump selection guidance.

Agitators
Include agitators, as needed, to facilitate pumping of liquid or slurry waste for transfer. Size the agitation equipment to provide adequate agitation of the volume of storage. Select equipment compatible with the type and consistency of the waste material. Base requirements for agitator sizing, installation, and operation on manufacturer's recommendations.

Solid/liquid waste separation
Use Waste Separation Facility (Code 632) to separate a portion of the solids from the manure or liquid waste stream, as needed.

CONSIDERATIONS

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

Time and locate agitation and transfer activities to minimize odor formation and the breeding of insects within the material.

Cover and/or minimize the disturbance of material to reduce the likelihood of air emissions, hydrogen sulfide formation, and release of particulate matter, volatile organic compounds, methane, and ammonia.

Consider abandonment, relocation, or additional floodproofing for existing reception structures located in flood-prone areas. For additional information on floodproofing structures, see “Floodproofing Non-Residential Buildings” (FEMA P-936, 2013).

Protect storage structure liners from hydrostatic soil pressures that may be caused by preferential flow paths along the outside of the installed pipe.

Consider a positive displacement pump for liquid waste with total solids exceeding 8 percent.

Increase the total dynamic head up to 30 percent for pumping manure slurries with 3 to 8 percent total solids (wet basis).

Use a wet sump and agitation pump to reduce solids separation within the gravity reception structure.

Select a pump with a low speed for manure slurries which contain abrasives such as sand.

Use a semi-open impeller pump to handle manure slurry with straw, twine, hair, and sludge. Pumps with cutting knives and recirculation agitation capacity also reduce plugging.

Install a cleanout or vent riser within 10 feet of the reception structure and other grade change locations on gravity transfer systems to reduce the risk of an air lock in the pipe.

Use premanufactured manholes as risers at stations to change direction for needed transitions.

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

Consider load out areas with sufficient volume to contain and convey any spillage or failure to the hauling vehicle or to a transfer or storage facility.

When applicable and compatible, consider the dual use of waste transfer pipelines for irrigation water delivery.

Install a locator wire in the trench with transfer pipelines.

Consider corrosion resistance and water tightness in the selection of pipe material and joints due to the nature of the waste material.

Consider the potential for struvite phosphate (magnesium ammonium phosphate) mineral deposition in smaller diameter pipes and places where there is high turbulence such as pipe connections and valves. Preventative measures may be needed, such as acid washing the pipe to prevent the buildup of deposits.

Consider the need for additional check valves, cleanouts, vent risers, knife valves, anti-siphon protection, and vacuum relief valves and open-air breaks, as appropriate, on all pipe systems.

Use leak detection methods and equipment for monitoring and periodic pressure testing of waste transfer systems installed in sensitive areas having large daily flow volumes, long flow lengths, or high flow pressures.

Consider installing thrust control consisting of a cast-in-place thrust block installed at every third joint, or a mechanical joint restraint device installed at every joint for gasketed pipe subjected to pulsating flow.

When exporting solid waste material off-farm, consider Waste Recycling (Code 633).

Consider the effects of adding liquid to manure that contains sand bedding. Liquid can enhance sand settling.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for constructing a waste transfer system that describe the requirements for applying this practice to achieve its intended use.

- Construction plans and specifications must include a location map, plan view, profiles, cross sections, details and specifications of all structures, etc., to ensure that the project can be properly constructed.
- NRCS acceptance may require pressure testing of a pressure pipe system prior to waste transfer service. If required, include the test protocol and results in the as-built documentation.
- *Include the maximum static (including pump shutoff head) and working pressure and the pressure rating of the pipelines, valves, and appurtenances.*

Quality Assurance Plan

A quality assurance plan is required that describes the type and frequency of testing, the items requiring inspection, the documentation required, and the qualifications of the person doing the work.

Address the following items in the quality assurance plan:

1. *Site and contact information*
2. *Introduction and project description – narrative format*
3. *Responsibilities of key parties*
4. *Pre-construction meeting*
5. *Inspection, observation, and testing requirements*
6. *As-built plans and other certification documentation*

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan for review with the landowner or operator responsible for the application of this practice. Provide specific instructions in the O&M plan for proper operation and maintenance of each component of this practice and any detail needed for the level of repairs to maintain the effectiveness over the useful life of the practice. Include—

- Evaluating the overall functionality of the waste transfer system for possible malfunctions that could lead to a spill or release of waste material. Address the identified potential failures in the inspection procedures of the O&M plan. Prepare an emergency response plan to be implemented in the event of such a failure.
- Agitating liquid or slurry waste material adequately prior to transfer.
- Flushing pipes used for transferring waste material with clean water after use and to reduce the risk of gas buildup and pipeline explosion.
- Periodically removing solids from conveyance conduits such as concrete-lined ditches, grates, etc.
- During outbreaks of disease, handling waste products according to the State veterinarian guidance on biosecurity for animal waste material.
- Sanitizing equipment leaving the farm, as appropriate, to prevent the spread of disease during an outbreak.
- Documenting use of confined space entry points and signage requirements and their review prior to entering areas with possible gas buildup or asphyxiation concerns.
- *Operating procedures including: typical operating procedures, procedures for proper start-up and shutdown for the operation of pumped transfer systems and valve operation sequence if applicable.*
- *System information including the general system description, assumed system performance, maximum design working pressure and the transfer system pressure rating of each transfer system.*

REFERENCES

Federal Emergency Management Agency. 2013. FEMA P-936, Floodproofing Non-Residential Buildings. Washington, D.C.

USDA NRCS. 2009. National Engineering Handbook (Title 210), Part 651, Chapter 10, Agricultural Waste Management Systems Component Design. Washington, D.C. https://directives.sc.egov.usda.gov/.

USDA NRCS. 2013. National Engineering Handbook (Title 210), Part 651, Chapter 11, Waste Utilization. Washington, D.C. https://directives.sc.egov.usda.gov/

USDA NRCS. 2011. National Engineering Handbook (Title 210), Part 651, Chapter 12, Waste Management Equipment. Washington, D.C. https://directives.sc.egov.usda.gov/

USDA NRCS. National Engineering Handbook (Title 210), Part 642, Chapter 2, National Construction Specifications. Washington, D.C. https://directives.sc.egov.usda.gov/

USDA NRCS. National Engineering Handbook (Title 210), Part 642, Chapter 3, National Standard Material Specifications. Washington, D.C. https://directives.sc.egov.usda.gov/

USDA NRCS. 2005. National Engineering Handbook (Title 210), Part 636, Chapter 52, Structural Design of Flexible Conduits. Washington, D.C. https://directives.sc.egov.usda.gov/

USDA NRCS. 2017. National Engineering Manual (Title 210), Part 536, Section 536.20, Design Criteria for Reinforced Concrete Structures. Washington, D.C. https://directives.sc.egov.usda.gov/

GLOSSARY

Animal Production Area – Means any part of the livestock operation that is used for the feeding and housing of livestock. This includes the entire animal confinement and feeding area, and any adjacent manure storage areas, animal lots, raw materials storage areas, and waste containment areas. This does not include pasture and cropland.

Bedrock – The solid or consolidated rock formation typically underlying loose surficial material such as soil, alluvium or glacial drift. Bedrock includes but is not limited to limestone, dolomite, sandstone, shale and igneous and metamorphic rock.

Note: Although solid or consolidated bedrock can sometimes be removed with typical excavation equipment, these materials are included in the above definition.

Channel – A narrow structure with negligible storage capacity, into which wastes are scraped or flushed for immediate transfer to reception structures, hoppers or waste storage facilities. Channels may include internal mechanical or hydraulic transfer mechanisms.

Cleanout Access – Pipe appurtenances such as air flushing valves, risers, manholes, and accessible openings of pipe into reception structures or storage facilities that allow mechanical cleaning or unplugging of a pipe.

Conduits to Groundwater – Sinkholes, swallets, fractured bedrock at the surface, mine shafts, non-metallic mines, tile inlets discharging to groundwater, quarries, or depressional groundwater rechargeareas over shallow fractured bedrock. Wells were intentionally left out of this NR 151 list.

Confined Space – 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 – 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.

Cultural Resources – Cultural resources are the traces of any past activities and accomplishments of people. They include tangible traces such as historic districts, sites, buildings, structures, historical documents and cemeteries. They also include traces of less tangible objects such as dance forms, aspects of folk-life, cultural or religious practices, and some landscapes and vistas.

Flood Prone Areas – These include areas delineated as floodplains on Federal Emergency Management Agency (FEMA) maps, or local floodplain maps as well as areas along perennial streams (blue lines) shown on the United States Geologic Survey quadrangle sheets that may be subject to out of bank flows.

Gleyed Soil –A soil condition resulting from prolonged soil saturation, which is manifested by the presence of grayish, bluish or greenish colors through the soil matrix. Gleying occurs under reducing conditions, by which iron is reduced predominantly to the ferrous state.

Hopper – Structure meant solely to feed wastes into a transfer pump. Hoppers are less than 6,000-gallon capacity.

Karst features – Refers to areas of land underlain by carbonate bedrock (limestone or dolomite). Typical land features in karst areas include sinkholes, network of interconnected fissures, fractures, disappearing streams, closed depressions, blind valleys, caves, and springs. See the companion document in Chapter 10 of the AWMFH for additional discussion of karst features

Leachate – 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.

Manure Processing Derivatives – The by-products and waste components that are produced as a result of treatment and processing practices. These include, but are not limited to, the following waste components: flush water, separated sand, separated manure solids, precipitated manure sludges, supernatants, digested liquids, composted biosolids, and process waters.

Perched Conditions –A soil moisture condition consisting of limited area including 1) saturated soil 2) depleted, gleyed or reduced matrices or, 3) reduced redoximorphic features, located above or part of a barrier to downward flow. Directly below the barrier to downward flow and above the normal free water elevation a soil moisture condition exists in a soil layer(s) which does not display 1) saturation; 2) depleted, gleyed or reduced matrices; or 3) reduced redoximorphic features.

Pump shutoff head – Maximum pressure a pump can produce. Represented by the highest point on the pump flow curve.

Pressure Rating – Estimated maximum water pressure the pipe is capable of withstanding continuously with a high degree of certainty that failure of the pipe will not occur. Pressure rating is determined by the pipe manufacturer.

Reception Structure – A collection vessel that will hold waste and facilitate its transfer. Reception tanks are larger than 6,000-gallon capacity.

Sinkholes – Closed, usually circular depressions which form in karst areas. Sinkholes are formed by the downward migration of unconsolidated deposits into solutionally enlarged openings in the top of bedrock.

Transfer System Pressure Rating – The lowest pressure rating of any pipe, pipe fittings, and other appurtenances. This is independent of pump shutoff head pressure.

Wastewater – Milking center waste, flush water, leachate from feed holding areas, and similar waste materials generated at the animal production area.

Working Pressure – The maximum designed operating pressure of the transfer system. Working pressure is a maximum of 72% of the transfer system pressure rating. For pumped systems, this is determined by the shut-off head of the pump and static head.