W 792

PREPARING FOR DISASTER:

Comprehensive Trench Burial Guidelines for Tennessee Poultry Producers

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UTEXTENSION
INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE

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Preparing for Disaster: Comprehensive Trench Burial Guidelines for Tennessee Poultry Producers

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Introduction

Prepare and plan now. Catastrophic mortality events occur on poultry farms as a result of natural disasters, accidents and disease. It is critical for poultry producers to prepare carefully for these events. This guide will assist Tennessee poultry producers with one disposal option, burial trenches. Burial may or may not be the most prudent disposal option for any particular farm. However, if burial is expected to be used as a disposal technique, **now is the time to determine if burial is a good option for your farm**. The information herein will help you identify appropriate burial locations, gain knowledge of recommended burial site setbacks, and learn how to size and build a large burial trench.

These guidelines are made with the expectation they will be used by poultry producers to perform burial of catastrophic losses originating from their own farm. Burial must occur on property owned by the producer. **It is not appropriate to use this guide to identify burial sites that involve multiple affected premises or disposal on property you don't own.**

Understand your liability. Decomposing animal carcasses produce fluids called leachate, a noxious byproduct of decomposition that contains conventional pollutants, like ammonia, and potentially harmful microorganisms. Although the soil under and surrounding burial pits helps remove these pollutants, trench burial of carcasses obviously incurs risk for future ground and/or surface water contamination. Because burial decomposition can take many years, even decades, this risk is long-term. **In short, the decision to bury large numbers of poultry carcasses incurs liability that the producer must be aware of and bear**.

Trench burial of animal carcasses may devalue the burial site property and render it unsuitable for some future uses. Deed modification to identify this use of the property is sometimes required. **If the burial site disturbed area exceeds 1 acre, the property owner MUST contact the Tennessee Department of Environment and Conservation (TDEC) for permit and deed modification guidance (615-532-9224).**

Questions and Answers

Q1. What's the best way to pick a location for burial trenches?

You can easily evaluate whether your farm soils are likely suitable for burial trenches in a matter of minutes. Simply go online to the USDA Natural Resources Conservation Service (USDA-NRCS) Web Soil Survey (WSS). The WSS houses a tool that will generate a color-coded interactive map of your farm soils based on burial site suitability. Green-shaded soils are **Not Limited**, meaning they are fully expected to be suitable for unlined burial trenches. Yellow-shaded soils are **Somewhat Limited**, meaning soil deficiencies are present that may partially impair their use for catastrophic mortality burial sites. Red-coded soils are **Very Limited**, meaning they have characteristics that prevent prudent use as burial sites.

Instructions to perform a burial site evaluation are provided below:

1. Go to the WSS website: websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx.
2. Under the **Quick Navigation** menu, select the **Address** option, type your address and press enter **(Figure 1).**
3. Use the **Zoom In** (), **Zoom Out** () and **Pan** () tools to view your entire farm (**Figure 2**).
4. Click to activate the irregular **Area of Interest** (AOI) tool () (**Figure 2**) and use it to outline your farm property boundary as the AOI. Double-click to finish.
5. After the AOI is drawn to your satisfaction, click on the "**Soil Data Explorer**" tab (**Figure 3**).
6. In the "**Soil Data Explorer**" tab, open the "**Disaster Recovery Planning**" drop-down menu (**Figure 3**).
7. In the "**Disaster Recovery Planning**" menu, open the "**Catastrophic Mortality, Large Animal Disposal Trench**" menu item (**Figure 3**).
8. Click "**View Rating**" to generate a soil suitability rating map. Take note of a warning you'll find at the bottom of the map: ***Boundaries between the soil types are inexact***. Be aware that ***the listed soil characteristics only apply to a 6-to-7-foot depth and then only if the area has not been modified*** by past excavation or fill.
9. Click the "**Printable Version**" button to print a hard copy of the map for final siting **(Figure 3).** Note that you can save the map using the "**View**" button in the dialog box that pops up. When you print the map, you'll find a **Map Unit Table** that describes your farm soils and a rating of their suitability for use as catastrophic mortality burial trenches.

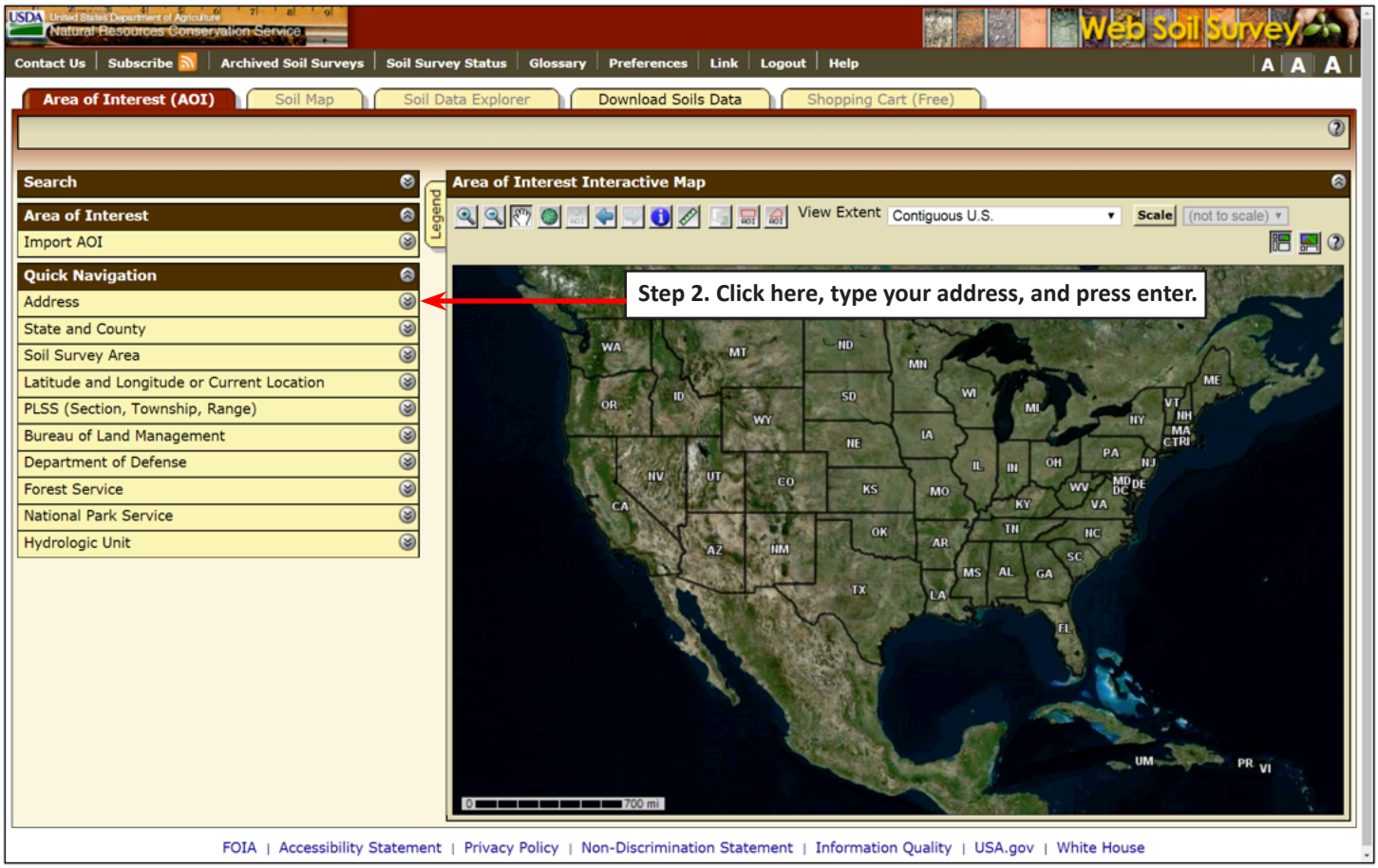

Figure 1. Screenshot of the Web Soil Survey website. The "Quick Navigation" menu item has an option to enter your farm address. After typing your address, press enter to quickly zoom to a local view of your farm.

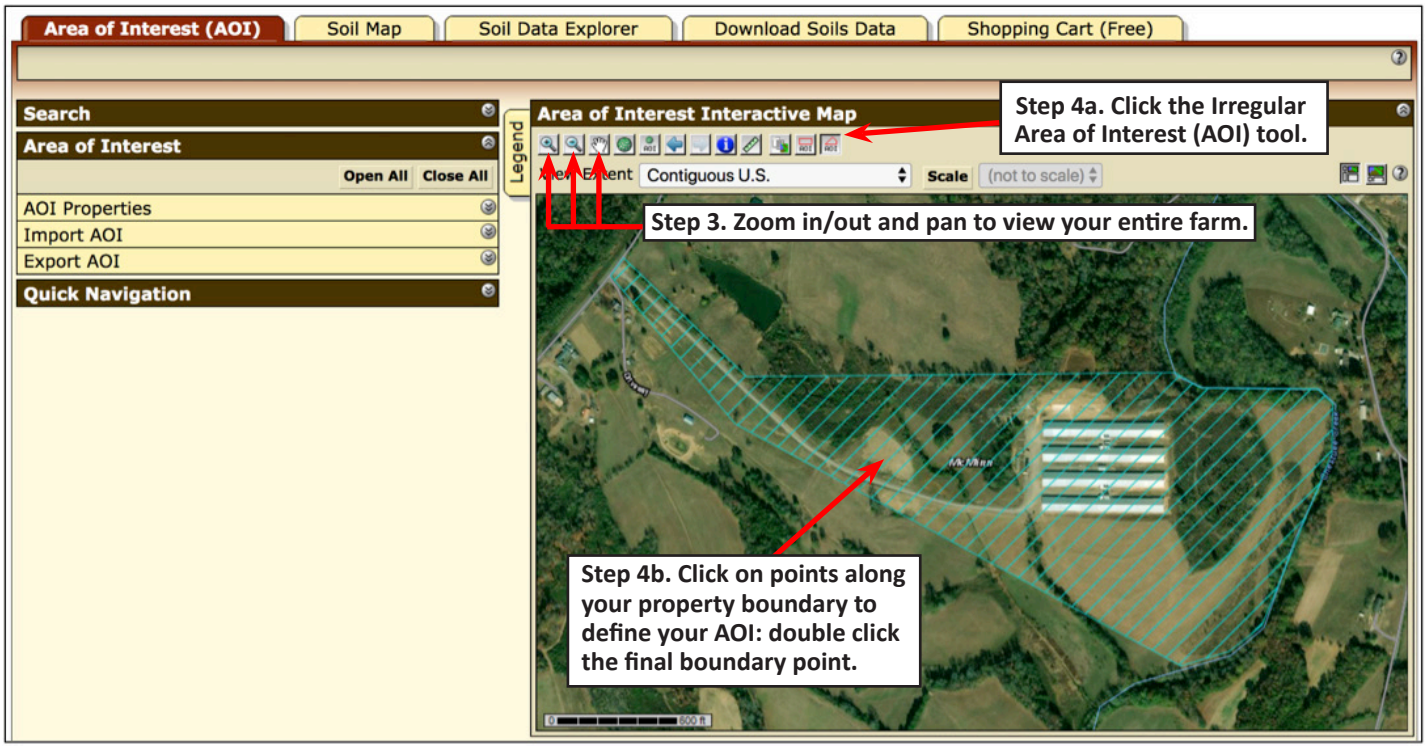

Figure 2. Screenshot of the Web Soil Survey website. The irregular "Area of Interest" (AOI) tool is used to define your AOI, for example, as your farm property boundary. Results are illustrated for a sample broiler farm in McMinn County, TN.

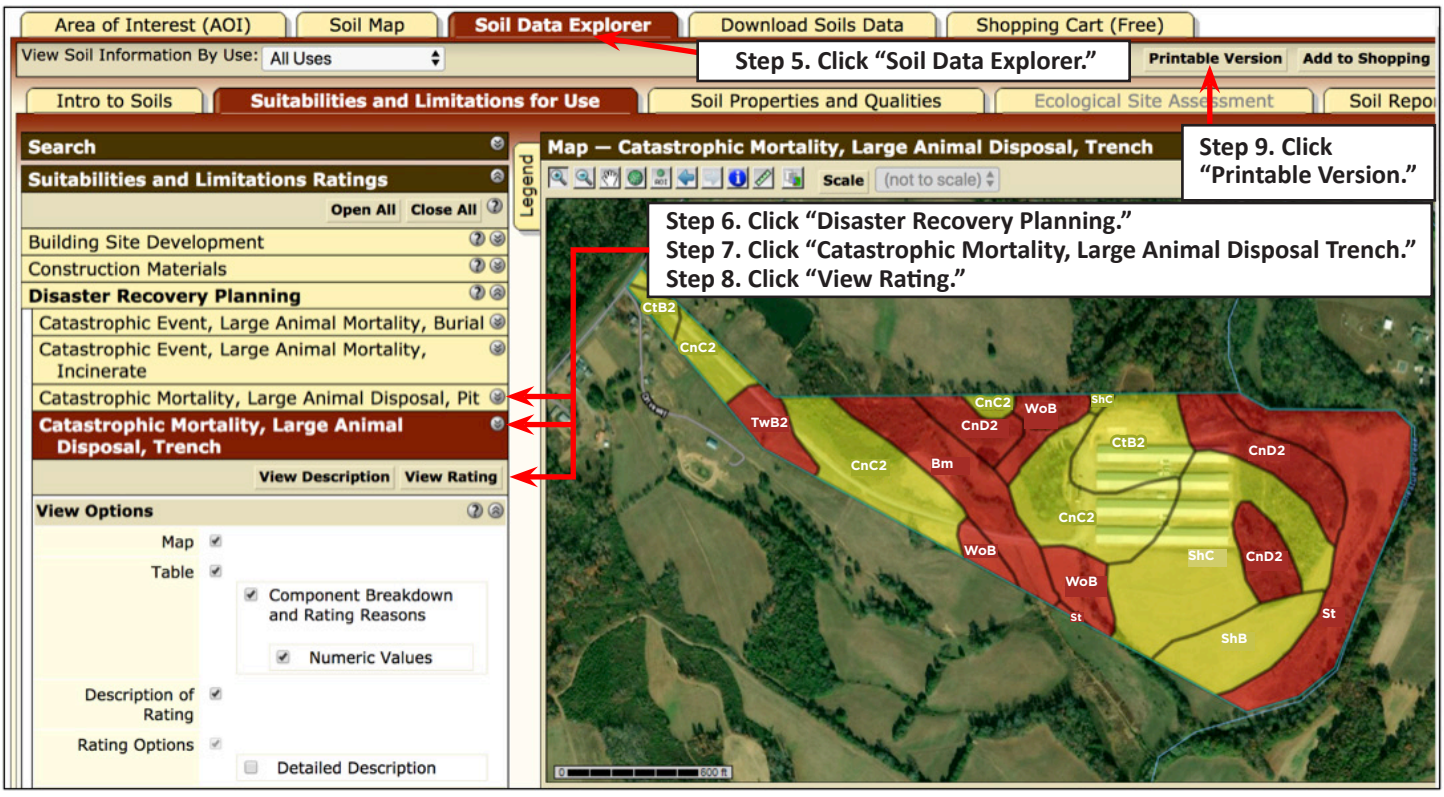

Figure 3. Screenshot of the Web Soil Survey website. An illustration of the resulting map for the "Catastrophic Mortality, Large Animal Disposal, Trench" tool is shown for the sample broiler farm in McMinn County, TN.

Q2. Why are some soils "Very Limited" for trench burial sites?

Some of your farm soils will likely be characterized as "**Very Limited**." To understand why, you should examine the WSS printout for your farm, which will include a **Map Unit Table** that lists the factors used to assign a score to each of your farm soils. If this score is equal to or greater than 1, the map unit is characterized as "**Very Limited**." Soils are typically characterized as "**Very Limited**" because of a few disqualifying characteristics described below.

A **Map Unit Table** is provided in **Figure 4** for the sample broiler farm in McMinn County, TN. Of the 67 acres within the farm boundaries, nearly half (31 acres) are categorized as "**Very Limited**." For map unit "St" (Steadman silty clay loam), the "**Rating Reasons**" column lists **Flooding** and **Wetness** as score factors, each with numeric scores of 1 (**Figure 4**). Each of these characteristics alone categorize the soil as unsuitable for a trench burial site and are expected because the "St" map unit is in a creek bottom (**Figure 3**). Burial sites should not be placed in wet soils or soils prone to flooding because burial pit fluids may be transported quickly from the burial site. Map unit "CnD2" (Coile silt loam) is "**Very Limited**" due to a **Slope** score of 1 (slope > 15%) (**Figure 4**). Again, this isn't surprising because this map unit is found in an area with steep slopes. Mass burial trenches should not be constructed in an area with slopes that exceed 15 percent because this can make trench construction difficult and increase the risk of leachate surfacing at lower elevations. Map unit "TwB2" (Townley-Coile complex) is also "**Very Limited**" due to a **Depth to Bedrock** score of 1 (**Figure 4**). Thin soils are obviously a poor choice for trench burial pits.

Other standalone reasons that soils can be listed as "**Very Limited**" include having an unfavorable composition. For example, too little or the wrong type of **Clay** may result in poor leachate treatment. Too much **Sand** can make the soil structurally inadequate and will tend to transport contaminants away from the burial site quickly. Soils with **Bedrock Outcrops** or **Large Rock** on or within the soil impede trench construction. Soils underlain by **Limestone Bedrock**, which is associated with a landform containing caves and sinkholes, are rated "**Very Limited**" because rapid and unpredictable groundwater flow is common. Soils with a high **Seepage Rate** or concentrated **Surface Drainage** are "**Very Limited**" because of high leachate transport rates.

Be aware that on some farms all the soils in areas with proper setbacks (see Question 3) may be "**Very Limited.**" In this case, other mortality disposal options **MUST** be considered (e.g., composting and landfilling). If burial will still be sought as your primary disposal method, you should consider having test pits (see Question 4) inspected professionally to verify the soils are adequate.

Tables — Catastrophic Mortality, Large Animal Disposal, Trench — Summary By Map Unit

Summary by Map Unit — McMinn County, Tennessee (TN107)

Summary by Map Unit — McMinn County, Tennessee (TN107)

Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
Bm	Bloomingdale silty clay loam, occasionally flooded	Very limited	Bloomingdale (85%)	Flooding (1.00)	5.7	8.8%
				Wetness (1.00)		
				Clay content (0.43)		
CnC2	Coile silt loam, 5 to 12 percent slopes, eroded	Somewhat limited	Coile (93%)	Clay content (0.42)	14.3	21.9%
				Slope (0.04)		
CnD2	Coile silt loam, 12 to 25 percent slopes, eroded	Very limited	Coile (85%)	Slope (1.00)	7.8	12.0%
				Clay content (0.42)		
CtB2	Corryton-Townley complex, 2 to 5 percent slopes, eroded	Somewhat limited	Corryton (83%)	Clay content (0.13)	5.1	7.9%
ShB	Shady loam, 2 to 5 percent slopes	Somewhat limited	Shady (90%)	Adsorption (0.06)	4.2	6.5%
ShC	Shady loam, 5 to 12 percent slopes	Somewhat limited	Shady (90%)	Adsorption (0.06)	11.6	17.8%
				Slope (0.04)		
St	Steadman silty clay loam, frequently flooded	Very limited	Steadman (96%)	Flooding (1.00)	10.2	15.6%
				Wetness (1.00)		
				Clay content (0.00)		
			Bloomingdale (2%)	Flooding (1.00)		
				Wetness (1.00)		
				Clay content (0.43)		
TwB2	Townley-Coile complex, 2 to 5 percent slopes, eroded	Very limited	Townley (75%)	Depth to bedrock (1.00)	1.7	2.6%
				Clay content (0.42)		
			Coile (25%)	Depth to bedrock (1.00)		
				Clay content (0.42)		
WoB	Wolftever silt loam, 1 to 5 percent slopes, occasionally flooded	Very limited	Wolftever (80%)	Flooding (1.00)	4.5	6.9%
				Wetness (1.00)		
				Clay content (0.42)		
			Bloomingdale (4%)	Flooding (1.00)		
				Wetness (1.00)		
				Clay content (0.43)		
Totals for Area of Interest					**65.2**	**100.0%**

Table — Catastrophic Mortality, Large Animal Disposal, Trench — Summary by Rating Value

Summary by Rating Value

Summary by Rating Value

Rating	Acres in AOI	Percent of AOI
Somewhat limited	35.2	54.0%
Very limited	30.0	46.0%
Totals for Area of Interest	**65.2**	**100.0%**

Figure 4. A Map Unit Table produced using the Web Soil Survey "Catastrophic Mortality, Large Animal Disposal, Trench" tool for the sample broiler farm in McMinn County, TN. Map unit symbols correspond to Figure 3. Map units, ratings and rating reasons are emphasized per the discussion in the text.

Q3. What property line setbacks should I use?

Even though you have potentially suitable soils on your farm, not all of the areas where those soils are found will be appropriate for burial trenches. This is because **burial trenches should be isolated from nearby sensitive areas** that could be impacted negatively by trench construction or contaminating fluids that enter local surface and/or groundwater. These concerns are addressed by **setbacks** per a formal Tennessee Department of Agriculture policy [1]. A setback is simply a specified distance to a sensitive area such as a property line, well, surface water or the first closed contour of a sinkhole (the point at which water drains into rather than away from a sinkhole) (**Figure 5**).

Private water supply wells. Fluids that drain from burial trenches into groundwater can subsequently be withdrawn from a well. **Due diligence is necessary to identify private water supply wells near your proposed burial site.** Drinking water well contamination carries health risks and liability for water treatment and/or well replacement. To reduce this risk, the minimum recommended setback from the closest edge of the burial trench to a private well is 300 feet if the well is down gradient from the trench. Down gradient means that the wellhead is at an elevation that is lower than the trench burial site. In this situation, it is likely that groundwater flows from the burial trench toward the well. If the wellhead is clearly up gradient from the burial site, the recommended setback can be reduced to 150 feet.

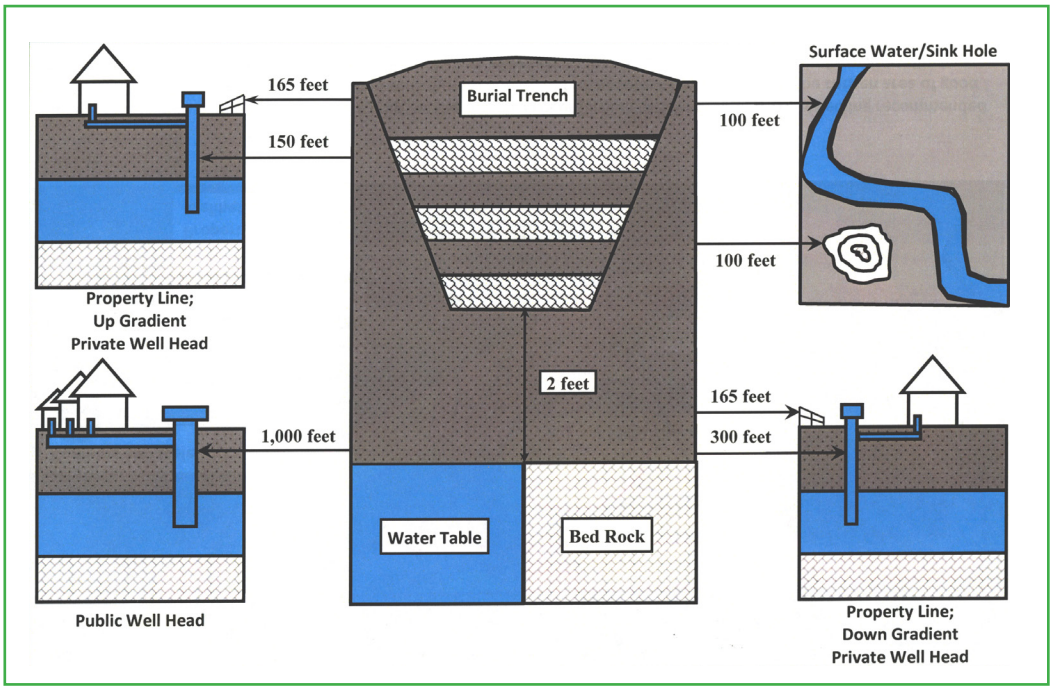

Figure 5. An illustration showing proper burial trench setbacks to sensitive areas.

Public water supply wells. Over one-third of Tennessee citizens are served by public water supply systems that use groundwater. A much larger setback of 1,000 feet is recommended to protect public wells from burial site contamination. The larger setback is necessary because public wells have high withdrawal rates that can cause groundwater to flow from the burial trench toward the well at much higher rates than a private water well. ***The location of public water supply wells in Tennessee is not publicly available.*** To find out if your property is within 1,000 feet of a public well, contact Scotty Sorrels with the Tennessee Department of Environment and Conservation **(scotty.sorrells@tn.gov; 615-532-9224),** who manages TDEC's well database. If you provide Mr. Sorrells with your farm address, he will examine the state's well database and let you know whether there are public wells within 1,000 feet of your property boundaries. The database that he maintains does contain a listing of private wells, but the database information on private wells is incomplete and may contain unreliable location information.

Mark up your soil map with your setbacks. After you have located property lines, inspected for surface water and sinkholes, and located wells near your farm, you should draw setbacks on your WSS map to help you choose an appropriate burial site. An example of this process is included in **Figure 6** for the sample broiler farm in McMinn County, TN.

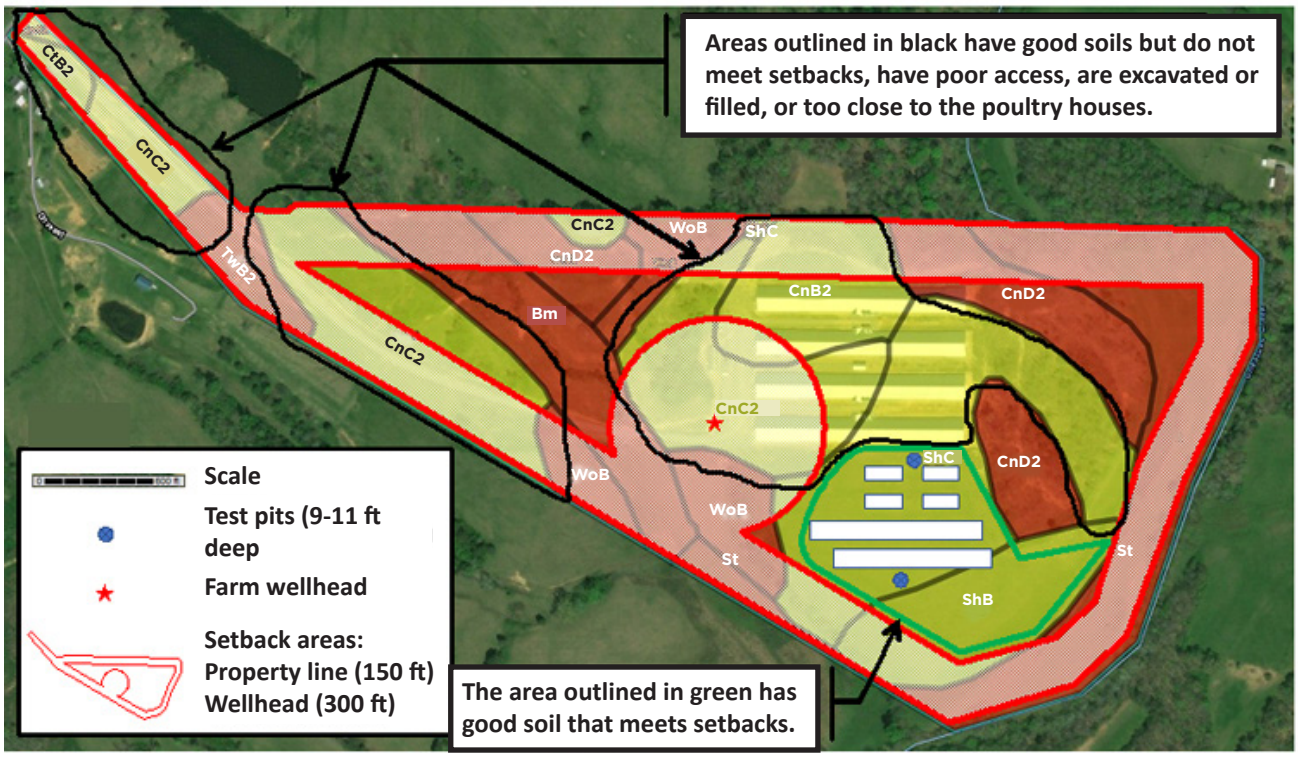

Figure 6. Modification of the WSS interactive map for the sample broiler farm in McMinn County, TN, reflecting recommended setbacks. Annotations indicate areas with good soils that do and do not meet setback requirements. The chosen area of good soils contains four short burial trenches (7 feet deep, 36 feet wide and 91 feet long) required for a whole-farm mortality loss event; two longer burial trenches (9 feet deep, 47 feet wide and 427 feet long) would be required if litter/debris must be buried.

Q4. Should I dig a test pit to verify my soils are suitable for trench burial?

Absolutely. It is critical to keep in mind that **the WSS map boundaries are inexact** and that your farm soil ratings are **based on characteristics that only apply to a 6-to-7-feet depth.** The Web Soil Survey results do not apply if the soils have been disturbed by fill or excavation. Areas that have been filled or excavated to a depth of 2 feet or more should not be used for mass burial trenches. Thus, the only way to be reasonably certain that any soil/location on your farm is appropriate for a burial trench is to ***dig a test pit(s).*** The test pit(s) should be located in soils rated "**Somewhat Limited**" or "**Unlimited.**" The test pit(s) should be targeted to a sufficiently large area (≥ 1 acre) that meets setback requirements (**Figure 5**) and is easily accessible (**Figure 6**). You should avoid distant areas (> 1,500 feet from your poultry houses) so that the burial process can occur quickly to avoid the onset of decomposition and the risk of spreading disease.

Tennessee One Call. Prior to digging your test pit(s), it's a good idea to locate any utility crossings on your farm by calling 811 or going online to sign up: call811.com/map-page/tennessee. This free service will occur within three to 10 working days.

Make sure you dig your test pit(s) deep enough. The size of your farm determines the burial space volume required to hold all poultry mortalities, plus any feed, litter and eggs that would need to be buried during a disease outbreak. On large farms, the sheer mass of carcasses during a catastrophic loss event will require multiple deep trenches (7 feet). Thus, test pit(s) should be dug to 9 or 11 feet, which would allow you to assess the site for a 7 or-9-feet-deep burial pit, respectively. The goal is to **dig at least 2 feet below the bottom of the planned burial trench.**

Before digging your test pit(s), it's a good idea to review factors that contribute to your target soil being "**Somewhat Limited**" and that make any nearby soils "**Very Limited.**" For example, the Shady Loam (ShC) that was chosen for the sample farm burial site (**Figure 6**) is between a Wolftever silt loam (WoB), which is prone to **Flooding** and **Wetness**, and the Coile silt loam (CnD2), which has a **Slope** that exceeds 15

percent. Thus, as the test pit(s) are being dug, conditions of soil wetness and the slope of the sites should be inspected carefully.

Look for *water and rock* when you dig your test pit(s). The bottom of burial trenches must remain above (2 feet minimum) the seasonally high groundwater table and bedrock (**Figure 5**).If water enters the test pit, or if the soil appears saturated with a gray mottled appearance, the target area should be abandoned and another location chosen. Ideally the pit should remain open overnight to see if water is present. If bedrock is encountered, the area should be abandoned. These two factors greatly increase the risk of ground and surface water contamination by burial pit leachate. Other things to watch for include heavy clay soils that will be difficult to backfill/spread and sandy soils that slough into your test pit.

Q5. How should the burial trench be constructed?

Don't wait until catastrophe strikes to try and figure out how to build a burial trench. A suggested design, **Figure 7**, emphasizes water quality protection by **avoiding placing mortalities in a large central mass** and **maintains ≈ 1:1 ratio of mortality to underlying soil volume in 1-foot layers of soil and mortalities** [2]. Thus, this design effectively utilizes underlying soil to remove pollutants from draining burial trench fluids and avoids generation of a concentrated, large mass of leachate. Construction guidelines for **Figure 7** are provided below:

1. **Topsoil** (top 6-10 inches) should be set aside prior to excavating deeper soils. Topsoil must be reused for the trench cover which **must be graded to drain and divert surface water**.
2. A trench used to bury mortalities should have a **surface area less than 1/10 acre (4,400 ft^2)** [2]. Multiple trenches are allowable if they are separated by at least 20 feet.
3. The **maximum recommended burial pit depth is 7 feet**, which allows for three 1-foot-deep burial layers **(Figure 7).** Deeper trenches may be used for wastes other than mortalities if test pits verify the bottom of the trench is at least 2 feet above bedrock or the seasonal high water table. **Deeper trenches increase risk of groundwater contamination**, so a 9-feet-deep trench should be used only as a last resort to bury litter/debris during a disease outbreak.
4. **The bottom width of the unlined burial trench must be a minimum of 10 feet and a maximum of 20 feet.** With a narrow trench, access to place or dump mortalities and soil into the trench is preferably from the trench side **IF** this can be done safely without risk of sidewall collapse.
5. Unless a Competent Person (with OSHA trench safety training) deems it safe otherwise, **the burial trench sidewalls should be 1V:1.5H or flatter** to avoid dangerous side sloughing.
6. Carcasses should be placed into the trench **in lifts no more than 1-foot deep** and **covered with at least 1 foot of soil**, except for the top layer which should be covered by at least 3 feet of soil. Soil between the carcass layers will help disperse and treat decomposition fluids. Three feet of soil over the shallowest layer of carcasses will deter digging scavengers. The carcasses should be spread uniformly across the width and length of the burial trench.
7. The number and size of burial trenches constructed should be determined by the volume and type of material to be buried per **Table 1** and **Figure 8** below. The answer to Question 6 considers how to determine the length and depth of a trench for a specific farm. Note that **if the burial site disturbed area exceeds 1 acre, the property owner MUST contact TDEC for guidance on required permits and deed modification (615-532-9224).**

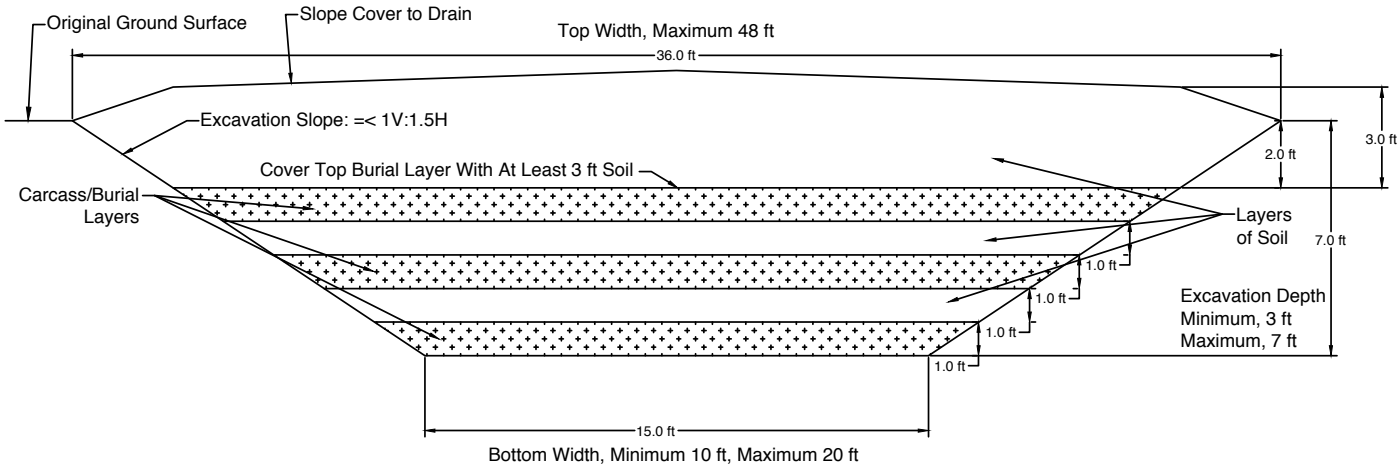

Figure 7. A cross-sectional image (viewed across the trench width) showing design guidelines for an on-farm, unlined trench to bury catastrophic poultry mortality losses. Note that the burial volume will be approximately one-third the excavation (bank) volume.

Q6. How wide and long should I plan to make the burial trench?

A challenge that poultry producers face when burying catastrophic mortality losses is sizing the burial trench. The trench size depends on the scale and circumstances of your losses, but in general you should be prepared to build a trench for a worst-case scenario (loss of diseased mature birds that requires disposal of all feed and eggs and potentially litter/manure). The size and number of burial trenches required to provide enough disposal volume for your worst-case scenario should be considered during burial trench siting (**Figure 6**).

Determine how much burial volume you need. Determining the burial pit size begins by estimating the burial volume requirement for your farm. Burial of all types of bird carcasses requires approximately 40 ft^3 per ton of mortalities, though recommended values range from ≈ 30-50 ft^3/ton [3]. Thus, it will take approximately 40 ft^3 of burial space for every 165 roosters (12 lbs/each), 200 hens (10 lbs/each), and 250-500 broilers or pullets (4-8 lbs/each). Denser components, such as eggs, require less burial volume (≈ 30 ft^3/ton). Less dense components such as feed and litter may also require disposal during disease outbreaks and require more burial volume (≈ 60 ft^3/ton). Keep in mind that litter and manure burial volumes can be **VERY LARGE = COST PROHIBITIVE**. In Tennessee, burial of litter is not strictly prohibited, but should occur only as a last resort ***in trenches separate from mortalities*****.** Some states do not allow litter/manure burial and instead prescribe composting and subsequent land application [4].

You can determine the total burial volume required for your farm using **Table 1**. An example of the disposal volume calculation for the sample broiler farm in McMinn County, TN, is provided in **Table 2**. You can see by inspecting **Table 2** that the disposal volume required for litter burial (79,200 ft^3) is far larger than for the lost birds (20,000 ft^3) and feed (1,200 ft^3).

Determine the trench width and length. After you have determined the required burial volume, the trench width, length and depth can be chosen using **Figure 8** and/or **Table 3a-c** considering the size and shape of available **Somewhat Limited** or **Not Limited** soils on your farm. To use **Figure 8**, simply draw a horizontal line across from the burial volume required to a preferred trench width and depth, then draw a line straight down to determine the trench bottom length. Use **Table 3a-c** to fine-tune the width and length by considering the trench area, the burial volume provided, and the excavation (bank) volume (which can be used to estimate cost). Keep in mind that unless a variance is obtained from the Tennessee Department of Agriculture, trenches used (see Question 8) to bury poultry mortalities are limited to a surface area of 4,400 ft^2 [2, 5]. Large farms, such as the sample broiler farm with 20,000 ft^3 of required mortality burial space (**Table 2**), will require several 1/10-acre burial trenches as shown in **Figure 6**.

Table 1. A trench burial volume worksheet for catastrophic poultry farm losses.

Mortalities					
Poultry Type	Number (farm total) N_M	Weight (lb) W_M	Total (ton) $T_M = \frac{N_M \times W_M}{2{,}000}$	Unit Volume (ft^3/ton) U_M	Burial Volume (ft^3) $V_M = T_M \times U_M$
Broilers				40	
Pullets					
Hens					
Roosters					
Other					
				Total Mortality Volume:	
Litter (burial is discouraged; consider composting and subsequent land application)					
Production Houses	Number (farm total) N_L	Length (ft) L	Width (ft) W	Depth (ft) D	Burial Volume (ft^3) $V_L = N_L \times L \times W \times D$
Broiler					
Pullet					
Layer — Scratch Area					
Layer — Under Slat					
Other					
				Total Litter Volume:	
Feed (burial is discouraged; consider composting with litter)					
Type	Number (farm total) N_F	Size (ton) W_F	Total (ton) $T_F = N_F \times W_F$	Unit Volume (ft^3/ton) U_F	Burial Volume (ft^3) $V_F = T_F \times U_F$
Feed Bins				60	
Other					
				Total Feed Volume:	
Eggs					
Type	Number (farm total) N_E	Weight (lb) W_E	Total (ton) $T_E = \frac{N_E \times W_E}{2{,}000}$	Unit Volume (ft^3/ton) (U_E)	Burial Volume (ft^3) $V_E = T_E \times U_E$
Broiler Breeder		0.14		30	
Other					
				Total Eggs Volume:	
TOTAL BURIAL VOLUME = Mortality + Litter + Feed + Egg (ft^3)					

Table 2. Trench burial volume calculations for the sample broiler farm in McMinn County, TN, during a disease outbreak that requires disposal of mature birds and all litter and feed.

Mortalities

Poultry Type	Number (farm total) N_M	Weight (lb) W_M	Total (ton) $T_M = \frac{N_M \times W_M}{2{,}000}$	Unit Volume (ft^3/ton) U_M	Burial Volume (ft^3) $V_M = T_M \times U_M$
Broilers	**200,000**	**5**	**500**	40	**20,000**
Pullets					
Hens					
Roosters					
Other					
			Total Mortality Volume:		**20,000**

Litter

Production Houses	Number (farm total) N_L	Length (ft) L	Width (ft) W	Depth (ft) D	Burial Volume (ft^3) $V_L = N_L \times L \times W \times D$
Broiler	**4**	**66**	**6oo**	**0.5**	**79,200**
Pullet					
Layer — Scratch Area					
Layer — Under Slat					
Other					
				Total Litter Volume:	

Feed

Type	Number (farm total) N_F	Size (ton) W_F	Total (ton) $T_F = N_F \times W_F$	Unit Volume (ft^3/ton) U_F	Burial Volume (ft^3) $V_F = T_F \times U_F$
Feed Bins	**8**	**25**	**200**	60	**1,200**
Other					
				Total Feed Volume:	

Eggs

Type	Number (farm total) N_E	Weight (lb) W_E	Total (ton) $T_E = \frac{N_E \times W_E}{2{,}000}$	Unit Volume (ft^3/ton) (U_E)	Burial Volume (ft^3) $V_E = T_E \times U_E$
Broiler Breeder		0.14		30	
Other					
				Total Eggs Volume:	

TOTAL BURIAL VOLUME = Mortality + Litter + Feed + Eggs (ft^3)	**100,400**

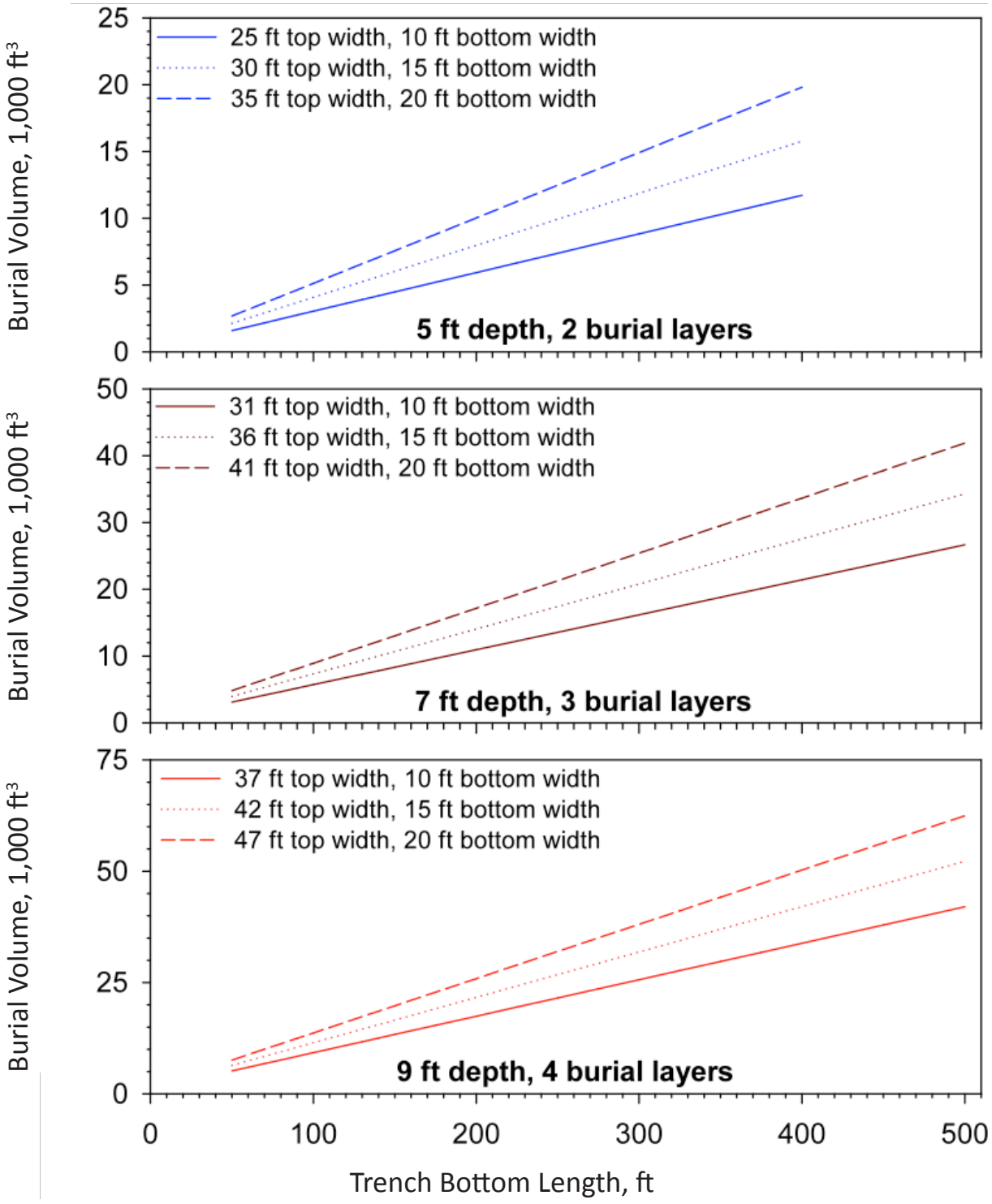

Figure 8. Plots of burial volume provided by trenches with three different trench bottom widths (10, 15 and 20 feet) at three different trench depths (5, 7 and 9 feet).

Table 3a. Surface area, burial volume and total excavation (bank) volume of a 5-foot depth trench with 25-, 30- or 35-foot top widths. Shaded cells exceed 4,400 ft² in surface area.

Bottom Length (ft)	Top Length (ft)	Bottom Width 10 ft; Top Width 25 ft			Bottom Width 15 ft; Top Width 30 ft			Bottom Width 20 ft; Top Width 35 ft		
		Surface Area (ft^2)	Surface Area (ft^3)	Bank Volume (yd^3)	Surface Area (ft^2)	Burial Volume (ft^3)	Bank Volume (yd^3)	Surface Area (ft^2)	Burial Volume (ft^3)	Bank Volume (yd^3)
50	65	1,625	1,598	187	1,950	2,144	241	2,275	2,689	295
60	75	1,875	1,888	218	2,250	2,534	282	2,625	3,179	346
70	85	2,125	2,177	250	2,550	2,923	323	2,975	3,669	396
80	95	2,375	2,467	281	2,850	3,313	364	3,325	4,159	446
90	105	2,625	2,756	312	3,150	3,703	405	3,675	4,648	497
100	115	2,875	3,046	344	3,450	4,092	446	4,025	5,138	547
110	125	3,125	3,335	375	3,750	4,482	487	4,375	5,628	597
120	135	3,375	3,625	407	4,050	4,871	528	4,725	6,117	648
130	145	3,625	3,914	438	4,350	5,261	569	5,075	6,607	698
140	155	3,875	4,204	469	4,650	5,651	610	5,425	7,097	748
150	165	4,125	4,493	501	4,950	6,040	650	5,775	7,587	799
175	190	4,750	5,217	579	5,700	7,014	753	6,650	8,811	924
200	215	5,375	5,940	658	6,450	7,988	855	7,525	10,035	1,050
225	240	6,000	6,664	736	7,200	8,962	957	8,400	11,259	1,176
250	265	6,625	7,388	814	7,950	9,936	1,059	9,275	12,484	1,302
275	290	7,250	8,111	893	8,700	10,910	1,161	10,150	13,708	1,427
300	315	7,875	8,835	971	9,450	11,884	1,264	11,025	14,932	1,553
325	340	8,500	9,559	1,050	10,200	12,858	1,366	11,900	16,156	1,679
350	365	9,125	10,282	1,128	10,950	13,832	1,468	12,775	17,380	1,804
375	390	9,750	11,006	1,207	11,700	14,807	1,570	13,650	18,605	1,930
400	415	10,375	11,730	1,285	12,450	15,781	1,672	14,525	19,829	2,056

Table 3b. Surface area, burial volume and total excavation (bank) volume of a 7-foot depth trench with 31-, 36- or 41-foot top widths. Shaded cells exceed 4,400 ft² in surface area. Values shaded in red were chosen for the sample broiler farm in McMinn County, TN.

Bottom Length (ft)	Top Length (ft)	Bottom Width 10 ft; Top Width 31 ft			Bottom Width 15 ft; Top Width 36 ft			Bottom Width 20 ft Top Width 41 ft		
		Surface Area (ft²)	Burial Volume (ft³)	Bank Volume (yd³)	Surface Area (ft²)	Burial Volume (ft³)	Bank Volume (yd³)	Surface Area (ft²)	Burial Volume (ft³)	Bank Volume (yd³)
50	71	2,201	3,091	324	2,556	3,954	405	2,911	4,817	485
60	81	2,511	3,615	375	2,916	4,629	470	3,321	5,642	563
70	91	2,821	4,140	426	3,276	5,303	534	3,731	6,467	641
80	101	3,131	4,664	476	3,636	5,978	598	4,141	7,291	719
90	111	3,441	5,188	527	3,996	6,652	663	4,551	8,116	796
100	121	3,751	5,713	578	**4,356**	**7,327**	**727**	4,961	8,940	874
110	131	4,061	6,237	629	4,716	8,001	791	5,371	9,765	951
120	141	4,371	6,761	679	5,076	8,676	855	5,781	10,590	1,029
130	151	4,681	7,286	730	5,436	9,350	920	6,191	11,414	1,106
140	161	4,991	7,810	781	5,796	10,025	984	6,601	12,239	1,184
150	171	5,301	8,334	831	6,156	10,699	1,048	7,011	13,063	1,261
175	196	6,076	9,645	958	7,056	12,386	1,209	8,036	15,125	1,455
200	221	6,851	10,956	1,085	7,956	14,072	1,369	9,061	17,186	1,649
225	246	7,626	12,266	1,211	8,856	15,758	1,529	10,086	19,248	1,843
250	271	8,401	13,577	1,338	9,756	17,444	1,690	11,111	21,309	2,036
275	296	9,176	14,888	1,465	10,656	19,130	1,850	12,136	23,371	2,230
300	321	9,951	16,199	1,591	11,556	20,817	2,011	13,161	25,432	2,424
325	346	10,726	17,509	1,718	12,456	22,503	2,171	14,186	27,494	2,618
350	371	11,501	18,820	1,845	13,356	24,189	2,332	15,211	29,555	2,811
375	396	12,276	20,131	1,971	14,256	25,875	2,492	16,236	31,617	3,005
400	421	13,051	21,442	2,098	15,156	27,561	2,652	17,261	33,678	3,199
450	471	14,601	24,063	2,351	16,956	30,934	2,973	19,311	37,801	3,586
500	521	16,151	26,685	2,604	18,756	34,306	3,294	21,361	41,924	3,973

Table 3c. Surface area, burial volume and total excavation (bank) volume of a 9-foot depth trench with 42-, 47- or 52-foot top widths. Shaded cells exceed 4,400 ft² in surface area. Values shaded in red were chosen to bury litter at the sample broiler farm in McMinn County, TN.

Bottom Length (ft)	Top Length (ft)	Bottom Width 10 ft; Top Width 42 ft			Bottom Width 15 ft; Top Width 47 ft			Bottom Width 20 ft; Top Width 52 ft		
		Surface Area (ft^2)	Burial Volume (ft^3)	Bank Volume (yd^3)	Surface Area (ft^2)	Burial Volume (ft^3)	Bank Volume (yd^3)	Surface Area (ft^2)	Burial Volume (ft^3)	Bank Volume (yd^3)
50	77	2,849	5,142	505	3,234	6,353	616	3,619	7,563	725
60	87	3,219	5,961	579	3,654	7,372	707	4,089	8,783	834
70	97	3,589	6,780	653	4,074	8,392	799	4,559	10,002	943
80	107	3,959	7,599	727	4,494	9,411	891	5,029	11,222	1,052
90	117	4,329	8,419	800	4,914	10,430	982	5,499	12,441	1,161
100	127	4,699	9,238	874	5,334	11,450	1,074	5,969	13,661	1,269
110	137	5,069	10,057	948	5,754	12,469	1,165	6,439	14,880	1,378
120	147	5,439	10,876	1,022	6,174	13,489	1,256	6,909	16,100	1,487
130	157	5,809	11,695	1,095	6,594	14,508	1,348	7,379	17,319	1,595
140	167	6,179	12,515	1,169	7,014	15,527	1,439	7,849	18,539	1,704
150	177	6,549	13,334	1,243	7,434	16,547	1,530	8,319	19,758	1,813
175	202	7,474	15,382	1,427	8,484	19,095	1,759	9,494	22,807	2,084
200	227	8,399	17,430	1,611	9,534	21,644	1,987	10,669	25,856	2,356
225	252	9,324	19,478	1,795	10,584	24,192	2,215	11,844	28,905	2,627
250	277	10,249	21,525	1,979	11,634	26,740	2,443	13,019	31,953	2,899
275	302	11,174	23,573	2,163	12,684	29,289	2,671	14,194	35,002	3,170
300	327	12,099	25,621	2,347	13,734	31,837	2,899	15,369	38,051	3,441
325	352	13,024	27,669	2,531	14,784	34,386	3,128	16,544	41,100	3,713
350	377	13,949	29,717	2,715	15,834	36,934	3,356	17,719	44,148	3,984
375	402	14,874	31,765	2,899	16,884	39,483	3,584	18,894	47,197	4,255
400	427	15,799	33,813	3,083	17,934	42,031	3,812	**20,069**	**50,246**	**4,527**
450	477	17,649	37,909	3,451	20,034	47,128	4,268	22,419	56,343	5,069
500	527	19,499	42,005	3,819	22,134	52,225	4,724	24,769	62,441	5,612

Q7. Does the burial site I've chosen have to be approved before it is used?

Catastrophic poultry losses require State Veterinarian notification. Tennessee Department of Agriculture policy requires poultry producers to notify the State Veterinarian (615-837-5120) if mortality losses exceed 10,000 lbs. Further, be aware that the following poultry diseases and conditions must be reported to the State Veterinarian's office (typically this will occur after an inspection by your integrator's veterinarian) [6]:

Avian Diseases:

- Avian influenza (Fowl plague)
- *Salmonella gallinarum* (Fowl typhoid)
- *Salmonella pullorum* (Pullorum disease)
- Newcastle disease

Avian Conditions:

- Unusual number of acute deaths
- Severe respiratory problems
- Central nervous system conditions
- High morbidity/mortality

Catastrophic losses not caused by disease. In the case of catastrophic losses not related to disease, there is currently no policy in place in Tennessee that requires the approval of a trench burial site, so long as the surface area of each trench used for mortalities is less than 4,400 ft^2 and the total trench area for mortalities and all other farm wastes does not exceed 1 acre. Trenches used to bury litter, feed, eggs and other components such as storm debris are allowed to exceed the 4,400 ft^2 surface area limitation that applies to mortality burial trenches.

Catastrophic losses caused by disease. State Veterinarian policy currently requires the use of ***preapproved*** burial sites for the disposal of carcasses infected with Highly Pathogenic Avian Influenza (HPAI) (and potentially other poultry diseases). Preapproval for HPAI burial sites can be obtained by mailing or emailing the Web Soil Survey map annotated with your chosen burial location (e.g., **Figure 6**) along with the Web Soil Survey Map Unit Table for your farm (e.g., **Figure 4**). Contact the State Veterinarian's office (615-837-5120) for more information on how to obtain burial site preapproval.

While preapproval of an HPAI mortality burial site does not require digging a test pit, be aware that ***a test pit will be required prior to actual use of the burial site for HPAI mortalities***. Further, current policy is that this test pit, as well as the construction of the burial trench, ***will be subject to review, approval and oversight by a professional soil scientist, geologist or engineer***. However, the trenches will generally be constructed per **Figure 7** and the guidelines published in this document.

Q8. How much time and expense is involved in burial trench construction?

Burial of catastrophic poultry losses is a **difficult, time-consuming and expensive endeavor**. Plan to hire an excavation construction company that will provide and manage their own equipment and operators (dozers, excavators, track/wheel loaders and haul trucks; a pan scrapper may be needed if litter will be buried). The best estimate of the time and cost to construct burial trenches can be obtained by contacting a local earthworks company.

A rough estimation of the time and cost to construct **mortality-only burial trenches** can be made using **Table 4**. This table is based on construction production and cost data published in 2012, increased by 10 percent to reflect 2018 costs (no location correction for costs are made) [7]. Variability in actual costs will be significant (on the order of $\pm$ 30 percent) depending on equipment and labor availability, project management efficiency, and weather delays. Additional costs that are not considered include disease outbreak decontamination, clearing and grubbing, loading mortalities for transportation (may be performed by the producer), and site seeding. The cost and time required for the sample McMinn County broiler farm would be as follows:

- Mobilization: $3,000 (2 days)
- Topsoil Removal/Stockpiling:
  - (4,356 ft^2/trench (**Table 3b**) × 3 trenches × 0.75 ÷ 27) × $4.54/$yd^3$ = $1,648
  - (4,356 ft^2/trench (**Table 3b**) × 3 trenches × 0.75 ÷ 27) ÷ 520 ft^3/day = 1 day
- Excavate Trench/Stockpile Soil
  - (727 yd^3/trench (**Table 3b**) × 3 trenches) × $11.38/$yd^3$ = $24,820
  - (727 yd^3/trench (**Table 3b**) × 3 trenches) ÷ 800 yd^3/day = 2.7 days
- Excavate Stockpiled Soil/Place in Trucks, Haul to Trench, Spread in Lifts
  - (727 yd^3/trench (**Table 3b**) × 3 trenches × 1.25) × $13.74/$yd^3$ = $37,459
  - (727 yd^3/trench (**Table 3b**) × 3 trenches × 1.25) ÷ 1,000 yd^3/day = 2.7 days
- Haul Mortalities to Trench, Spread in Trench Lifts
  - (7,327 ft^3/trench (**Table 3b**) × 3 trenches × 1.25 ÷ 27) × $10.84/$yd^3$ = $11,031
  - (7,327 ft^3/trench (**Table 3b**) × 3 trenches × 1.25 ÷ 27) ÷ 1,000 yd^3/day = 1 day
- Recover Stockpiled Topsoil, Place and Shape Topsoil to Cover Trench
  - (4,356 ft^2/trench (**Table 3b**) × 3 trenches × 0.75 × 1.25 ÷ 27) × $2.36/$yd^3$ = $1,071
  - (4,356 ft^2/trench (**Table 3b**) × 3 trenches × 0.75 × 1.25 ÷ 27) ÷ 1,000 yd^3/day = 0.5 day
- Trench Construction Cost ≈ $76,029 ($152/ton); Total Time ≈ 10 days

The costs for burial are very high and in fact exceed the cost for landfill disposal [8] (≈ $50-75 ton) plus trucking (≈ $25-50/ton). The sample farm analysis clearly reveals that the best way to reduce burial cost is to avoid stockpiling excavated soil using trucking (i.e., place the soil by the trench during excavation) though that may be difficult logistically.

Table 4. Time and cost worksheet for mortality-only burial trench construction.

Work Item	Cost and Time Basis (B)	Unit Cost (UC)	Time/Output (O)	Cost ($) B × UC	Time (day) B ÷ O
Mobilize Equipment/Labor	1	$1,500-3,000	1-3 days		
Remove/Stockpile Topsoil [a]	Area (ft^2) (**Table 3a-c**) × 0.75 ÷ 27	$4.54/$yd^3$	520 yd^3/day		
Excavate Trench/Place in Trucks, Haul to Stockpile Site [b]	Bank Volume (yd^3) (**Table 3a-c**)	$11.38/$yd^3$	800 yd^3/day		
Excavate Stockpiled Soil/Place in Trucks, Haul to Trench, Spread in Lifts [c]	Bank Volume (yd^3) (**Table 3a-c**) × 1.25	$13.74/$yd^3$	1,000 yd^3/day		
Haul Mortalities to Trench (load by others), Spread in Trench Lifts [d]	Burial Volume (ft^3) (**Table 3a-c**) ÷ 27	$10.84/$yd^3$	1,000 yd^3/day		
Recover Stockpiled Topsoil, Place and Shape Topsoil to Cover Trench [e]	Area (ft^2) (**Table 3a-c**) × 0.75 ÷ 27	$2.36/$yd^3$	1,000 yd^3/day		
			TOTAL		

[a] **Equipment/Labor Crew**: 200 horsepower dozer, remove 6-9" of topsoil and stockpile on-site, 300 ft haul; 1-dozer operator, 0.5 laborers, 12 labor hours daily; RSMeans 31 14 13.23 1430. Note that no volume correction for topsoil is credited in the calculation for trench excavation and backfill.

[b] **Equipment/Labor Crew 1**: Excavator, hydraulic, crawler mounted, 1 yd^3 bucket, 100 yd^3/hr; excavator operator, laborer, 16 labor hours daily; $2.90/$yd^3$ reflecting 15% increase for loading into truck; RSMeans 31 23 16.42 0200. **Equipment/Labor Crew 2**: 3-8 yd^3 trucks, cycle 0.5 mile, 15 MPH average, 10-minute wait/load/unload; 3 truck drivers, 24 labor hours daily. Hauling basis conversion used: loose volume = 1.25 × bank volume; $8.48 yd^3; RSMeans 31 23 23.20 1014.

[c] **Equipment/Labor Crew 1**: Excavator, hydraulic, crawler mounted, 1 yd^3 bucket, 125 loose yd^3/hr (modeled here as equivalent to 100 bank yd^3/day); excavator operator, laborer, 16 labor hours daily; $2.90/$yd^3$; RSMeans 31 23 16.42 0200. **Equipment/Labor Crew 2**: 3-8 yd^3 trucks, cycle 0.5 mile, 15 MPH average, 10 minute wait/load/unload**;** 3 truck drivers, 24 labor hours daily; 8.48yd^3$; RSMeans 31 23 23.20 1014. **Equipment/Labor Crew 3**: 200 horsepower dozer, bulk backfilling, up to 300 ft haul, no compaction; 1-dozer operator, 0.5 laborers, 12 labor hours daily; $2.36/$yd^3$; RSMeans 31 23 23.13 1300. RSMeans production for dozer decreased 20%, cost increased 20%, to account for mortality burial inefficiencies.

[d] **Equipment/Labor Crew 1**: 3-8 yd^3 trucks, cycle 0.5 mile, 15 MPH average, 10-minute wait/load/unload**;** 3 truck drivers, 24 labor hours daily; $8.48 yd^3/yd^3; RSMeans 31 23 23.20 1014. **Equipment/Labor Crew 2**: 200 horsepower dozer, bulk backfilling, up to 300 ft haul, no compaction; 1 dozer operator, 0.5 laborers, 12 labor hours daily; $2.36/$yd^3$; RSMeans 31 23 23.13 1300. RSMeans production for dozer decreased 20%, cost increased 20%, to account for mortality burial inefficiencies.

[e] **Equipment/Labor Crew 1**: 200 horsepower dozer, bulk backfilling, up to 300 ft haul, no compaction (production adjusted down to 1000 yd^3/day, cost increased 20%, to account for shaping inefficiencies); 1 dozer operator, 0.5 laborers, 12 labor hours daily; $1.97/$yd^3$; RSMeans 31 23 23.13 1300.

Q 9. After the burial process is finished, how do I manage the burial site?

After the burial process is complete, it's important to inspect and maintain the site weekly for at least one year. This will include **maintaining the integrity of the topsoil covering the burial pit**. The most efficient means of maintaining the cover soil is to make sure that the site is well-vegetated as soon as practical after the burial process is complete and promptly repairing/reseeding eroded areas. If burrowing or digging animals damage the trench or grazing animals have access to the site, it may be necessary to fence the site for at least several months. **Soil will subside in the area of the burial trench as the carcasses decompose.** When settling occurs, additional cover soil may need to be supplied or the existing cover soil may need to be reshaped to drain properly. **The goal is to assure that rainfall drains away from and does not pool on top of the burial trench.**

If you witness leaking leachate down gradient of the burial trench(es), the leachate should be contained with earth berms that allow the leachate to seep into the soil. The goal is to prevent the leachate from entering ditches or other drainage ways and ultimately surface waters. It's also important to prevent leachate from contaminating rainfall runoff and subsequently entering surface waters. You should notify the Tennessee Department of Agriculture State Veterinarian's office (615-837-5120) and TDEC (615-532-9224) if leachate surfaces from a burial trench site.

You will not be able to use the burial trench site for many years (perhaps decades) if digging is required, for example, to construct a building foundation. After several years, it may be possible to use the site for pasture or hay production, or perhaps even crop production if vegetation is easily maintained on the burial site.

Q10. Who do I contact with questions or requests for burial site approval?

This document has been prepared by University of Tennessee Extension for the benefit and education of poultry producers who may face catastrophic mortality losses. Your local county Extension agent or Shawn Hawkins (865-974-7722) can be contacted for advice and planning assistance. In addition, you may wish to contact the State Veterinarian's office (615-837-5120) and TDEC (615-532-9224), the ultimate approval authorities for burial sites used during disease outbreaks.

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