Chesapeake Bay Program Best Management Practices

Agriculture BMPs – Approved for CBP Watershed Model

BMP	Description	Units	Nitrogen Efficiency	Phosphorus Efficiency	Sediment Efficiency	Cost
Animal Waste Management System – Livestock	Animal Waste Management Systems are designed for the proper handling, storage, and utilization of wastes generated from animal confinement operations and include a means of collecting, scraping, or washing wastes from confinement areas into appropriate waste storage structures. Lagoons, ponds, or steel or concrete tanks are used for the treatment and/or storage of liquid wastes, and storage sheds or pits are common storage structures for solid wastes. Landuse applied to: manure acre Reductions per system = system AEU's/145 times manure acre loading rate times reduction efficiency** (see footnote)	AEU's*	75%	75%	N/A	
Animal Waste Management System – Poultry	Animal Waste Management Systems are designed for the proper handling, storage, and utilization of wastes generated from animal confinement operations and include a means of collecting, scraping, or washing wastes from confinement areas into appropriate waste storage structures. Landuse applied to: manure acre Reductions per system = system AEU's/145 times reduction efficiency** (see footnote)	AEU's*	14%	14%	N/A	

BMP	Description	Units	Nitrogen Efficiency	Phosphorus Efficiency	Sediment Efficiency	BMP Implementation
Barnyard Runoff Controls - With Storage & Without Storage	This practices includes the installation of practices to control runoff from barnyard areas. This includes practices such as roof runoff control, diversion of clean water from entering the barnyard and control of runoff from barnyard areas. Use the first percent efficiency if controls are installed on an operation with a manure storage; and the second percent if the controls are installed on a loafing lot without a manure storage. The sediment efficiency has not been incorporated into the current watershed model but will be included in the updated model that is under development at this time. Landuse applied to: manure acre Reductions = Total animals using barnyard (counted as AEU's)/145 times manure acres loading rate times reduction efficiency.	Acres/ AEU's	10%/20%	10%/20%	40%	
Carbon Sequestration	Carbon Sequestration refers to the conversion of cropland to hay land (warm season grasses). The hay land is managed as a permanent hay land providing a mechanism for sequestering carbon within the soil. (Note: this practice has not be incorporating into the watershed model nor has specifications been developed for its use as an approved BMP) Landuse conversion: conventional till and conservation till to hayland Reduction = original landuse loading rate – hayland loading rate times total acres converted. (Temporary reduction methodology not officially approved for use)	Acres	Landuse Conversion	Landuse Conversion	Landuse Conversion	
Cereal Cover Crops	Cover crops grown to provide winter cover of cropland, non-harvested Landuse applied to: conventional till and conservation till	Acres	Convent. Till Early - 45% Late --- 30%	Convent. Till Early - 15% Late --- 7%	Convent. Till Early - 20% Late --- 10%	

BMP	Description	Units	Nitrogen Efficiency	Phosphorus Efficiency	Sediment Efficiency	BMP Implementation
Cereal Cover Crops (cont)	Reduction = landuse loading rate times total acres planted times reduction efficiency. Efficiency varies by when planted. If planted up to 7 days prior to published first frost date use early value. If planted up to 7 days after published first frost date use late value.		Conserv. Till Early – 45% Late – 30%	Conserv. Till Early – 0% Late – 0%	Conserv. Till Early – 0% Late – 0%	
Commodity Cereal Cover Crops	Commodity cover crops grown to provide winter cover of cropland, harvested. Landuse applied to: conventional till and conservation till Reduction = landuse loading rate times total acres planted times reduction efficiency. Efficiency varies by when planted. If planted up to 7 days prior to published first frost date use early value. If planted up to 7 days after published first frost date use late value.	Acres	Convent. Till Early - 25% Late --- 17% Conserv. Till Early – 25% Late – 17%	Convent. Till Early - 0% Late --- 0% Conserv. Till Early – 0% Late – 0%	Convent. Till Early - 0% Late --- 0% Conserv. Till Early – 0% Late – 0%	
Conservation Plans (Farm Plans)	This is a comprehensive plan that addresses natural resource management on agricultural lands and utilizes best management practices that control erosion and sediment loss and manage runoff. These plans include conservation tillage, crop rotations and structural practices such as grassed waterways, sediment basins and grade stabilization structures. Landuse Applied to: conventional till, conservation till, hayland and pasture Reductions = landuse loading rate times acres of BMP implemented times landuse percent efficiency.	Acres	Convent. Till - 8% Conserv. Till - 3% Hayland 3% Pasture 20%	15% 5% 5% 10%	25% 8% 8% 14%	
Conservation Till	Conservation Tillage involves planting and growing crops with minimal disturbance of the surface soil. No-till farming is a form of conservation tillage in which the crop is seeded directly into vegetative cover or crop residue with no disturbance of the surface soil. Minimum tillage farming involves some disturbance of					

BMP	Description	Units	Nitrogen Efficiency	Phosphorus Efficiency	Sediment Efficiency	BMP Implementation
Conservation Till (cont.)	the soil, but uses tillage equipment that leaves much of the vegetative cover or crop residue on the surface. Landuse conversion – conventional till to conservation till Reductions = conventional till loading rate minus conservation till loading rate times total acres converted Note: Through 2002 progress reporting, the amount of conservation-tilled land for Pennsylvania has been based on data acquired by the Chesapeake Bay Program from the Conservation Technology Information Center (CTIC). The CTIC provides an estimate of the amount of conservation-tilled acres by year. PA has not reported this practice as a BMP and has deferred to the CTIC data.	Acres	Landuse conversion	Landuse conversion	Landuse conversion	
Nutrient Management-Agriculture	Nutrient Management is a comprehensive plan that describes the optimum use of nutrients to minimize nutrient loss while maintaining yield. These plans detail the type, rate, timing, and placement of nutrients for each crop. Landuse applied to: conventional till, conservation till and hay The reductions associated with implemented nutrient management plans are computed by the model for each model run. Reductions vary by landuse and by model segments and range between 20 to 30 percent.	Acres	Built into model simulation	Built into model simulation	Built into model simulation	
Phytase Feed Additives – Poultry	Use of Phytase as a poultry feed to reduce phosphorus concentrations in poultry litter. Reduction applies as a change in manure phosphorus content. This practice is currently being credited	AEUs	N/A	16%-26%	N/A	

BMP	Description	Units	Nitrogen Efficiency	Phosphorus Efficiency	Sediment Efficiency	BMP Implementation
	automatically in all model assessment runs					
Retirement of Highly Erodible Land	Retirement takes marginal and highly erosive Agricultural land cropland out of production by planting permanent vegetative cover such as shrubs, grasses, and/or trees. Land retired and planted to trees would be reported under the "tree planting" BMP Landuse conversion: conventional till and conservation till conversion to mixed open landuse Reductions = original landuse loading rate minus mixed open landuse loading rate times total acres converted	Acres	Landuse Conversion	Landuse Conversion	Landuse Conversion	
Riparian Forest Buffers – Agriculture	Riparian Forest Buffers are linear wooded areas planted along rivers and streams. Reduction credits for riparian include both a percentage reduction and a landuse credit for the acres of trees planted Landuse conversion: conventional till, conservation till, hayland or pasture to forest land Reductions = original landuse loading rate minus forest loading rate times acres of total acres converted Plus: Upland landuse loading rate time's total acres treated times percent efficiency. For nitrogen every 435.6 linear feet of buffer is estimated to treat 5 upland acres of land and for phosphorus and sediment every 435.6 linear feet of buffer is estimated to treat 2 upland acres of land (100 foot buffers).	Acres	Landuse Conversion Plus	Landuse Conversion Plus	Landuse Conversion Plus	

BMP	Description	Units	Nitrogen Efficiency	Phosphorus Efficiency	Sediment Efficiency	BMP Implementation
Riparian Forest Buffers – Agriculture (cont.)	Upland landuse efficiency varies by hydrologic setting as follows: Appalachian Plateau Blue Ridge Mesozoic Lowlands Piedmont – Carbonate Piedmont – Crystalline Valley and Ridge – Carbonate Valley and Ridge - Silicicastic		 60% 45% 70% 45% 60% 45% 44%	 60% 50% 70% 50% 60% 50% 45%	 60% 50% 70% 50% 60% 50% 45%	
Riparian Grass Buffers	Grassed Buffers are linear strips of maintained grass or other non-woody vegetation between the edge of fields and streams, rivers or tidal waters. Reduction credits for riparian grass buffers include both a percentage reduction and a landuse credit for the acres of trees planted Landuse conversion: All landuses except manure acre and developed land converted to mixed open Reductions = Original landuse loading rate minus mixed open loading rate times total number of acres planted. Plus: Upland landuse loading rate time's total acres treated times percent efficiency. For nitrogen every 435.6 linear feet of buffer is estimated to treat 5 upland acres of land and for phosphorus and sediment every 435.6 linear feet of buffer is estimated to treat 2 upland acres of land (100 foot buffers). Upland landuse efficiency varies by hydrologic setting as follows: Appalachian Plateau	Acres	Landuse Conversion Plus 41%	Landuse Conversion Plus 60%	Landuse Conversion Plus 60%	

BMP	Description	Units	Nitrogen Efficiency	Phosphorus Efficiency	Sediment Efficiency	BMP Implementation
	Blue Ridge Mesozoic Lowlands Piedmont – Carbonate Piedmont – Crystalline Valley and Ridge – Carbonate Valley and Ridge – Silicicastic		31% 48% 31% 41% 31% 37%	50% 70% 50% 60% 50% 65%	50% 70% 50% 60% 50% 65%	
Rotational Grazing/ Grazing Land Protection with Stream Fencing	This practice involves dividing pasture areas into cells or paddocks. Each paddock is intensively grazed for a short period, and then allowed to rest and recover before being grazed again. The amount of time each cell is grazed and then rested relates to the time of year, quality of the forage and the growth stage of the forage. Landuse applied to: pasture Reductions = Pasture land loading rates times acres of pasture with rotational grazing times percent efficiency. A second reduction is calculated to account for the portion of land between the installed fence and the stream that is no longer pastured. This reduction is calculated as landuse conversion of pasture to mixed open land Reductions = pasture loading rate minus mixed open land loading rate times total aces excluded.	Acres 0f grazed land and Acres of excluded Land	20% and Landuse Conversion	20% and Landuse Conversion	20% and Landuse Conversion	
Stream Protection with Fencing and with Off-Stream Watering	Stream protection with fencing involves the fencing of narrow strips of land along streams to completely exclude livestock. The fenced areas may be planted to trees or grass. Landuse applied to: pasture Percent efficiency reductions = upland landuse loading	Length of Fence and	60% and	60% and	75% and	

BMP	Description	Units	Nitrogen Efficiency	Phosphorus Efficiency	Sediment Efficiency	BMP Implementation
Stream Protection w/ Fencing and Off-Stream Watering cont.)	rate times total acres treated times percent efficiency (for this calculation every 208 linear feet of buffer is estimated to treat two upland acres of land) A second reduction is calculated to account for the portion of land between the installed fence and the stream that is no longer pastured. This reduction is calculated as a landuse conversion of pasture to mixed open land Reductions = pasture loading rate minus mixed open loading rates times total acres excluded	Acres of Excluded Land	Landuse Conversion	Landuse Conversion	Landuse Conversion	
Stream Protection without Fencing with Off Stream Watering	This option involves the use of troughs or "watering holes" in remote locations away from streams, as well as the placement of stream crossings. Stream crossings usually have some length of fencing adjacent so that livestock will not bypass the crossings. In some instances, trees are planted away from the stream to provide shade for the livestock. The protected area acts as a buffer between stream and livestock. Landuse applied to: pasture Percent efficiency reductions = upland landuse loading rate times total acres treated times percent efficiency (for this calculation every 208 linear feet of protected area is estimated to treat two upland acres of land)	Acres	30%	30%	38%	
Tree Planting	Reforestation practices or planting of trees that are not classified as riparian forest buffers. Planted trees are considered permanent.	Acres	Landuse Conversion	Landuse Conversion	Landuse Conversion	

BMP	Description	Units	Nitrogen Efficiency	Phosphorus Efficiency	Sediment Efficiency	BMP Implementation
	Landuse conversion: any combination of conventional till, conservation till, hayland, pasture, mixed open, and pervious developed land to forest Reductions = original landuse loading rate minus forest loading rate times number of acres planted					
Wetlands – Ag land	Wetland Restoration is the reestablishment of wetlands on agricultural lands where they used to exist. Restored wetlands may be any wetland classification including forested, scrub-shrub or emergent marsh. Landuse conversion: conventional till, conservation till, hay or pasture to forest Reductions = original landuse loading rate minus forest loading rate times acres converted. Plus: Upland landuse loading rate time's total acres treated times percent efficiency. For nitrogen every 435.6 linear feet of buffer is estimated to treat 5 upland acres of land and for phosphorus and sediment every 435.6 linear feet of buffer is estimated to treat 2 upland acres of land (100 foot buffers). Upland landuse efficiency varies by hydrologic setting as follows: Appalachian Plateau Blue Ridge Mesozoic Lowlands Piedmont – Carbonate Piedmont – Crystalline	Acres	Landuse Conversion plus 60% 45% 70% 45% 60%	Landuse Conversion Plus 60% 50% 70% 50% 60%	Landuse Conversion Plus 60% 50% 70% 50% 60%	

BMP	Description	Units	Nitrogen Efficiency	Phosphorus Efficiency	Sediment Efficiency	BMP Implementation
	Valley and Ridge – Carbonate Valley and Ridge - Silicicastic		45% 44%	50% 45%	50% 45%	
Yield Reserve	Agricultural Yield Reserve programs are intended to provide incentives through yield insurance for crop losses to farmers who apply nitrogen and phosphorus at levels below their recommended application rates. Participating farmers would be paid to apply 15 percent to 25 percent less nutrients on crops than is recommended in their Nutrient Management Plan. Landuse applied to: conventional till and conservation till Reductions estimated for using watershed model simulations. An approved reduction methodology has not been developed. Efficiency varies by landuse and model segment.	Acres	15%-25%	15%-25%	N/A	