



# AEM Tier 2 Worksheet

## Silage Storage

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### Glossary

**Biochemical Oxygen Demand (BOD):** The decrease in oxygen content of a water sample brought about by the bacterial breakdown of organic matter.

**Footer Drain:** Sub-surface drainage tubing installed below grade to prevent sub-surface water from entering a silage storage area. It is not meant to convey polluted runoff or seepage (leachate).

**Soil permeability:** The ability of liquid to flow through soil.

**Vegetated Treatment Area (VTA):** An area of grass sod, meeting NRCS Standard NY-635, for removing sediment, organic matter, nutrients and other pollutants from storm-related high flow from silage storage areas.

**Vegetated Flow Distance:** The length runoff water can flow over a vegetated surface to a waterbody, excluding any length water flows over a non-vegetated surface.

**Waterbody:** A lake, reservoir, pond, river, continuously-flowing stream, continuously-flowing spring, wetland, estuary or bay.

**Watercourse:** Water flowing over a non-vegetated channel to a waterbody.

**25 year, 24 hour storm** - the amount of rainfall in a 24-hour period with a probable recurrence interval of once in 25 years. See Northeast Regional Climate Center for amounts - <http://www.nrcc.cornell.edu/pptext/isomaps.html>

### Background

When silage is harvested and stored properly, it should have minimal impact on the environment. However, if silage is not harvested or stored properly, liquid (called seepage or leachate) or runoff carrying silage liquid and/or solids may escape from the silage storage. This leachate contains high concentrations of nutrients, acid, and Biochemical Oxygen Demand (BOD). If it gets into soil or water, it can damage the quality of ground and surface water.

If leachate enters a surface water source, it readily feeds bacteria that can deplete the oxygen in water. Its BOD is approximately 5 times as great as manure and 100 times greater than municipal sewage. This concentrated waste has led to the death of fish and other kinds of aquatic life. Offsite impacts can be dramatic; leachate accounts for approximately half of all reported fish kill incidents in New York State.

Leachate can increase the levels of acid, phosphorus, ammonia and nitrate present in the water. It gives the water an unpleasant smell and can cause health problems for humans and animals.

### AEM Principle:

Leachate from silage storages should be properly collected and treated to protect surface and ground water resources, soil and aquatic habitats.

AEM Tier 2 Worksheet: Silage Storage: Bunker Silos		Potential Concern		
Factors Needing Assessment	Lower 1	2	3	Higher 4
What is the moisture content (%) of silage stored in horizontal silage storages?	Always below 70%	Mostly below 70%	Frequently above 70%	Always above 70%
Is clean water excluded from the silage storage area?	Footer drains and diversions prevent all clean water from entering the silage storage without collecting dirty water. Footer drains are checked for excessive algae growth or other signs of excessive nutrient loss.	Footer drains collect clean sub-surface water and surface water diversions prevent runoff from the 25 yr, 24hr storm from entering the silage storage without collecting dirty water.		No clean water exclusion.  <b>OR</b> Footer drain collects silage leachate and it is untreated.
Is there a well-maintained roof or cover that diverts rain water from the silage area?				
Are there noticeable leachate leaks through cracks or holes in silage storage floors, walls, or foundations?				
How is spoiled silage and waste feed dealt with?				
Is leachate production causing kill zones?	There are no kill zones on any side of the silage storage.	Small kill zones appear but are quickly repaired.	There are several small kill zones present.	Significant kill zones are present.
What is the vegetated flow distance from the silage storage to the nearest watercourse?	Greater than 1000 ft.	Between 400 and 1000 ft.	Between 100 and 400 ft.	Less than 100 ft.

AEM Tier 2 Worksheet: Silage Storage: Bunker Silos		Potential Concern		
Factors Needing Assessment	Lower 1	2	3	Higher 4
<b>What is the potential of silage storage to contaminate groundwater?</b> <ul style="list-style-type: none"> <li>• What is the depth to groundwater and/or bedrock?</li> <li>• Is there a potential for groundwater pollution due to the permeability of the soils? What is the soil type?</li> <li>• How far is the silage storage from a well and is it up or down slope?</li> <li>• What was the result of the most recent water supply nitrate test?</li> </ul>				
<b>What is the potential for silage leachate to reach a tile drainage system (farmstead or field)?</b>				
<b>How is silage leachate and contaminated runoff collected and handled?</b>	There is a designed collection system for all silage leachate and contaminated runoff directed to a properly designed storage structure and land applied according to a nutrient management plan. All O&M is performed as prescribed.	There is a designed collection system for low flow rates of silage leachate for subsequent field application. High flows go to a properly designed vegetated treatment area. Screens are kept clean and O&M is performed as prescribed.	No silage leachate collection system exists.  <b>AND</b>  Leachate drains to a vegetated area and does not appear to reach a watercourse.	No silage leachate collection system exists.  <b>OR</b>  Collected leachate is directed to a ditch, concentrated flow or farmstead drainage system.
<b>Is there a VTA?</b>  <b>If yes, has Nitrate Leaching Index evaluation and soil phosphorus testing been completed?</b>				

<b>AEM Tier 2 Worksheet: Silage Storage: Bunker Silos</b>		<b>Potential Concern</b>		
<b>Factors Needing Assessment</b>	<b>Lower 1</b>	<b>2</b>	<b>3</b>	<b>Higher 4</b>
<b>Are any other high-moisture commodities (i.e. brewers' grain) stored?</b>  <b>If yes, is leachate from these storages appropriately collected and treated?</b>				
<p>Benefits to other resources can also be possible while working toward improved water quality. Taking stock of how existing and future management affect <b>soil, water, air, plants, animals, energy, greenhouse gases, people, and economics</b> can result in more effective plans and additional benefits to farms and communities both now and into the future.</p> <p><b>Additional Comments:</b></p>				

<b>AEM Tier 2 Worksheet: Silage Storage: Upright Silos</b>		<b>Potential Concern</b>		
<b>Factors Needing Assessment</b>	<b>Lower 1</b>	<b>2</b>	<b>3</b>	<b>Higher 4</b>
<b>What is the moisture content of silage stored in tower silos: - 40 ft. and under? - Above 40 ft.?</b>	- Always below 65%	- Mostly below 65% - Always below 65%	- Frequently over 65% - Mostly below 65%	- Always over 65% - Frequently over 65%
<b>Is clean water diverted from the silo loading area?</b>	All outside water from roofs and the surrounding area is diverted from the loading area.	Outside water from roofs and the surrounding area up to the 25 yr, 24 hr storm is diverted from the loading area.		There is no clean water diversion.  <b>OR</b> Footer drain collects leachate.
<b>Is there a well-maintained roof or cover that diverts rain water from the silage area?</b>				
<b>Are there noticeable leachate leaks through cracks or holes in silage storage floors, walls, or foundations?</b>				
<b>How is spoiled silage and waste feed dealt with?</b>				
<b>What is the potential of silage storage to contaminate groundwater?</b> <ul style="list-style-type: none"> <li>• What is the depth to groundwater and/or bedrock?</li> <li>• Is there a potential for groundwater pollution due to the permeability of the soils? What is the soil type?</li> <li>• How far is the silage storage from a well and is it up or down slope?</li> <li>• What was the result of the most recent water supply nitrate test?</li> </ul>				
<b>What is the potential for silage leachate to reach a tile drainage system (farmstead or field)?</b>				

<b>AEM Tier 2 Worksheet: Silage Storage: Upright Silos</b>		<b>Potential Concern</b>		
<b>Factors Needing Assessment</b>	<b>Lower 1</b>	<b>2</b>	<b>3</b>	<b>Higher 4</b>
<b><i>How is silage leachate and contaminated runoff collected and handled?</i></b>	<p>There is no silage leachate.</p> <p style="text-align: center;"><b>OR</b></p> <p>There is a designed collection system for all silage leachate and contaminated runoff directed to a properly designed storage structure and land applied according to a nutrient management plan.</p>		<p>No silage leachate collection system exists.</p> <p style="text-align: center;"><b>AND</b></p> <p>Leachate drains to a vegetated area and does not appear to reach a watercourse.</p>	<p>No silage leachate collection system exists.</p> <p style="text-align: center;"><b>OR</b></p> <p>Collected leachate is directed to a ditch, concentrated flow or farmstead drainage system.</p>
<p><b><i>Are any other high-moisture commodities (i.e. brewers' grain) stored?</i></b></p> <p><b><i>If yes, is leachate from these storages appropriately collected and treated?</i></b></p>				
<p><i>Benefits to other resources can also be possible while working toward improved water quality. Taking stock of how existing and future management affect soil, water, air, plants, animals, energy, greenhouse gases, people, and economics can result in more effective plans and additional benefits to farms and communities both now and into the future.</i></p> <p><b><i>Additional Comments:</i></b></p>				

<b>AEM Tier 2 Worksheet: Silage Storage: Ag Bags</b>		<b>Potential Concern</b>			
<b>Factors Needing Assessment</b>	<b>Lower 1</b>	<b>2</b>	<b>3</b>	<b>Higher 4</b>	
<b>What is the moisture content of silage stored in ag bags?</b>	Even filling, consistent shape of bag – no leachate bulges.			Bag is noticeably bulging from leachate accumulation.	
<b>What is the site condition of the ag bag area?</b>	Surface is graded away from any water course and toward a grassed area. Area is hardened to allow loading and unloading and is kept clean of spoiled or wasted feed.			The surface is muddy and rutted; flows are directed towards a watercourse. Surface is not being maintained.	
<b>Is clean water excluded from the silage storage area?</b>	Outside surface water is excluded from the ag bag area.			Outside surface water is not excluded from the ag bag storage area.	
<b>How is spoiled silage and waste feed dealt with?</b>					
<b>What is the vegetated flow distance from the silage storage to the nearest watercourse?</b>	Greater than 500 ft.	Between 350 and 500 ft.	Between 100 and 350 ft.	Less than 100 ft.	
<b>What is the potential of silage storage to contaminate groundwater?</b> <ul style="list-style-type: none"> <li>• What is the depth to groundwater and/or bedrock?</li> <li>• Is there a potential for groundwater pollution due to the permeability of the soils? What is the soil type?</li> <li>• How far is the silage storage from a well and is it up or down slope?</li> <li>• What was the result of the most recent water supply nitrate test?</li> </ul>					

AEM Tier 2 Worksheet: Silage Storage: Ag Bags		Potential Concern		
Factors Needing Assessment	Lower 1	2	3	Higher 4
What is the potential for silage leachate to reach a tile drainage system (farmstead or field)?				
Are any other high-moisture commodities (i.e. brewers' grain) stored?  If yes, is leachate from these storages appropriately collected and treated?				
<p>Benefits to other resources can also be possible while working toward improved water quality. Taking stock of how existing and future management affect <b>soil, water, air, plants, animals, energy, greenhouse gases, people, and economics</b> can result in more effective plans and additional benefits to farms and communities both now and into the future.</p> <p><b>Additional Comments:</b></p>				

AEM Tier 2 Worksheet: Silage Storage: Temporary Silage Piles		Potential Concern			
Factors Needing Assessment	Lower 1	2	3	Higher 4	
What is the size and type of temporary silage piles?	No piles on bare ground.		Small piles from unexpected high yields. Not created every year and are covered.	Piles occur annually due to inadequate storage facilities.	
Is clean water excluded from the silage storage area?	Outside surface water is excluded.			Outside surface water is not excluded.	
Is there a well-maintained cover that diverts rain water from the silage area?					
How is spoiled silage and waste feed dealt with?					
What is the vegetated flow distance from the storage piles to the nearest watercourse?	Greater than 1000 ft.	Between 600 and 1000 ft.	Between 200 and 600 ft.	Less than 200 ft.	
What is the potential of silage storage to contaminate groundwater? <ul style="list-style-type: none"> <li>• What is the depth to groundwater and/or bedrock?</li> <li>• Is there a potential for groundwater pollution due to the permeability of the soils? What is the soil type?</li> <li>• How far is the silage storage from a well and is it up or down slope?</li> <li>• What was the result of the most recent water supply nitrate test?</li> </ul>					
What is the potential for silage leachate to reach a tile drainage system (farmstead or field)?					

<b>AEM Tier 2 Worksheet: Silage Storage: Temporary Silage Piles</b>		<b>Potential Concern</b>		
<b>Factors Needing Assessment</b>	<b>Lower 1</b>	<b>2</b>	<b>3</b>	<b>Higher 4</b>
<b>Are any other high-moisture commodities (i.e. brewers' grain) stored?</b>  <b>If yes, is leachate from these storages appropriately collected and treated?</b>				
<p>Benefits to other resources can also be possible while working toward improved water quality. Taking stock of how existing and future management affect <b>soil, water, air, plants, animals, energy, greenhouse gases, people, and economics</b> can result in more effective plans and additional benefits to farms and communities both now and into the future.</p> <p><b>Additional Comments:</b></p>				