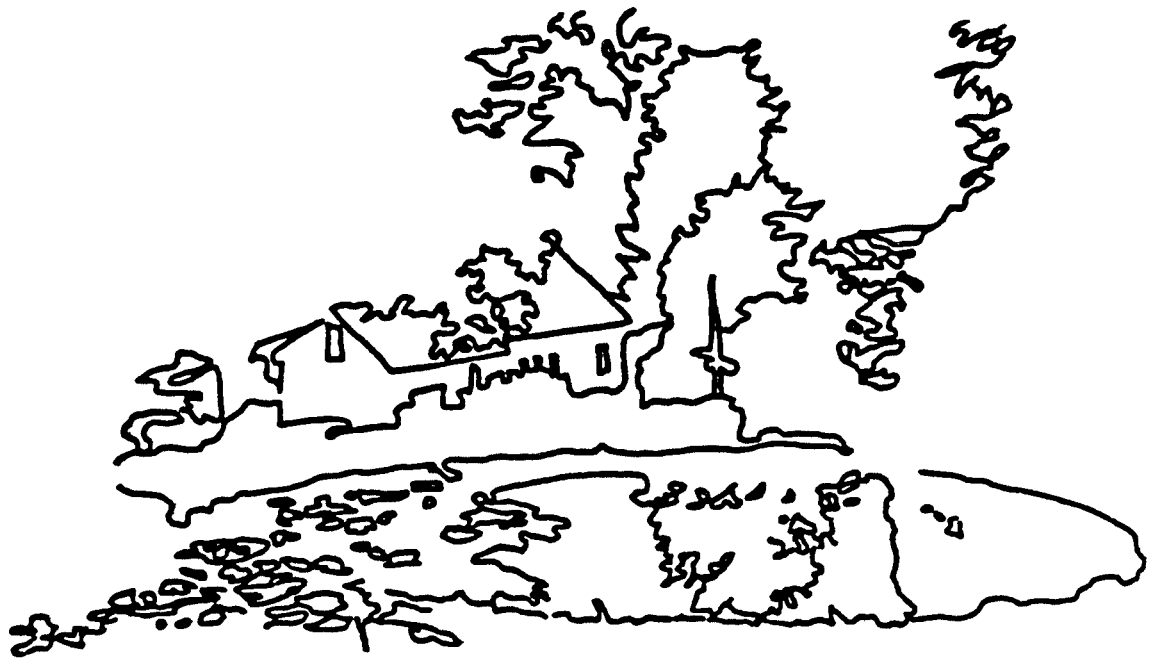




United States
Department of
Agriculture

Natural
Resources
Conservation
Service

The Maintenance of Residential Stormwater Management Areas



Source of sketch: Montgomery County, Pennsylvania, October,

Issued January 2000

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The Maintenance of Residential Stormwater Management Areas

Introduction and Background

Prior to the implementation of stormwater controls, construction and development often result in severe alterations in watershed drainage patterns. These alterations have often resulted in downstream flooding on residential and commercial properties, as well as low-lying road crossings. Uncontrolled stormwater volume increases streambank erosion and results in major detrimental changes in the physical characteristics of receiving streams. Residential and commercial land uses result in polluted stormwater runoff, which can reach water bodies unless control mechanisms are in place. This polluted runoff is also referred to as nonpoint source pollution. Federal, state, and local laws and regulations require stormwater management and the control of nonpoint source pollution.

Homeowner's associations and facility managers can perform simple and routine maintenance, while more detailed complex maintenance and repair would require contracting with knowledgeable consultants. The goals of an effective maintenance program should be to prolong the service life of the stormwater facilities, minimize expensive repair costs and preclude adverse downstream impacts.

This guidance document has been prepared for homeowner's associations and residential and commercial property managers to help them understand the basic maintenance needs for stormwater management areas.

Brief Description of Wet and Dry Ponds

Two of the most common types of best management practices that address stormwater management are dry ponds and wet ponds.

A dry pond is a permanent stormwater management facility that temporarily stores incoming stormwater. The pond typically is dry between storm events. Dry ponds should incorporate extended detention of runoff from small rainfall events. The primary purpose of dry ponds is to reduce and delay stormwater runoff peaks. The benefits are reduced potential for flooding and erosion in downstream areas. (See fig. 1.)

A **wet pond** is a stormwater management facility, which includes:

- a permanent pool of water for enhancing water quality and
- additional capacity above the permanent pool for detaining stormwater runoff.

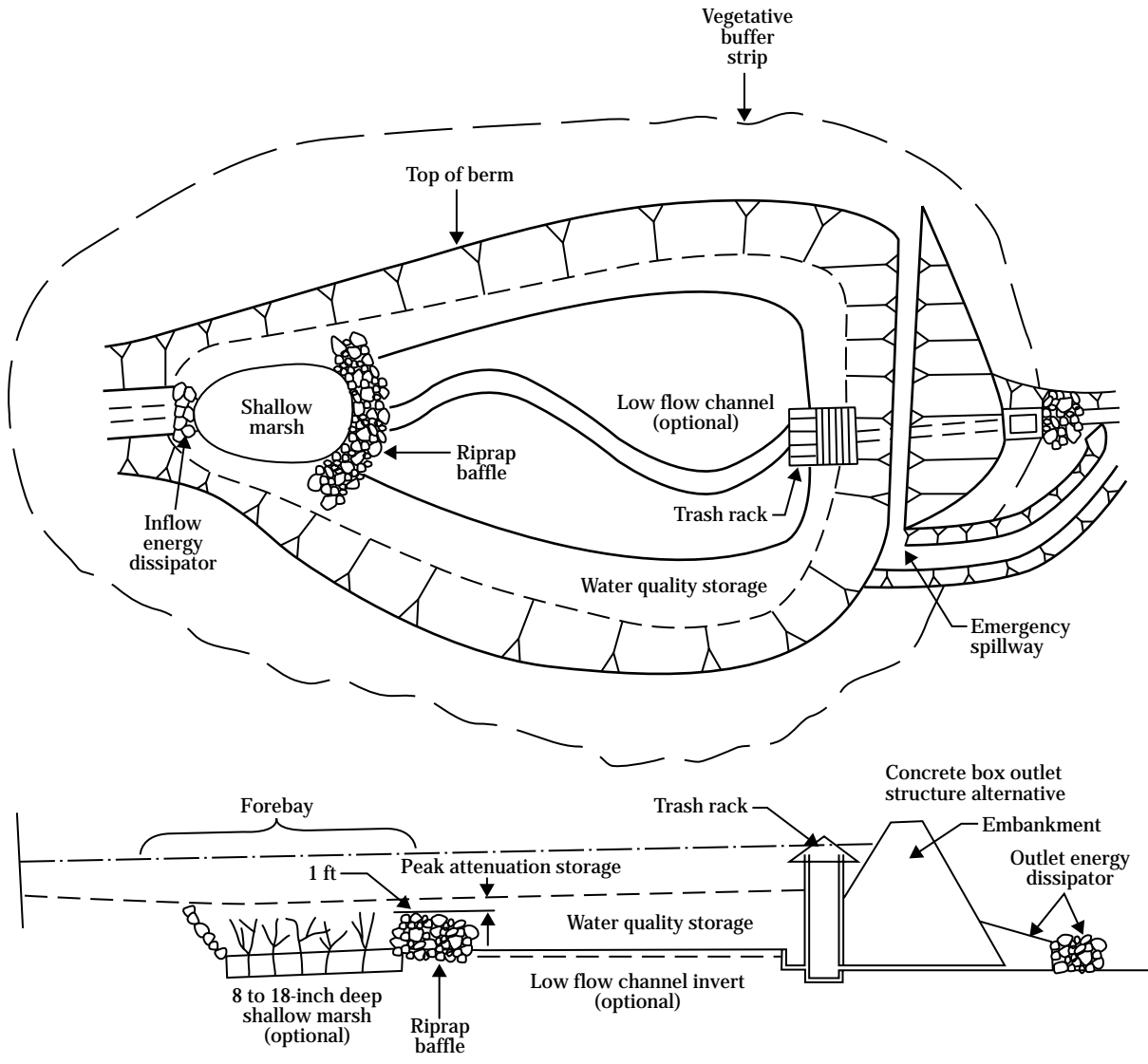
Wet ponds fill with stormwater and release most of it over a period of a few days. (See fig. 2.)

Maintenance Types

Routine and non-routine maintenance items are shown in the table 1. Routine maintenance includes items that associations and property managers should perform. Non-routine maintenance items are those that associations and property managers should have an awareness, but should be handled by a professional with expertise in this field.

Homeowner's associations should retain a copy of the design drawings and planting schemes for the stormwater management facilities. It should be noted that structural areas should be checked at least annually and after major storm events.

Figure 1 Dry Pond - Plan and Elevation



Source of sketch:
Pennsylvania handbook of best management practices for developing areas, spring, 1998.

Figure 2 Wet Pond - Plan and Elevation

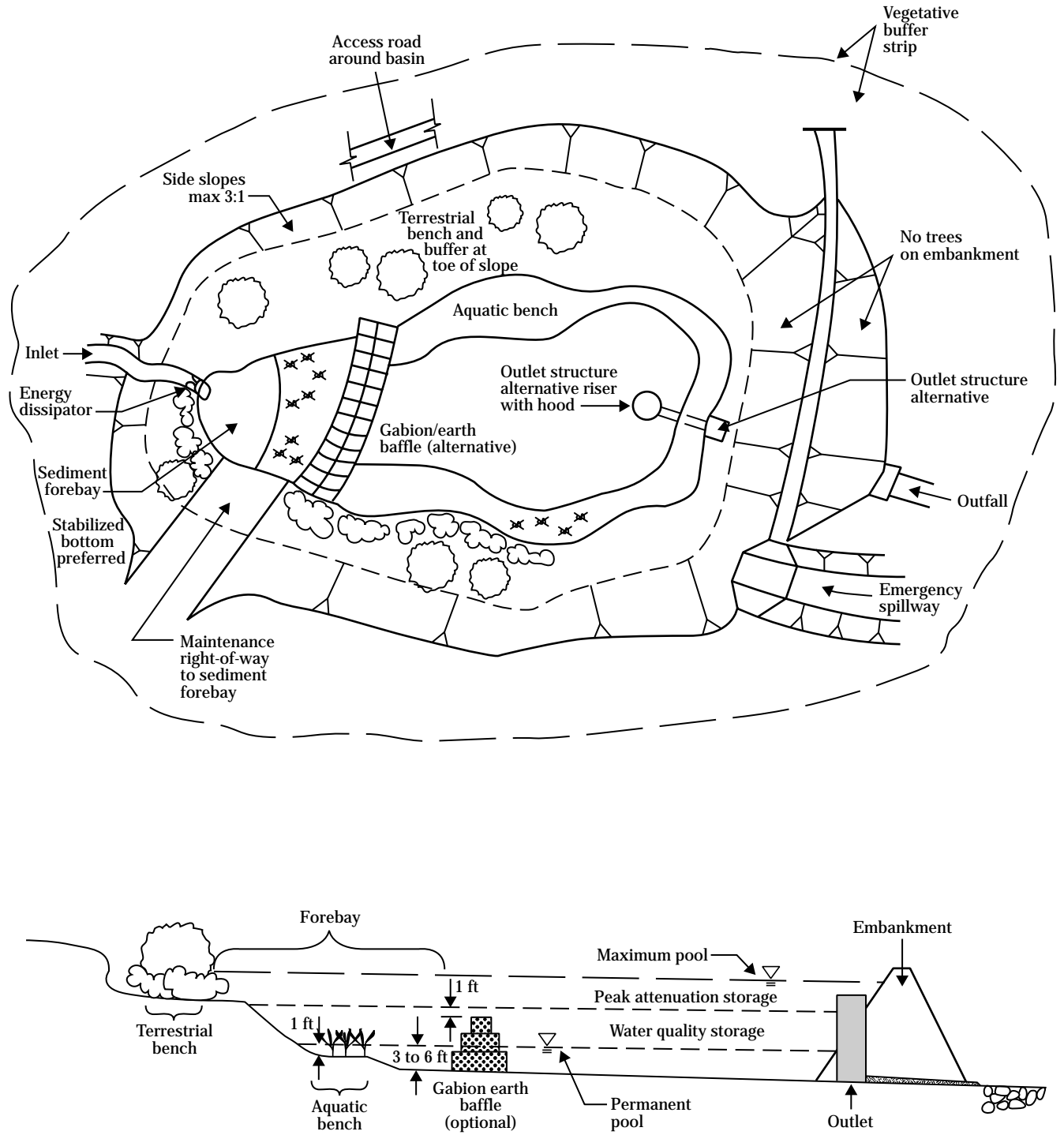


Table 1 Routine and non-routine maintenance items

Routine maintenance	Non-routine maintenance
Visual inspection	Bank stabilization
Debris/litter control	Inlet and outlet structure maintenance/replacement
Maintaining upstream undisturbed areas to minimize invasive vegetation	Mechanical components maintenance
Nutrient excesses and odors	Structural repairs – embankments, inlets, outlets, pipe replacement/repair, removal of fallen trees (could be considered routine).
Minor bank stabilization and erosion control - sheet & rill	Removal of excessive sediment
Minor sediment removal - shovel, rake, pick, or wheelbarrow	Rare condition (extremely low pH, spills of oils and toxic materials, swimming pool water draining.)
Vandalism & fence maintenance	Major bank stabilization – gullies
Algae and aquatic vegetation	Removal of excessive algae and aquatic vegetation
Mowing and harvesting of upland vegetation	

Visibility of the facility—Community needs and preferences determine to a large extent the type and amount of necessary maintenance for aesthetic purposes.

Landscaping—Maintenance needs vary greatly depending upon the type of vegetation.

Upstream conditions—Watershed conditions above the facility will largely determine the type and amount of sediment and other pollutants that are entering that facility.

Safety—Some tasks can be carried out by non-technical staff or residents quite effectively. However, all programs should carefully ensure the safety of anyone carrying out maintenance tasks, and often a professional should be hired to conduct the work. Confined spaces should never be entered without proper training and permits

from occupational and safety regulatory agencies. Confined areas may accumulate toxic and flammable gases for humans.

Need for professional judgment—Professional judgment should be solicited regularly to ensure that all needs of the facility are met. Even though some maintenance tasks can be routinely performed by property owners, there are many problems that are not obvious to the untrained eye. (See appendix 1.)

Carrying out the maintenance plan—In the execution of a maintenance plan, safety, cost, and effectiveness of the maintenance activities need to be balanced. Some minor maintenance items can be accomplished by the facility owners, such as litter removal, light weeding, and light mowing. The best solution, however, is to contract with a professional to do the more extensive sediment

removal work. Mowing and handling of a wheelbarrow can be dangerous on the sloping embankments of a wet or dry pond. Filling eroded areas and soil disturbing activities, such as resodding or replanting vegetation, are also items that a professional landscaping firm might best manage. If it is not done right the first time, excessive erosion will result. In addition, trained personnel will be able to identify potential problems early or when it is most cost effective to correct. Most maintenance needs are site specific.

Financing—A fund should be established to provide for the costs of long-term maintenance needs. These long-term needs might include: extensive sediment removal, structural repairs, landscaping, invasive plant management and control, and litter removal.

Inspection checklists

Checklists to assist associations and property managers during routine inspections similar to the following are particularly helpful.

Debris and obstructions removal

Special attention should be given to the removal of floating debris (leaves, paper, trash, branches, and other manmade and natural materials), which can clog the outlet device or riser. The benefits of debris removal include:

- Reducing the chance of clogging in the outlet structures, trash racks, low flow channels, and other facility components
- Preventing possible damage to vegetated areas
- Reducing potential mosquito breeding habitats
- Improving facility appearance
- Reducing conditions for excessive surface algae

Erosion and sediment control

It is very important to ensure the integrity of the visible banks, slopes, and bottom of ponds. Healthy ground cover must be routinely maintained on all embankments of wet and dry ponds and on the bottoms of dry ponds. Bare areas should be reseeded and stabilized as quickly as possible depending on the season of the year. In the spring, summer, and fall, seed and stabilize within 20 days. In the winter, consider using

synthetic materials and then reseed and stabilize with living vegetation during the growing season. Erosion will result in sediment clogging the facility.

The roots of woody vegetation, such as trees and shrubs, tend to destabilize the embankments. Consistent mowing of the embankment and emergency spillway will control any stray seedlings that take root. Woody growth away from the embankment does not generally pose a threat to the stability of the embankments and can play an important role in maintaining a healthy pond ecosystem. Trees and shrubs, however, should be planted outside of maintenance and access areas.

Structural and mechanical equipment

Maintenance of these items is usually beyond the capabilities of homeowner associations. If a problem is observed, it is a good idea to have a professional to investigate and correct the problem early before it becomes a major expense. Some of the structures and equipment that may be encountered include:

- valves,
- sluice gates,
- fence gates,
- locks,
- access latches,
- aeration equipment,
- pumps, and
- inlet and outlet structures.

Vegetation maintenance

To ensure grass vigor, maintain as an upland meadow. This includes cutting no shorter than 6 to 8 inches high. If a more manicured lawn setting is desired, more mowing and special attention to turf health will be needed. Some communities consider the tall wetlands-type vegetation (typically, cattails or rushes) that may grow in dry ponds as unaesthetic. Some of this vegetation is actually beneficial as it provides water quality benefits and wildlife habitat. Some vegetative needs include:

- pH adjustment (as required),
- pruning,
- pest control,
- reseeding,
- thatch removal, and
- weed removal.

A Minimum Inspection Checklist for Stormwater Ponds

Item to check	Dates observed and/or corrected		Comments on what observed (attach a sketch)
	Observed	Corrected	
Obstructions of the inlet or outlet structures by trash and debris			
Excessive erosion or sedimentation in the basin			
Inspect the embankment area to ensure integrity (holes, trees, roots, weeps, seeps, slumping, and faults)			
Depression or wet spots in the bottom of a dry pond			
Deterioration of pipes			
Condition of the emergency spillway			
Erosion of the embankments and side slopes (erosion and gullies)			
Upstream and downstream channel conditions			
Signs of vandalism			

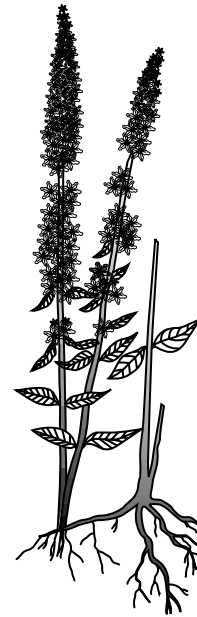
Other items

Sediment filtration—Vegetative cover outside of the embankment, filters sediment from runoff as it flows into the pond. It also prevents erosion of the banks of the pond. A minimum 24 foot vegetated buffer strip is ideal around wet ponds. This buffer strip should be mowed no more than four times per year. Mowing requirements can be tailored to the specific needs of a particular site and the adjacent neighbors.

Surrounding vegetation fertilization (not recommended, except in special cases)—It is important not to over fertilize the surrounding vegetation. This could result in excess nutrients being washed into the pond, which can contribute to excessive alga growth. As a general rule, the nutrient needs of the surrounding vegetation should be evaluated by testing the pH and nutrient content of the soil prior to fertilization. The adjustment of pH may be necessary to maintain vegetation. Fertilization of all turf areas should occur in the fall of the year.

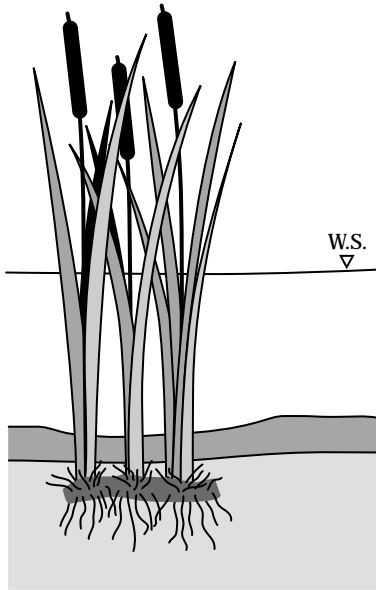
Purple loosestrife—If your wetland and/or stormwater management area becomes invaded with purple loosestrife, there are methods to reduce its presence. It is important to catch its presence early, which is pretty evident by the long purple flower head. To rid the wetland and/or stormwater management area of it manually, it is important to ensure that the rhizomes (large tuberous root systems) are removed as well as the plant prior to flowering (June through September). Plant parts, immediately upon removal, should be placed in a bag to prevent further spread of the species. If it is not possible to do this, regular removal of the flower heads before the seeds are dispersed will help keep this plant at bay. Digging is not recommended as it creates disturbance, which may favor the spread of the species. Herbicides are generally not effective for purple loosestrife as its seeds are long-lived and therefore the solution is only short-term. Herbicide applications need to be repeated for several years. As a caution, purple loosestrife may be available at local nurseries. Do not introduce into pond areas. (See fig. 3.)

Figure 3 Purple loosestrife

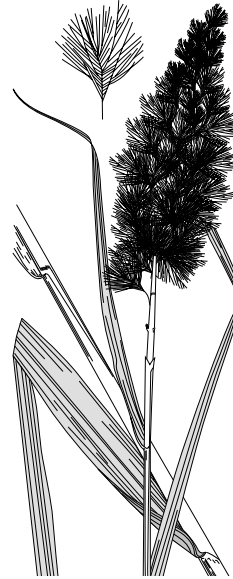


Cattails and common reed (Phragmites)—It is important to find out what plants were originally planted when the pond or stormwater wetland was constructed. The cattails that were planted in these areas are one of the most beneficial plants at improving water quality. Ponds and stormwater wetlands were originally designed with the intent of retaining and/or treating stormwater. Wildlife habitat was an ancillary benefit at best prior to the mid-1990's.

Shallow water (less than 2 feet) will often be taken over by water-loving plants. Dense, tall emergent vegetation, most commonly cattails and phragmites, may limit waterfowl use of a pond. Cattails provide good wildlife habitat but can take over a shallow pond. Phragmites is much more invasive, taller, and generally does not provide for a scenic view. Once established, phragmites is very difficult to completely eradicate. (See figs. 4 and 5.)

Figure 4 Cattails

Too dense of a stand of cattails and/or phragmites can reduce populations of invertebrates, amphibians, reptiles, and may possibly increase the mosquito populations. It is important to keep some areas of open water. Eradication of these species generally requires the assistance from a natural resource professional. A natural resource professional is a person, who has been trained in ecology and/or environmental assessment including soils, plants, animals, air quality, human involvement, and water quantity and quality (appendix 1).

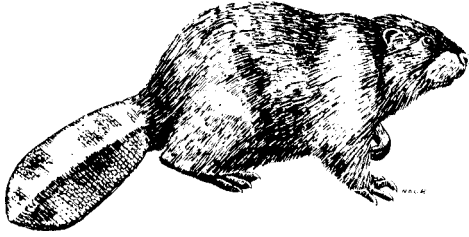
Figure 5 Phragmites

With respect to diversity, research has shown that lower pollutant inputs generally yield greater plant diversity. Conversely, higher pollutant inputs yield lower plant diversity. Hence, if a pond becomes populated with Phragmites, cattails or both, it may indicate a high pollutant load. These species, among others, are two of the best plants for improving water quality.

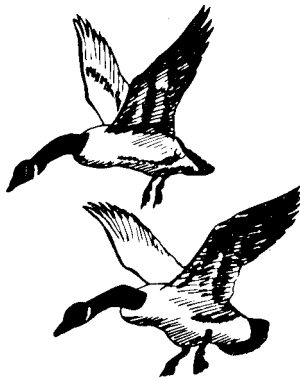
It is recommended for the homeowner's association to decide early on how much it is willing to spend in time and effort on vegetation maintenance.

Wildlife maintenance

Beavers have been known to take up residence in facilities with ponded water. Beavers can cut down small shrubs and trees adjacent to the pond and may cause an increase in the amount of ponding. If excessive tree damage or ponding is observed, contact a natural resource professional. Beavers will attempt to block the pond inflow and outflow structures. (See fig. 6.)

Figure 6 Beaver

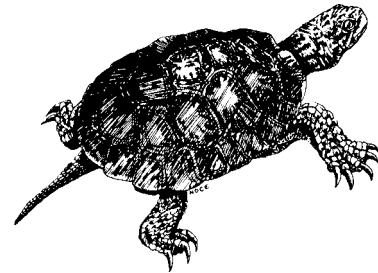
Resident Canada geese may also be a problem in stormwater wetland or pond. If too many geese populate the area, their excretions may cause algal blooms and odor problems. Their paths, created by feeding on new shoots of grass and continuous trampling may also cause small gullies to form. To keep the resident Canada geese populations low, it is important to maintain an area around the pond to its edge with high grasses and shrubs. A width of approximately 24 feet is recommended. (See fig. 7.)

Figure 7 Canada geese

Other animals, such as muskrats and groundhogs, may dig out burrows that could deteriorate the structural integrity of an embankment. Muskrats, in particular, will burrow tunnels up to 6 inches in diameter. Existing burrows should be filled as soon as possible to minimize animal burrowing. Another measure could involve trapping of the muskrats if the problem becomes extensive. (See fig. 8.)

Figure 8 Muskrat

As a warning to small children, they should not pick up snapping turtles. It is recommended that local fish and wildlife professionals be contacted regarding the number of snapping turtles in a specific pond to maintain its ecological balance. Snapping turtles differ from other turtles by their ridges on the shell and tail and their hooked beak (fig. 9).

Figure 9 Snapping turtle

Other (aesthetics, mosquitoes, algae, fish kills, odors)

Mosquitoes are not as big a problem as is often perceived. There are proven control strategies that can be used. While ponded water can create mosquito and other insect breeding habitat, it also provides habitat for insect predators such as swallows, purple martins, fish, frogs, bats, and dragonflies to keep the nuisance populations in check. The best mosquito control technique in ponds is to prevent stagnant areas from forming in the permanent pool. This means that all floating debris should be removed to preclude still or standing surface waters that provide breeding habitat.

Some mosquito management tips

- Wetlands should be managed to minimize the formation of stagnant pools.
- Flowing water conditions should have a minimum velocity of 2 feet per second.
- Provide vegetative cover for the water surface, i.e. encourage duckweed.
- Provide nesting and perching structures for purple martins, swallows, and bats (appendix 2).
- Encourage aquatic predation — i.e. introduce fish and frogs.
- Use bacteria, i.e. biological control.

Fish kills can result from an imbalance in the ecological system or if there is direct discharge through the storm sewer system, such as swimming pool draining, vehicle oil changes, car washing detergents, and other household products. Fish kills can also result from algae die-offs. The homeowner's association should adopt a storm sewer stenciling program to help promote an understanding that storm sewers flow to the basin, then to the stream.

Odors are generally not a problem. Sometimes a sulfur odor is evident, but this is usually very localized and present when there is very little wind current. Algae die-offs can result in excessive odors from the pond. If odor becomes a big problem in a wet pond, it may be necessary to allow for a draw-down period within the pond, which would require assistance from a natural resource professional.

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Appendix 1

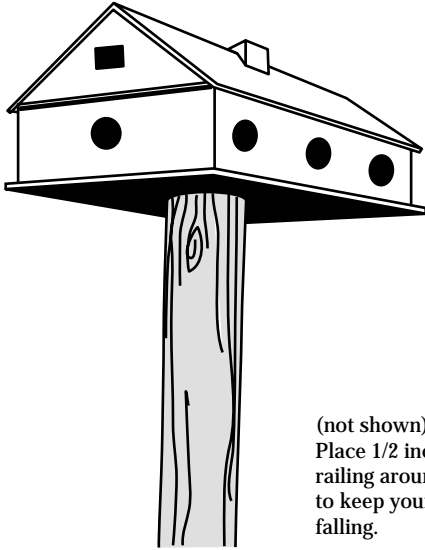
Provided is a suggested format for listing local Natural Resources professionals:

Agency and contact person	Address	Phone number	FAX number
Local conservation district office			
Local Cooperative Education and Extension Service Office			
United States Department of Agriculture, Natural Resources Conservation Service Office			
Local Fish and Wildlife Service Office for game and non-game species			
Private Consultants			
Other Natural Resource professionals			

Appendix 2:

Provided are some details for the construction of houses for purple martins, swallows, and bats to help control the insect populations around stormwater ponds.

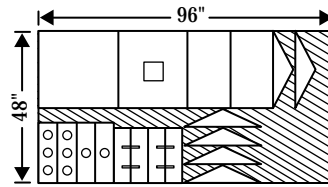
Purple Martin house



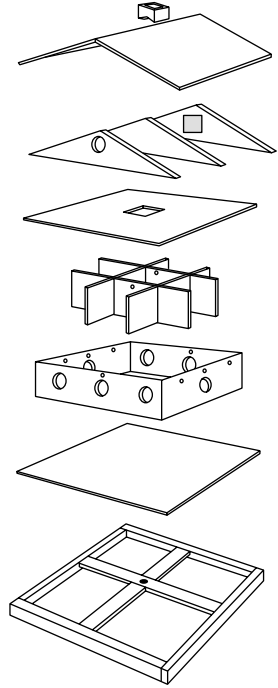
(not shown)
Place 1/2 inch dowel railing around balcony to keep young from falling.

Materials

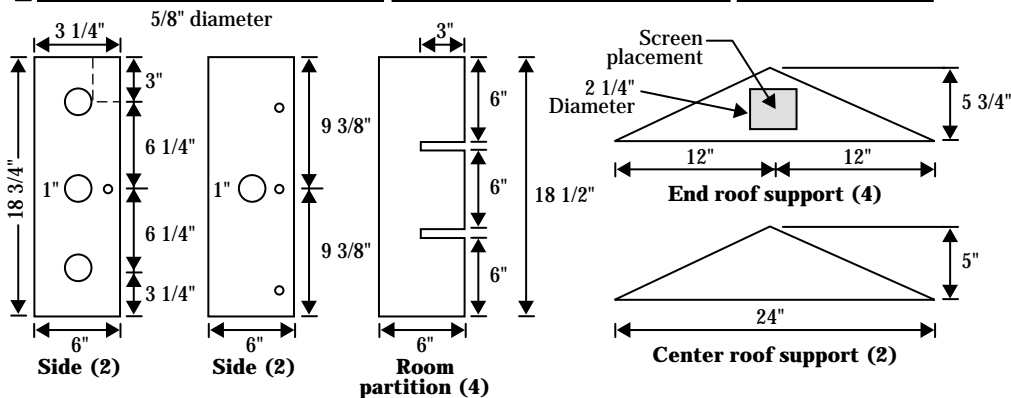
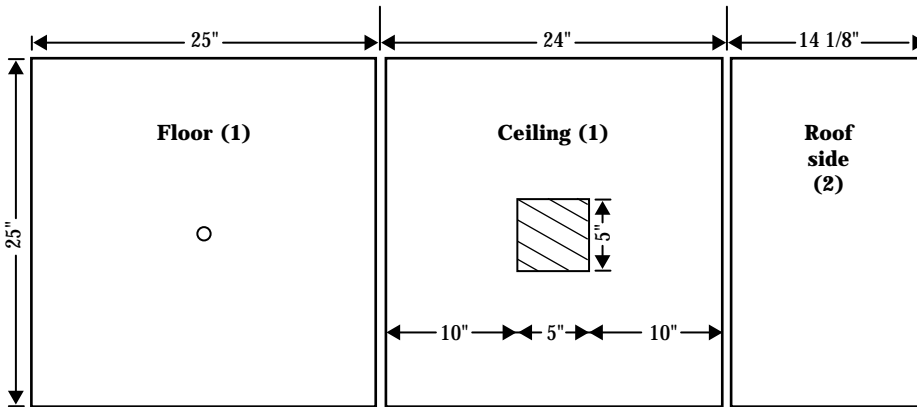
- 4' x 8' x 1/4" plywood
- 2" x 2" x 6" for chimney
- 1" x 2" x 14' (base)
- 1" x 1" x 8' (corner blocks)
- 4" x 8" metal window screen
- 4" x 4" x 14' cedar post



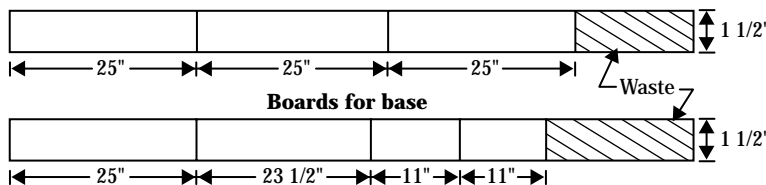
Layout pattern



Expanded view of martin house. A threaded rod inserts through the base and up through the chimney.



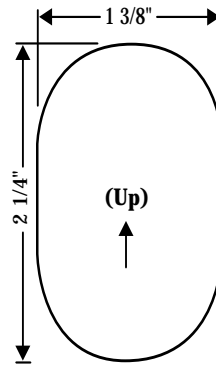
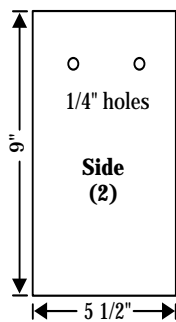
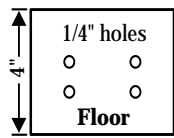
Entrance hole diameter 2 1/4". Locate 5/8" ventilation holes 1" below top edge of sides.



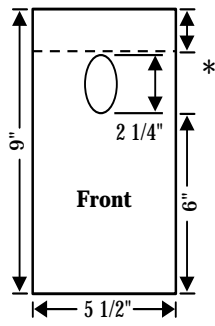
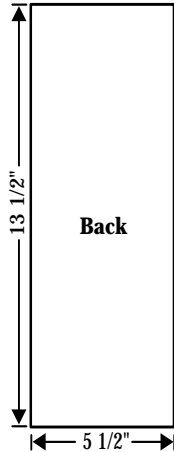
Note: This plan is for a one-story house. To add a second story, make one more ceiling unit (25" x 25") four more sides, and four more room partitions.

(Plans from Penn State College of Agricultural Sciences Cooperative Extension.)

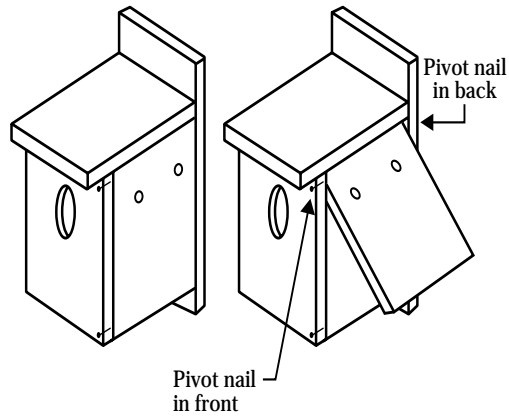
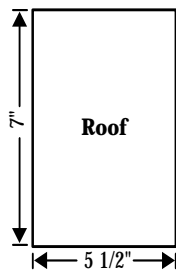
Nest box for Tree Swallow or Eastern Bluebird



Note:
Entrance hole for
Great Crested
Flycatcher should
be a round hole 1 1/4"
in diameter

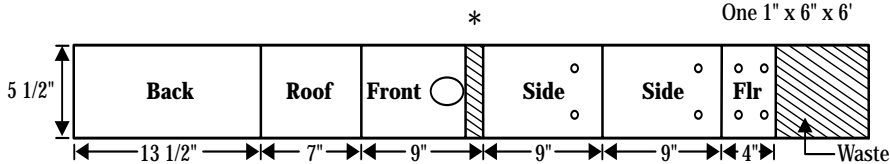


*Note: If slot entrance is used front
will measure 5 1/2" x 7". Leave
opening at top.



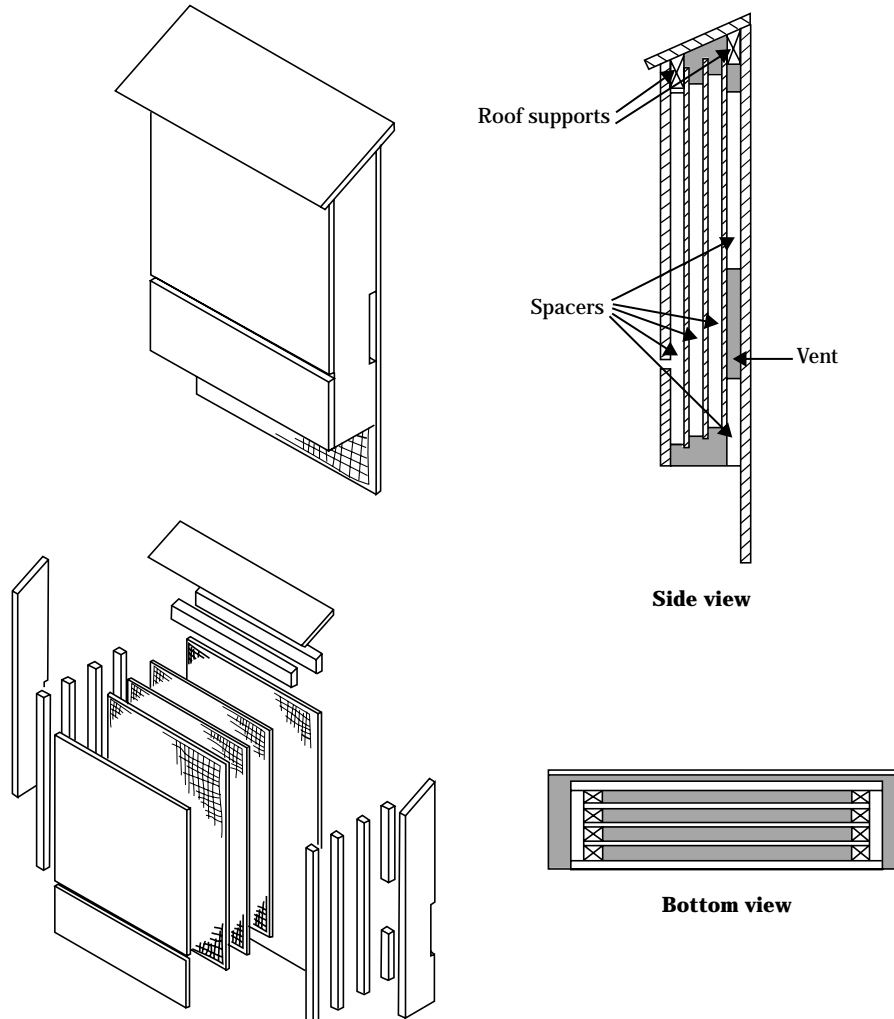
Two "pivot" nails allow side to swing out for cleaning.
Use one nail at bottom to close side.
Nail holds side closed.

Lumber:
One 1" x 6" x 6'



(Plans from Penn State College of Agricultural Sciences Cooperative Extension.)

Bat house design



1. Measure and mark all wood as per cutting diagrams on page seven. Cut out all parts.
2. Cut six pieces of netting 14" x 21". Staple to partitions.
3. Screw back to sides, caulking first. Be sure top angles match.
4. Cut a piece of netting 16" x 30" and staple to inside surface of back. Be sure netting lies flat and does not pucker.
5. Construct house as per drawings above. Place spacers on partitions, screw top front piece to sides first then screw bottom front piece to sides to create a 1/2" vent between the two, attach roof supports, attach roof.
6. Caulk between roof and sides, sides and front pieces, and sides and back piece so as to seal house airtight. Do not allow screws to protrude into roosting chamber. Paint exterior at least twice with appropriate color.