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Department of
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Natural
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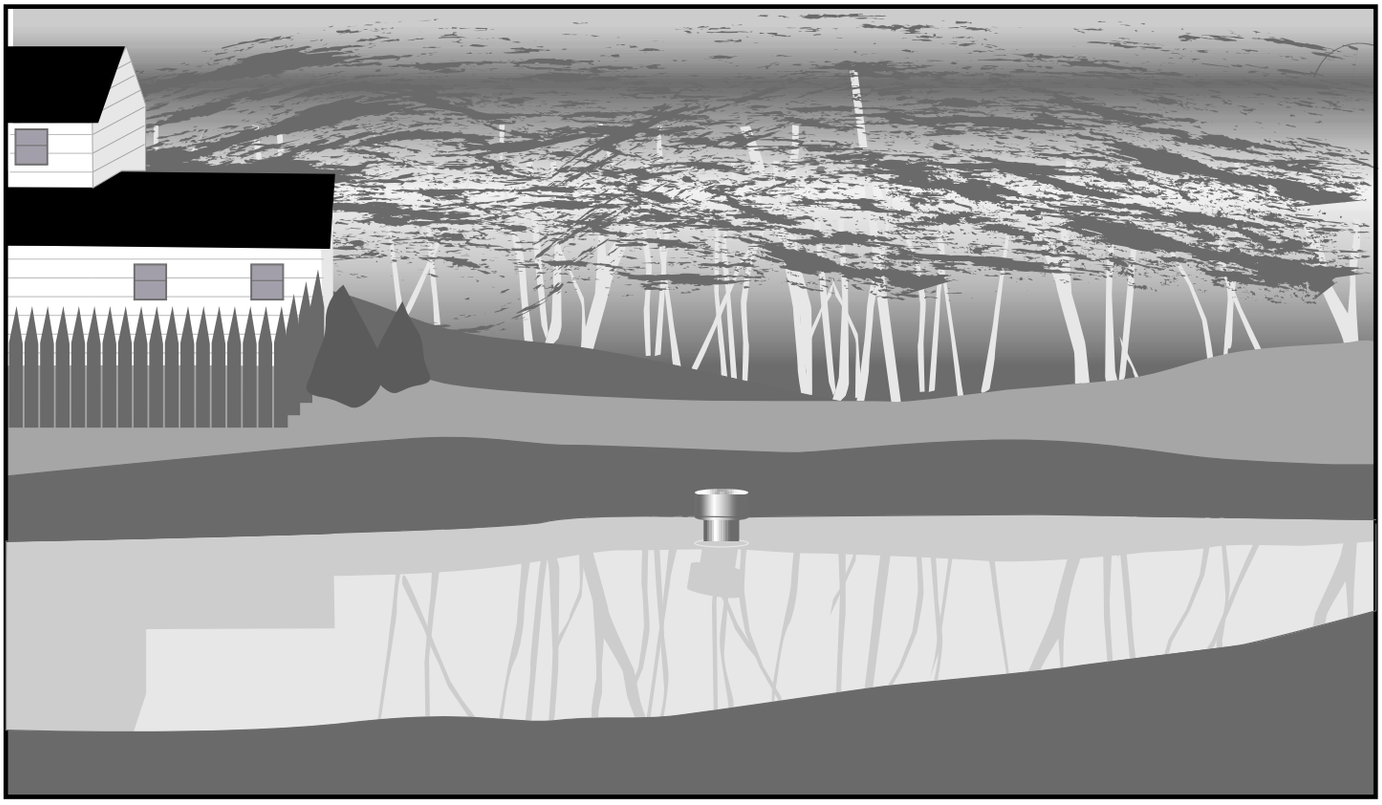
Conservation
Service

The Maintenance of Residential Stormwater Management Areas



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USDA NRCS
Natural Resources Conservation Service

Mid-Atlantic
Interdisciplinary
Resource Team

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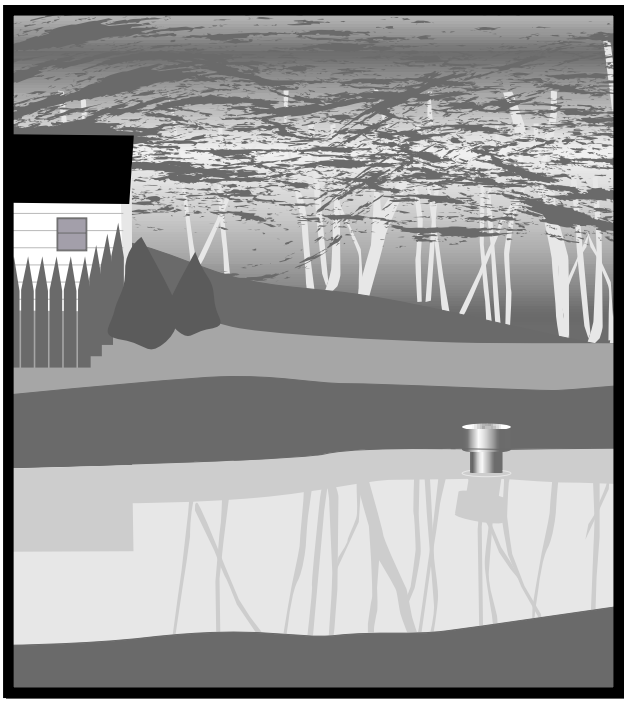


Acknowledgments

Carl DuPoldt, USDA, NRCS, East Reg. Urban Cons. IRT, Hammonton, NJ

Julie Hawkins, USDA, NRCS, Mid-Atlantic IRT, Dover, DE

Marianne Hardesty, USDA, NRCS, Newark, DE

Pete Marole, New Castle County Department of Special Services, Newark, DE

Cathy Martin, Fisheries Biologist, Delaware Department of Natural Resources and Environmental Control, Division of Fish and Wildlife

Richard Mickowski, New Castle Conservation District, Newark, DE

Debi Weiker, New Castle Conservation District, Newark, DE

The Maintenance of Residential Stormwater Management Areas

Introduction and Background

Prior to the implementation of stormwater controls, construction and development often resulted in severe alterations of watershed drainage patterns. These alterations caused downstream flooding on residential and commercial properties, as well as low-lying road crossings. Uncontrolled stormwater volume also increases streambank erosion and results in major detrimental changes in the physical characteristics of receiving streams. Residential and commercial land uses often discharge polluted stormwater runoff, which can reach waterbodies 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 associations and property managers can perform simple and routine maintenance of their stormwater management facility. More detailed complex maintenance and repair would require contracting with professional consultants. The goals of an effective maintenance program should be to prolong the service life of the stormwater facilities, minimize expensive repair costs and avoid adverse downstream impacts.

This guidance document has been prepared for homeowner 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.

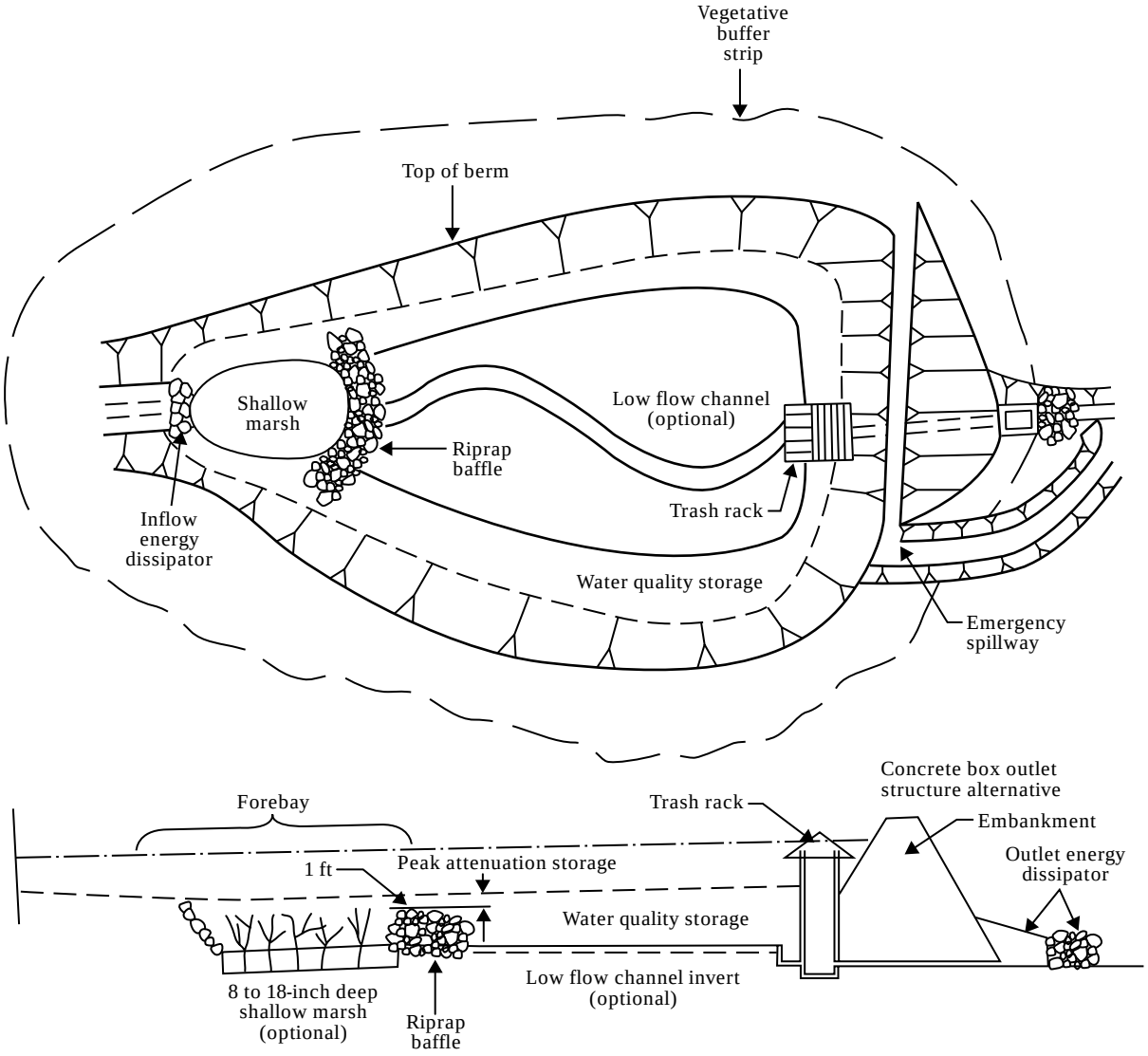
A **dry pond** (fig. 1) is a stormwater management facility that temporarily stores incoming stormwater. The pond typically is dry between storm events. Dry ponds should incorporate extended detention of runoff from small rainfall events to trap first-flush nutrients. The primary purpose of dry ponds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

A **wet pond** (fig. 2) 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. The benefits of a wet pond include those of the dry pond and additional water quality and wildlife improvements.

Maintenance Types

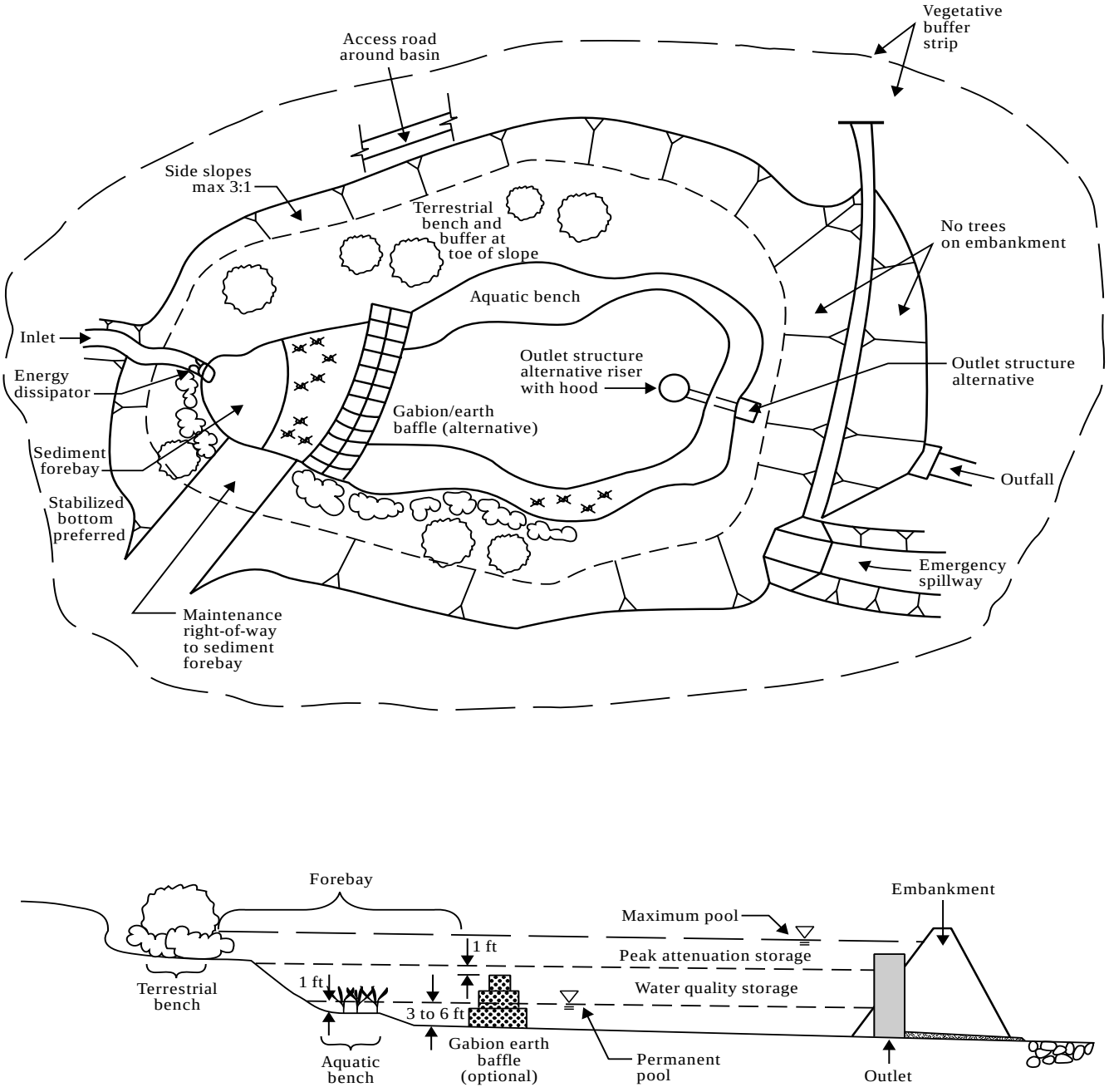
Routine and non-routine maintenance items are shown in table 1. Routine maintenance includes items that associations and property managers should perform. Non-routine maintenance items are those that homeowner associations and property managers should be aware of, but should be handled by a natural resource 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). Structural items may require the expertise of an engineer.

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



Source:
Pennsylvania Handbook of Best Management Practices for Developing Areas, spring, 1998.

Figure 1 Dry Pond - Plan and Elevation



Source:
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	Major 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
Minor bank stabilization and erosion control - sheet & rill	Removal of excessive sediment
Minor sediment removal - shovel, rake, pick, or wheelbarrow	Rare conditions (extremely low pH, spills of oils and toxic materials, swimming pool water draining)
Vandalism & fence maintenance	
Algae and aquatic vegetation	Removal of excessive algae and aquatic vegetation
Mowing and harvesting of upland vegetation	

Maintenance Considerations

Visibility of the Facility—Community needs and preferences determine to a large extent the type and amount of necessary maintenance for aesthetic purposes. 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 as these spaces may accumulate toxic and flammable gases.

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. (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. For sediment removal, however, the best solution is to contract with a professional. 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. 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 removal of debris and litter.

Inspection Checklists

Checklists are particularly helpful to associations and property managers during routine inspections. See appendix 2 for a sample.

Debris and Obstructions Removal

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

- Reducing the chance of blocking 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 re-seeded and stabilized as quickly as possible depending on the season of the year. In the winter, consider using synthetic materials and then reseed and stabilize with vegetation during the growing season. If left unchecked, erosion will result in sediment depositing in 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 prevent the trees and shrubs from taking 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 are usually beyond the capabilities of homeowner associations. If a problem is observed, it is a good idea to have a professional investigate and correct the problem early before it becomes a major expense. Some of the structures and equipment that may be encountered are as follows:

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

Vegetation Maintenance

Turf maintenance—To ensure grass vigor, maintain as an upland meadow by cutting no shorter than 6 to 8 inches high during non-nesting periods. 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 the following:

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

Sediment filtration—Vegetative cover around the pond 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 or once a year where wildlife habitat is a concern. 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 algae 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 (fig. 3)—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 evident by the long purple flower head. To rid the wetland and/or stormwater management area of it manually, both plants and rhizomes (large tuberous root systems) must be removed prior to flowering (June through September). Place plant parts immediately 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 favors the spread of the species. Herbicides are generally not effective for purple loosestrife, as its seeds are long-lived; therefore, it only provides for a short-term solution. If herbicide applications are used, they will need to be repeated for several years. As a caution, purple loosestrife may be available at local nurseries. Do not introduce this plant into pond areas.

Cattails and common reed (Phragmites)—It is important to find out what plants were originally planted when the pond or stormwater wetland was constructed. Ponds and stormwater wetlands were originally designed with the intent of retaining stormwater; hence, only one or two plant species were planted. Water quality treatment and wildlife improvements have since been added to their design, increasing the diversity of plants used in the ponds.

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

Too dense of a stand of cattails and/or phragmites can reduce populations of invertebrates, amphibians and reptiles and may possibly increase the mosquito populations. It is important to keep approximately 30 to 50 percent of the pond surface as open water. Eradication of these plant species generally requires the assistance from a natural resource professional.

With respect to diversity, research has shown that lower pollutant inputs generally yield greater plant diversity. Conversely, higher pollutant inputs yield

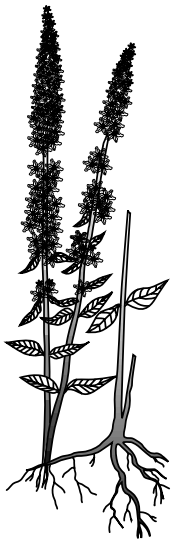


Figure 3 Purple loosestrife

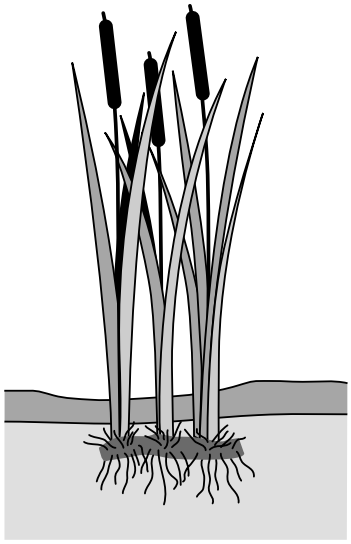


Figure 4 Cattails

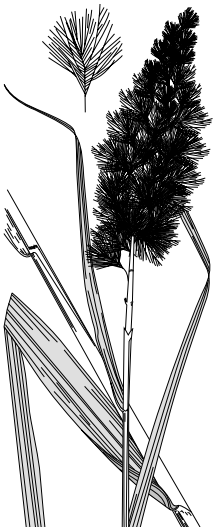


Figure 5 Phragmites

lower plant diversity. Hence, if your pond becomes populated with phragmites, cattails or both, it may also indicate a high pollutant load. These two plants are among the best plants for improving water quality.

It is recommended that homeowner associations decide early on how much they are willing to spend in time and effort on vegetation maintenance.

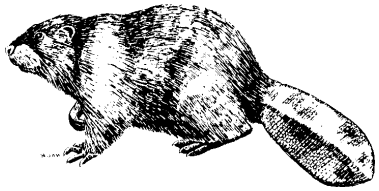


Figure 6 Beaver

Wildlife Maintenance

Beaver (fig. 6) have been known to take up residence in facilities with ponded water. Beaver 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. Beaver will attempt to block the pond inflow and outflow structures.

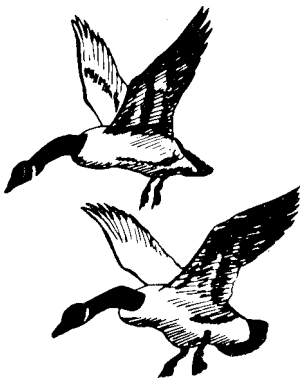


Figure 7 Canada geese

Resident Canada geese (fig. 7) may also be a problem in your stormwater wetlands or ponds. 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. Do not feed geese as it encourages them to stay.

Muskrats and groundhogs (fig. 8)–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.

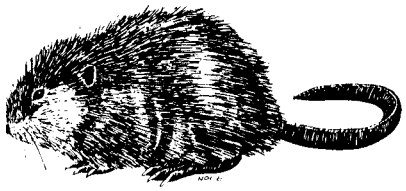


Figure 8 Muskrat

Snapping turtles (fig. 9)–Warn small children that 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.

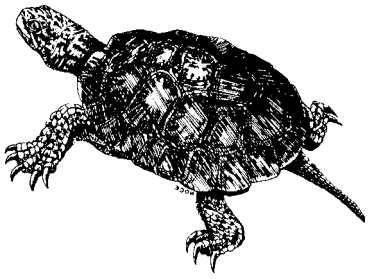


Figure 9 Snapping turtle

Other Concerns (mosquitoes, algae, fish kills, and 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 birds (swallows and 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.

Mosquito management tips:

- Manage wetlands to minimize the formation of stagnant pools.
- Encourage flowing water conditions by removing debris and excessive vegetation.
- Provide vegetative cover for the water surface.
- Provide nesting and perching structures for purple martins, swallows, and bats (appendix 3).
- Encourage aquatic predation; i.e., introduce fish and frogs.

Algae—Heavy algal growth is caused by excess nutrients, warm water, and sunlight. Control methods vary depending on the type of algae. Contact a natural resource professional for assistance in controlling excess algae.

Fish kills can result from an imbalance in the ecological system or if there is a direct discharge through the storm sewer system, such as chlorinated swimming pool water, vehicle oil, car wash detergents, and other household chemicals. Fish kills can also result from algal die-offs. The homeowner associations should adopt a storm sewer stenciling program to help promote an understanding that storm sewers flow to the basin and then to a nearby 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. Algal die-offs can result in strong odors from the pond. If odor becomes a big problem in a wet pond, contact a natural resource professional.

Aesthetically, your pond should mimic natural pond conditions. This includes a variety of habitats for plants and animals as well as some open water.

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Appendix 1 Suggested format for listing local natural resources professionals

Agency and contact person	Address	Phone number	FAX number
Local Conservation District office			
Local Cooperative 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

A Minimum Inspection Checklist for Stormwater Ponds

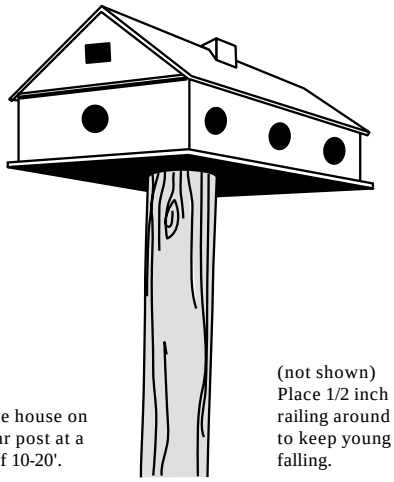
Item to check	Dates observed and/or corrected		Comments on what observed (attach a sketch)
	Observed	**Corrected**	
Obstructions of the inlet or outlet structures by trash and debris			
Excessive erosion or sedimentation in the basin			
Inspect the embankment area to ensure integrity (holes, trees, roots, 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			

Note: Inspections should occur at least annually and after major storms or as a follow-up to a complaint.

Appendix 3 Details for the construction of houses for purple martins, swallows, and bats.

Purple Martin house

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

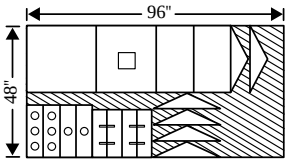


Place the house on the cedar post at a height of 10-20'.

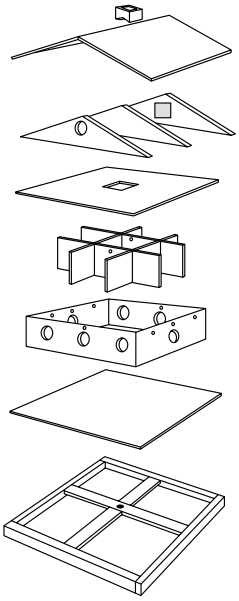
Materials

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
(recommended for the fixed height house)

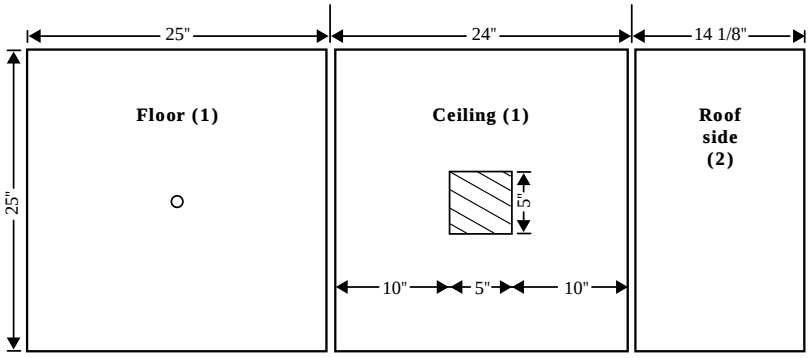
(not shown)
Place 1/2 inch dowel railing around balcony to keep young from falling.



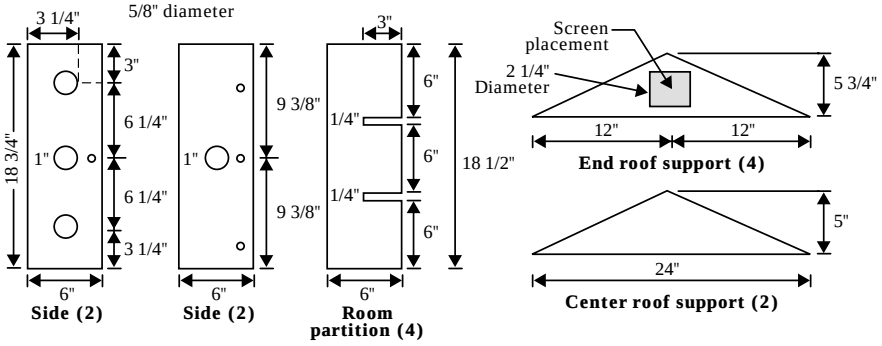
Layout pattern



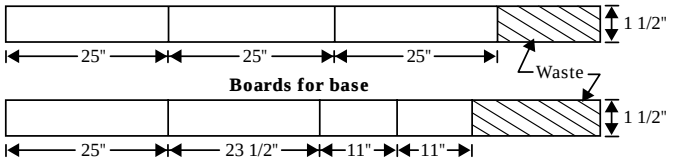
Expanded view of martin house. A threaded rod inserts through the base and up through the chimney.



5/8" diameter



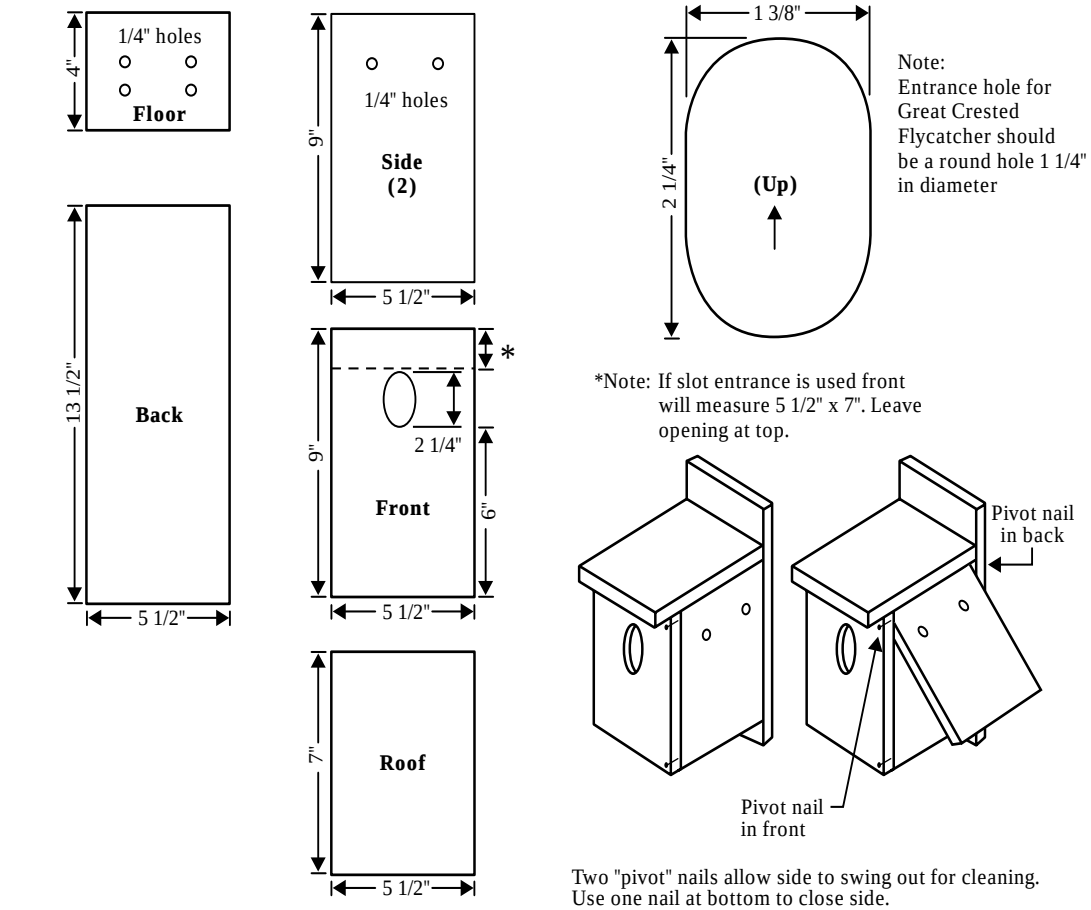
Entrance hole diameter 2 1/4". Locate 5/8" ventilation holes 1" below top edge of sides.



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.

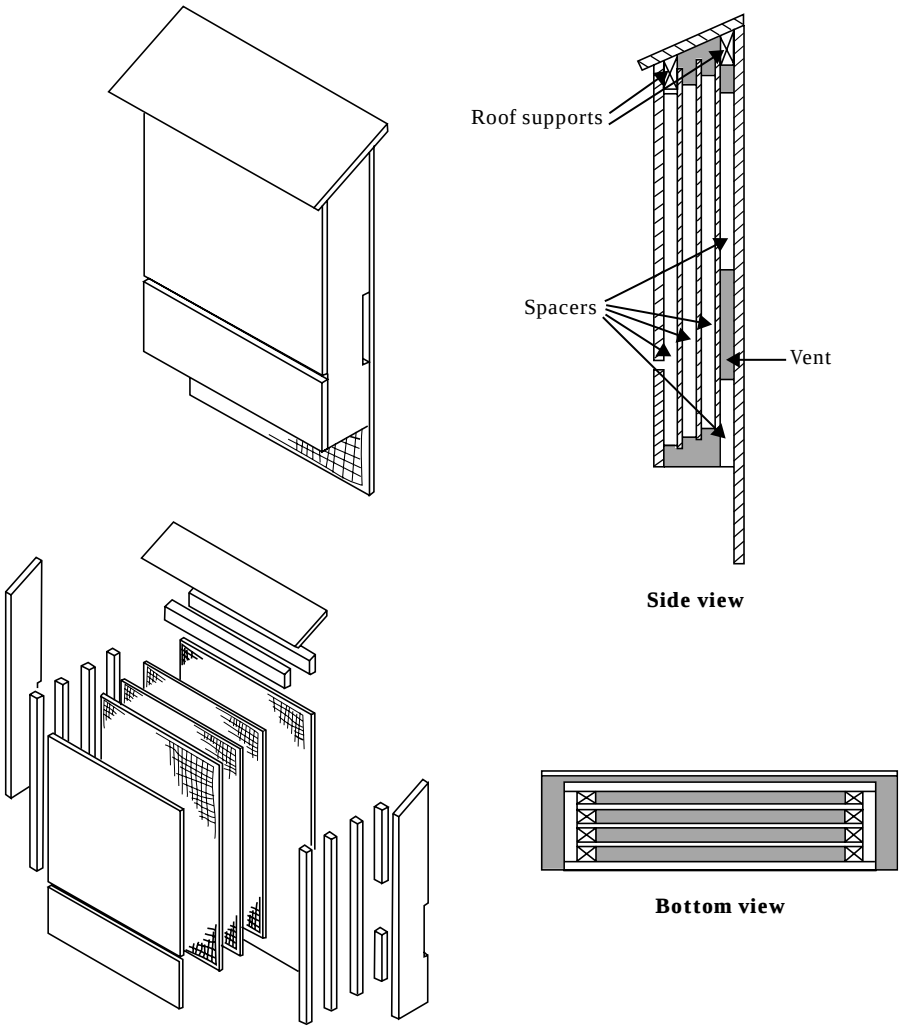
Nest box for Tree Swallow

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



Bat house design

(Plans from Penn State University and PA Game Commmission. Designed by Lisa Williams)



1. Measure and mark all wood: back 1' 6" by 2'; roof 1' 7" by 6 1/2"; interior pieces 1' 4 1/2" by 1/2"; front top 1'6" by 9 1/16"; and front bottom 1'6" by 5 1/2".
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.
7. Place bottom of box 10' above ground on a building or pole and orient the box to southeast or southwest.