

## **Manure and Wastewater Handling and Storage Engineering Procedure**

The following information contains guidelines and procedures for design and construction of the manure and wastewater handling and storage element of a comprehensive nutrient management plan (CNMP). It establishes the minimum documentation to be developed for each system.

### **Planning and Design**

#### **Planning**

Planning is required to identify the resource concerns, determine the owner's objectives, inventory the resources, analyze the resources, and present alternatives with estimated costs. This planning can be provided by the Natural Resources Conservation Service (NRCS) or others. The owner will select an alternative, and an Environmental Quality Incentives Program (EQIP) contract (if applicable) will be written. To design the project, the owner can select either a technical service provider (TSP) or NRCS.

The resource inventory may contain items such as number, type, and size of animals; location of wells; soil information; water table; area of feedlot; manure handling equipment; utility location; property lines; location of neighbors; safety considerations; and the amount (if any) of fresh water draining into the feedlot.

#### **Design Surveys**

Topographic surveys are needed to locate facilities and determine elevations and drainage. The survey may consist of as little as a profile for a clean water diversion or as much as a detailed topographic survey of the entire barn and feedlot area for a system of diversions, settling basins, and storage ponds. In general, a survey is needed for all practices that require earthwork.

At least one good bench mark, which will not be destroyed during construction, is required. Shots should be taken on physical features and landmarks in the vicinity that will orient the survey and make it possible to relocate any survey points.

#### **Geologic Investigation**

Soil borings or excavations will be conducted to determine foundation characteristics and will be logged using the Unified Soil Classification System.

Static water levels will be measured and recorded when the level stabilizes. Apparent seasonally high water tables (perched) will be noted as shown by the soil characteristics.

## Design

The design of the practices required to meet the objectives shall be in accordance with whichever are applicable of the following conservation practice standards in Section IV of the NRCS electronic Field Office Technical Guide (eFOTG):

- [313, Waste Storage Facility](#)
- [632, Solid/Liquid Waste Separation Facility](#)
- [634, Waste Transfer](#)
- [521D, Pond Sealing or Lining, Compacted Clay Treatment](#)
- [362, Diversion](#)
- [521B, Pond Sealing or Lining, Soil Dispersant Treatment](#)
- [521C, Pond Sealing or Lining, Bentonite Treatment](#)
- [635, Vegetated Treatment Area](#)

The design of complimentary conservation practices shall be in accordance with the appropriate conservation practice standards in Section IV of the [eFOTG](#).

Detailed documentation that shows all the assumptions made and all the equations and references used shall accompany each design.

The design should take into account the following items as they deal with manure and wastewater:

- Collection
- Transportation
- Storage
- Treatment
- Utilization (This item will be covered by the nutrient management plan.)

### Design References

- [National Engineering Handbook Part 651 \(NEH 651\), Agricultural Waste Management Field Handbook](#) and the [Kansas Supplements to NEH 651](#)
- Midwest Planning Service (MWPS) references
- American Society of Agricultural and Biological Engineers (ASABE) standards and engineering practices

### **Preparation of Plans**

A design folder shall be prepared for all systems. The folder is to contain the investigations, notes, computations, drawings, sketches, and other data used in the design analysis. It also is to contain the construction drawings and specifications, table of quantities, and the operation and maintenance plan. The items are to be recorded neatly and organized in a folder or binder (or referenced if too large to be included) so that they can be efficiently reviewed.

The plans (drawings and specifications) are to be prepared in a manner and format that provide all the information needed to construct the works of improvement. Other design data should only be included on the drawings if it will not unnecessarily complicate the drawings or confuse the individuals using the drawings during construction or checkout.

Drawings must be large enough to provide adequate detail. On simple jobs, 8½-inch by 11-inch sheets may be adequate; however, jobs that are more complex will require 11-inch by 17-inch sheets.

### Title Sheet

- Owner/operator name
- Index
- Table of Quantities

### Location Map

Location maps are to be shown on all plans. Use an appropriate scale and show the following on the map:

- Location of roads, property lines, and fences
- Location of the proposed work with legal description
- Locations of neighbors
- Location of lakes, streams, bridges, culverts, wells, and other structures which are important to the design
- Watershed delineation for freshwater diversion
- North arrow and scale

### Plan View

The plan view will contain an accurate contour map of the structure site. The maximum contour interval will be 2 feet. The largest scale that will permit the plan view to be contained on one sheet will be used. It is recommended that the scale not exceed 1 inch = 200 feet. The scale used should be a common ratio (for example, 1 inch = 10, 20, 30, 40, 50, 60 feet or multiples thereof).

A plan profile sheet should be considered to readily relate layout with elevations. Where the contour map is shown on a plan profile sheet, consideration shall be given to making the profile scale the same as the plan scale.

The plan view will show the following items in detail:

- The storage pond and/or structure, diversion, settling basin, components (such as pipe inlet, chute, pump, etc.), and complementary conservation locations, as needed
- Necessary dimensions or data for construction layout
- Location of cross sections
- Watershed sizes and boundaries of all runoff control structures

- All bench marks (with descriptions), soil borings, buildings, fences, paved areas, wells, utilities, lakes, streams, roads, culverts, bridges, borrow areas, waste areas, or other improvements that influence the design or construction of the proposed work
- Location of safety fence, if required
- Property lines and names of property owners
- North arrow and scale
- Location of borrow area, if needed

### Cross Sections and Profiles of Storage Ponds and Structures

The location of cross sections and profiles must be stated such as "along centerline," "cross section A-A," or "at station." Cross sections or profiles parallel to each axis of storage ponds or structures are required as a minimum.

Standard cross section drawings may be used to complete the details of very simple storage ponds provided the typical cross sections accurately represent the sections. Cross sections and profiles of storage structures or pond components (such as chutes and ramps) are also required.

The following information is to be shown on cross sections or profiles of storage ponds or structures:

- The original ground line
- Stripping details
- Details (with appropriate labels) of all excavation (including foundation excavation, if required) and earthfill areas
- Core trench bottom elevations and bottom width, if required
- Elevations of the subcut and finished bottoms
- Subcut and finished bottom widths
- The constructed and settled top of fill elevations - Show the top of the fill at settled height with a solid line and constructed height with a dashed line.
- Top width of fill
- Side slope ratios
- Topsoil details
- Location and details of liner(s), if required; depth of soil liner perpendicular to slope
- Soil logs and ground water levels

### Structure Details

Show the plan, profiles, cross sections, elevations, reinforcement, or other details that may apply. Steel reinforcement details must be shown for all components of concrete tanks, walls, floors, footings, beams, and columns. Where drainage and/or granular backfill are required, this is to be shown on the wall cross section detail.

### Soil Logs

The soil borings or test pits data recorded in the field will be included on the construction drawings. All soil logs will be accurately plotted on the plan view to show the location and, on the cross section or profile, to show the location and elevation.

### Estimated Quantities

Show quantities, size, and kind of all materials needed for construction in tabular form.

### Construction and Material Specifications

Construction and material specifications will be provided for all practices and need to be supported by and coordinated with the design data and the construction drawings.

### Cost Estimate

The estimated cost of the project will be itemized on a separate sheet and be included in the design folder.

### **Plan Approval**

The designated individual shall approve completed construction plans and supporting data in the design folder. This approval assures that the plans were developed according to the appropriate NRCS practice standards.

### **Copies of the Approved Plans**

A minimum of 7 copies of plans normally will be needed for distribution as follows:

- Contractor
- Owner/operator
- For owner to submit to the Kansas Department of Health and Environment (KDHE) for a permit (4 copies)
- For use by NRCS (including as-built plan documentation)

### **Required Plan Contents**

- Construction and material specifications and construction notes
- Complete set of construction drawings, including all standard (pre-approved) plans
- Seeding, fertilizing, and mulching plan (may be developed by NRCS)
- Operation and maintenance plan
- Waste volume calculations (for use in developing the nutrient management plan)
- Inspection plan

## **Construction**

### **Construction Layout**

- Furnish the contractor with complete sets of drawings and specifications prior to construction.
- Field layout will be in accordance with plans except for necessary changes that have been authorized by the individual who approved the original plans. If changes are made, they are to be recorded on the as-built plans with documentation of proper approval.
- Contact permitting agencies when major changes are made or unforeseen conditions arise.
- Large earth cuts and fills may be slope staked. Slope stakes may be offset a specified distance so as not to be disturbed during construction.

### **Inspection of Construction**

- A pre-construction conference should be held prior to starting work to ensure that all parties (owner, contractor, and engineer) know what work is to be done and how it will be accomplished.
- Inspection plans shall be followed by the inspection personnel.
- Inspection personnel will inspect construction to the fullest extent possible, especially work that is not readily observed after installation.
- Inspection personnel must be sensitive to developments during construction that are different from the assumptions made in the design. When these developments occur, the individual shall evaluate the conditions and make any adjustments necessary to the drawings and specifications. If changes are made, they are to be recorded on the as-built plans with documentation of proper approval.
- Contact permitting agencies when major changes are made or unforeseen conditions arise.
- Critical items such as placing concrete, installing the liner, and backfilling around conduits require continuous inspection.
- Field notes and check notes made during construction will be kept as part of the documentation records. As much checking as possible will be done during construction so that errors made are corrected before completion.

## **Construction Checkout**

### **Checking Procedures**

- Checkout documentation should be recorded in a field notebook or similar document.
- Make visual inspection of completed structures.
- Determine that adequate survey field notes, plans, specifications, and construction layout data are available as a basis for comparing completed work with planned or specified work.

### Earthen Storage Ponds

- Take profiles along the centerlines of core trench bottoms (if used) and tops of pond embankments.
- Take cross sections along each centerline of the pond (including top and bottom elevations, top and bottom widths, and exterior and interior side slopes) and typical cross sections of core trenches, if used.
- Determine elevations of bottom corners.
- On large ponds (where either bottom dimension exceeds 200 feet), additional cross sections perpendicular to the longer axis are required. The maximum spacing between cross sections will not exceed 100 feet.
- On lined ponds, the items above will be taken before and after liner installation. This may require taking "partial" cross sections as the liner subgrade is prepared and as the liner is installed.
- Survey the profile of the centerline and at least 1 cross section of all runoff inlet structures (chutes, pipes, ramps, etc.)
- Survey a representative cross section of the auxiliary spillway (if used) to show the constructed elevation and dimensions.

### Concrete Storage Structures

- Document locations and sizes of steel reinforcing.
- Measure bottom dimensions and survey elevations at corners and midpoints of walls.
- Survey the top of wall elevations at corners and midpoints.
- Measure and record wall, floor, and cover thicknesses at random points that appear least likely to meet specifications.
- Measure the constructed dimensions of all specified openings.

Note: All readings and measurements will be made on completed formwork prior to placing concrete and will be confirmed when forms are removed.

### Pre-Fabricated Structures

Sufficient survey and measurements shall be made and recorded to document and certify that the structure is located as planned and installed according to the manufacturer's specifications.

### Other Conservation Practices

Provide cross sections, profiles, side slopes, dimensions, and other pertinent information to confirm that the practices are located as planned and installed according to the specifications.

### As-Built Plans

- As-built plans are required for all agricultural waste management systems. For earthwork and structure components, the as-built will be recorded on the original plan or a copy showing any construction changes and documentation of proper approval. As-built documentation of constructed changes to storage ponds will include storage calculations showing adequate constructed storage volume. These final volume calculation sheets will be considered a part of the as-built plans.
- For pre-approved plans, the as-built will consist of a complete location and layout plan with reference to the standard plan name, number, and date.
- If there are changes or developments that come up during construction that need to be documented with the permitting agencies, either a set of as-builts or a completion report that describes the changes is recommended.

### Minimum Documentation to be Given to NRCS

- Design folder (including survey notes)
- A list of applicable construction and material specifications and construction notes
- Seeding, fertilizing, and mulching plan (may be developed by NRCS)
- Operation and maintenance plan
- Waste volume calculations (for use in developing the nutrient management plan)
- Inspection plan
- As-built plans, completion report, and checkout survey notes