VERMONT
POND CONSTRUCTION GUIDELINES

Agency of Natural Resources
Department of Environmental Conservation
Water Quality Division
103 South Main Street
Waterbury VT 05671-0408

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For more information,
visit the Water Quality Division website at
http://www.vtwaterquality.org

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NOTES

POND CONSTRUCTION GUIDELINES

Table of Contents

Please note that the listing of companies, equipment, and supplies in this guide does not constitute endorsement by the state of Vermont. The existing lists have resulted from numerous requests from landowners about ponds and are for informational purposes. The lists will most likely be expanded and updated upon notification in the future.

Helpful Booklets, Brochures and Maps
available from
VT DEC Water Quality Division
802-241-3770 or 802-241-3777

Vermont Significant Wetlands Inventory Maps

Purple Loosestrife - A Beautiful Plant Threatens Vermont's Wetlands. **Brochure.** ***2002.***

Native Vegetation for Lakeshores, Streamsides, and Wetland Buffers **- What you need to know to re-establish or enhance a buffer strip along water and wetlands in Vermont. 43pp.**

What You Should Know About Constructing a Pond or Dam**. Fact Sheet.**

Lake and Pond Plants **- A Guide to Vermont's Common Aquatic Plants and their Natural Values in Lakes . 33pp.**

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Available from Countryman Press in Woodstock VT:

Earth Ponds, The Country Pond Maker's Guide to Building, Maintenance and Restoration**, 2nd edition by Tim Matson provides many practical considerations and technical advice from someone who has constructed many ponds in this region.**

Purchase privately:

Pond Life **(Golden Nature Guide) by George Reid, is recommended as a useful identification book for animal and plant life. Paperback 160pp.**

Bruce Pion
Navigator Environmental Services
PO Box 31
Lowell VT 05847
802-744-6433

David Dana
PO Box 1
N Pomfret VT 05053
802-457-9104

Natural Resources Consulting Services
167 South Street
Concord NH 03301 or
Field Office: 67 West Shore Road
Grand Isle VT 05458
802-878-4800
pwsnrcs@comcast.net

Doug Leach Excavation Inc
161 Forrest Farm Rd
Pawlet VT 05761
802-325-3697

5. Out-of-State Pond Management Consultants (Partial Listing)

Aquatic Control Technology
11 John Road
Sutton MA 01590-2509
508-865-1000

POND CONSTRUCTION GUIDELINES

We often look forward to the enjoyment of creating a small pond with abundant fish and wildlife. Ponds may have many uses and may enhance our landscapes. There may also be numerous problems with the construction and management of small ponds.

The following guidelines are for general information purposes in planning, building, and maintaining small ponds in Vermont. The Agency accepts no responsibility for any damage, direct or indirect, of whatever nature, and by whoever suffered arising out of any failed projects. It is the responsibility of the landowner to comply with applicable federal, state, and local laws, regulations and permits.

A. Types of Ponds

Excavated Ponds, Runoff Ponds, or Potholes

Excavated ponds are the simplest to construct and the only kind that can be built economically on nearly level ground. The pond is made by scooping out a pit below the surrounding groundwater level, generally by bulldozer. During the excavation process, soil should be disposed of in an upland site at least 50 feet from the edge of any waterbody or wetland so as not to wash back into that waterbody or wetland.

Embankment Ponds

Embankment ponds generally impound water behind an earth berm or dam built across a watercourse. They are best suited to areas where slopes range from gentle to

steep and where the watercourse is deep enough that water in the ponded area is at least six feet deep. You will need to seek the advice of an engineer or contractor in preparing plans for an embankment pond. The Agency of Natural Resources does not encourage the construction of ponds on streams due to the possible effects on fisheries. Generally, less environmental impact will occur if the pond is built off stream.

Replacement Ponds

Replacement ponds generally try to duplicate similar conditions as existed previously; i.e., man-made ponds or beaver-created ponds that have deteriorated over the years resulting in loss of water. Generally all that is required is a rebuilt water control structure. You may need the advice of an engineer or contractor for the water control structure. Before restoring the dam it is important to determine whether or not wetlands present will be impacted (see Section G for regulatory considerations).

B. Selecting a Site

1. Before deciding on a pond site, it is most helpful to carefully survey the site to gain knowledge of topographical conditions. For economy, locate the pond where the largest storage volume can be obtained with the least amount of earthwork. US Geological Survey (USGS) topographic maps, aerial photographs and the US Department of Agriculture Natural Resources Conservation Service (NRCS) Soil Surveys are all valuable tools in finding a pond site.

4. Vermont Pond Consultants (Partial Listing)

Soggy Boot Consultants
1489 Lower Elmore Mountain Road
Morrisville VT 05661
Carlton Piper 802-888-3433

Gurney Bros. Construction
Gurney Road
N Springfield VT 05150
Donald Gurney - 802-886-2210

Root Engineering
305 Summer Street
Springfield VT 05156
Phone/ Fax: 802-885-8419
Mobile: 603-558-2700

Stephen Austin
Box 20
Concord VT 05824
802-695-2961

Woodard Construction, Inc.
Arlington VT 05250
802-375-6676

Ron Majorell, Landscape Contractor
Warren VT 05674
802-496-2850

Tim Matson
PO Box 288
Miller Pond Rd
Thetford Center VT 05075
802-333-9019
earthponds.com

3. Technical assistance may be available from the field offices of the USDA NRCS throughout Vermont. The NRCS may be able to conduct a site evaluation and provide recommendations on the pond proposal.

USDA NRCS Field Office Location	District	Telephone #
Bennington	(Bennington)	802-442-2275
Berlin	(Winooski)	802-828-4493
Brattleboro	(Windham)	802-254-9766
Middlebury	(Otter Creek)	802-388-6748
Morrisville	(Lamoille)	802-888-4935
Newport	(Orleans)	802-334-6090
Rutland	(Rutland)	802-775-8034
St. Albans	(Franklin/Grand Isle)	802-527-1296
St. Johnsbury	(Caledonia/Essex)	802-748-2641
White River	(White River)	802-295-7942
White River Junction	(Ottauquechee)	802-295-7942
Williston	(Winooski)	802-879-4785

www.vt.nrcs.usda.gov

2. The size of the watershed or area that drains into the pond is important. If too large, you may have severe pond erosion problems; if too small, you may not have enough water to fill the pond. Generally, one should allow at least two acres of watershed drainage for each acre-foot of water to be stored in the pond. (One acre-foot is equal to the amount of water to cover one acre, one foot deep.) If there are dependable springs in the area, you may not need as large a watershed to fill the pond.

3. Watersheds with active erosion will likely fill the pond with sediment in a short time. Permanent vegetative cover in waterways leading to the pond will help protect the pond from muddy water and excessive vegetation.

4. Avoid sites where runoff water from barn lots, sewage disposal fields, landfill areas, and similar areas may pollute the pond. Runoff containing fertilizers or a high amount of phosphorous (such as from cow manure) may result in algae blooms.

5. Soils in the pond area must hold water with a minimum of seepage. Clay and silty-clay are good for "sealing the bottom" of the pond. Sandy-clay is generally suitable, but sand, gravel, and sand-gravel mixtures are generally too porous to be suitable. A technique for sealing porous soil is to layer the basin with clay, bentonite or a plastic liner.

6. Soil fertility and water quality can readily affect plant growth. Fertile agricultural soils are generally productive for wetland plants. Highly acidic water (below pH of 5.0) are considerably less productive.

C. Pond Uses

There are many uses for ponds, and, unfortunately, some uses are incompatible with each other. For example, a pond managed for fish production is generally too deep for waterfowl habitat. The main use you have in mind generally determines how large of a pond is needed and where you should build it. You should estimate your water requirements for each purpose and be sure that you provide a supply adequate for all the intended uses.

Fish

A pond for fish production generally requires a depth of seven to ten feet for one quarter of the area of the pond. Shallower ponds may freeze to the bottom during winter and may become too warm for fish in the summer. The water along the shoreline should be about three to four feet deep to inhibit the growth of shallow water plants. It should be possible to completely drain the pond or lower the level in one or two weeks. Aquatic plants may become a problem when they cover greater than 25 percent of the surface area. These plants can be manually removed or eliminated by lowering the water level of the pond.

Waterfowl

Waterfowl and other wildlife may be attracted to ponds which have an ample food supply and enough surrounding vegetation to provide some protection. Puddle ducks, such as mallards and black ducks, prefer

8. If the pond project has the potential to impact the habitat for rare, threatened, or endangered species of plants and animals, you should contact the Nongame and Natural Heritage Program. Contact: Steve Parran, VT Department of Fish & Wildlife, Waterbury, 241-3700.

9. A permit is required under Title 10 Chapter 47 •1263a for certain activities used to control aquatic vegetation and insects or other aquatic life including lamprey in waters of the State of Vermont. To determine if your proposed activity requires a permit, contact: VTDEC, 802-241-3777.

H. Safety

It is likely that your pond will be used for recreation regardless of the intended main use. Be sure to remove all trees, stumps, and brush from the pond area if it is likely to be used for swimming. Also remove all rubbish, wire, discarded machinery, and old fences. It is a good idea to place lifesaving equipment on the shore near the swimming area. If skating is likely, place a long plank or ladder nearby for rescue operations.

I. Additional Assistance

1. For assistance in determining whether an area is a wetland, contact the VT Wetlands Office at 802-241-3770.

2. For a list of Vermont and Out-of-State nurseries that carry native species of herbaceous plants, trees, and shrubs for wetland and pond plantings, wildlife habitat development, or landscaping shorelines, contact the VT Wetlands Office at 802-241-3770.

5. If dredged or fill material is placed in a wetland or waterbody or if a wetland will be impacted by the construction of the pond, a permit may be required from the US Army Corps of Engineers. Contact: Marty Abair Lefebvre, Essex Jct, 802-872-2893.

6. No instream pond may be constructed without the approval of the VT Department of Fish and Wildlife. The pond may warm stream water or block fish migration or have wildlife impacts (i.e., beaver or waterfowl, among others). Contact your District Fisheries or Wildlife Manager (see table below) to obtain approval or if you have questions about fisheries or wildlife.

District 1 - Springfield	**802-885-8855**
District 2 - Rutland	**802-786-5900**
District 3 - Barre (Wildlife) **- Roxbury (Fisheries)**	**802-479-2621** **802-485-7566**
District 4 - Essex Junction	**802-878-1564**
District 5 - St. Johnsbury	**802-751-0130**

7. For purposes of the lakes and ponds inventory and nuisance plant control, the Division of Water Quality requests notification for the construction of any pond greater than five acres. Contact: VTDEC, Waterbury, 802-241-3777.

shallow waters for feeding. Areas with water between 6 inches and three feet deep are needed to grow the aquatic plants that wild birds need. Aquatic plants should have a 50:50 ratio to open water for optimal waterfowl habitat. Specific plants, such as burreeds, wild rice, arrowhead and sago pondweed, are desirable for attracting certain species of wildlife. Make sure to match plants with your climate zone. Be careful also about fluctuating water levels that might dry out or flood the plants you've established. Be sure the p fine gravel or sand accessible to the birds.

Waterfowl require grit for their digestion. At least one island in the pond will provide a refuge for the waterfowl from predatory animals as well as providing additional food and cover. Nesting boxes create a safe habitat for breeding ducks, particularly for wood ducks. These shelters should be installed on tree trunks or on poles by the water's edge. A metal collar on the tree or pole below the nesting box will keep out predators, especially raccoons. Mowing of the grass on the dam and in the surrounding area should be delayed until August 1 since waterfowl may use the area to nest.

Muskrats may move into a pond containing their preferred foods like cattails, waterlily and iris, however they can damage a pond embankment by digging their homes. Beavers may cause problems by plugging outlets to raise the water levels. Pond owners who wish to accommodate beavers should install trash guards on outlets to prevent damming. To remove beavers, contact the local game warden for permission.

Sediment or Retention Ponds

Ponds can be constructed to provide flood storage or to remove sediments from the water. For either of these purposes, it is important to direct the stormwater on the site to the pond. Substantial regrading may be necessary if the existing site topography does not readily accomplish this goal. Ponds for either of these purposes should be maintained by regularly dredging the accumulated sediments and removing them to an upland location.

D. Water Control Structures

Structures can range from inexpensive earthen structures to more sophisticated concrete structures and spillways. Structural design should be based on at least a 25 year storm event. Careful planning can help prevent structure failure.

Dikes

Dikes are earthen dams that are best constructed from impervious mineral soils. Fill is usually applied in six to twelve inch layers and compacted. A clay core throughout the dike helps to prevent seepage. A large

Proposed Pond Size in Acres	Proposed Depth in Feet	Estimated Volume in Cubic Feet
1	11	479,160
2.5	4	435,600
3.5	3	457,380
5	2	435,600
11	1	479,160

3. The Vermont Wetland Rules regulates dredging, draining, filling, grading, removal of vegetation, the alteration of the flow of water into or out of a wetland and other similar activities within significant wetlands or their adjacent buffer zones. In order to obtain a Conditional Use Determination to conduct any of these activities, the applicant must show that the proposed activity will not adversely impact the functions of the wetland in question. Contact: VTDEC Wetlands Office, Waterbury, 802-241-3770.

4. If the project involves the placement of fill in a wetland or other discharge into a wetland or other waterbody, a Water Quality Certification may be required. Contact: VTDEC Wetlands Office, Waterbury, 802-241-3770.

With the disturbance of wetland soils and the revegetation of the area comes the possibility of the establishment and spread of nuisance species. Two wetland species are very aggressive and tend to choke out native vegetation. The two obnoxious nuisance species are purple loosestrife, *Lythrum salicaria*, and the common reed, *Phragmites australis*. Be on the alert for these two species during the five years following construction. If either of the two plants become evident, they should be hand-pulled and destroyed before spreading throughout the pond area.

G. Regulatory Considerations

1. If the pond will impound or be capable of impounding 500,000 cubic feet or more of water, a permit will be required from the VT Department of Environmental Conservation (VTDEC). Contact: Steve Bushman, Dam Safety Engineer, Waterbury, 802-241-3450.

2. If the project necessitates work in a stream that drains an area of ten square miles or more, a stream alteration permit may be required from VTDEC. Contact: Fred Nicholson, Rutland, 802-786-5906; Christopher Brunelle, Essex, 802-879-5631; or Patrick Ross, Barre, 802-476-2679.

dike width may help to control possible muskrat damage. Dikes should be seeded immediately after construction to prevent erosion.

Emergency Spillway

Any constructed pond which impounds runoff water or streamflow should provide an emergency spillway to pass heavy runoff waters beyond what the control structure would be capable of handling.

Concrete Structures

Concrete structures include such structures as roller gates, sliding gates, radial gates, and stoplog structures, all of which require the assistance of an engineer for design.

Tubes or Pipes

This includes high tube overflows, capped or gated tubes, and drop inlets, among others. It is advisable to place rip rap around the exit and entrance of the control pipe to prevent erosion.

E. Construction Guidelines

1. The banks of the pond should be no steeper than 3:1 slope; i.e., three feet horizontally to one foot vertically, to a depth of three feet in order to create stable banks. A steeper slope will erode. Gentler slopes, from 5:1 to a 10:1 slopes, are preferable if you want to attract waterfowl or grow wetland plants.

2. All areas stripped of vegetation, except the ponded area, should be seeded and mulched as soon as possible. Confine clearing limits to the immediate construction area to avoid unnecessary disturbance.

3. An erosion control plan compatible with the *Vermont Handbook for Soil Erosion and Sediment Control* should be established and followed until the area is established. The handbook is available from the Water Quality Division.

4. Accessibility is very important. If the area chosen for a pond is too wet, it would prohibit the use of heavy equipment.

5. The time of the year planned for construction and the type of equipment is also important. All earth work should be done during the driest portion of the year (i.e. between June 15th and September 15th).

Agency of Natural Resources

Policy on Constructing Ponds in a Wetland

The Agency of Natural Resources does not encourage the construction of ponds in a wetland unless it can be shown that the proposed project will truly enhance the wetland and help to increase wetland values. A brief management plan should also be considered. See Section G for regulatory considerations.

F. Maintenance and Potential Problems

Timely inspection and maintenance of your pond is just as important as good design and construction.

Maintenance

1. Inspect your pond carefully after every heavy rain event. Reseed areas and fill any rills or gullies immediately.
2. Burrowing animals, such as muskrats, can severely damage dams and earthen spillways.
3. Embankments should be inspected for seepage regularly. All methods for sealing ponds are expensive. Clays, chemicals, or flexible membranes are commonly used. Call your local office of the Natural Resources Conservation Service, listed on page 14, for more information.
4. Keep the spillways free of trash at all times. Use trash racks over the inlet of the pipe spillway to keep it from clogging with trash and debris.

Potential Problems

1. Predation of fish and other wildlife by larger birds and mammals.
2. Fish diseases.
3. Leeches.
4. Siltation caused by erosion upstream of the pond.
5. Algae blooms generally caused by excess nutrients reaching the pond.
6. Low dissolved oxygen (more common in very small, shallow ponds) caused by muddy water or by continued use of area by animals. Example: puddle ducks.
7. Swimmers' itch.
8. Liability for swimmers/winter activities.
9. Aquatic nuisance plants.