NEBRASKA GAME AND PARKS COMMISSION

NEBRASKA POND GUIDE

Private Waters Program
Management Assistance for Lakes, Ponds, Pits & Streams
SPORT FISH RESTORATION

RESOLVING COMMON MAINTENANCE PROBLEMS
WATER CLARITY

The clarity of a pond is primarily determined by the abundance of individual, free-floating microscopic plants (phytoplankton/algae) and animals (zooplankton), organic materials, and suspended soil particles. If water is enriched with phosphorous, nitrogen, or animal wastes, a large algal bloom can occur, turning the pond green. When this happens, the pond can look like pea soup or like it has paint floating on the surface. See **PG08-9** for vegetation control methods. If the pond was recently green in color, but quickly turned brown, the algae have died and are now decomposing. High populations of zooplankton or certain algae species can also give the water a brown color. A tannic acid buildup, resulting from the breakdown of accumulated organic materials from a marsh/wetland area or from tree leaves in the pond, can stain pond water the color of tea. When a pond contains non-transparent muddy water, it is the result of tiny particles of soil, especially clay soil, suspended in the water.

Muddy water detracts from a pond's appearance and it also has the following disadvantages:

- reduces food production, especially for small fish, by shading-out microscopic plant life on which the food chain is based
- reduces the total weight of fish the pond can support (carrying capacity)
- reduces the ability of sight-feeding fish, such as largemouth bass and bluegills, to capture prey
- can eliminate beneficial aquatic vegetation (both submergent and emergent) that provides important habitat for fish and other wildlife
- contains lower oxygen levels due to reduced photosynthesis
- subsequent sediment deposits can smother fish eggs and bottom-dwelling organisms.

Although most ponds will be muddy following major inflow events caused by heavy rains in the watershed, the suspended sediment in good ponds should settle out within a week. Water in new ponds may be muddy until pond banks become vegetated; therefore, it is very important to establish and maintain vegetative cover around the pond as soon as construction is completed. See **PG08-2** for additional information on establishing aquatic and terrestrial vegetation along with ensuing benefits.

To correct a muddy water problem, the cause has to first be determined. Take a sample of pond water in a clear glass jar and set it on a shelf. If after one week the water is fairly clear and the mud has settled out, the main cause of the problem is likely due to either soil erosion, wave action in shallow water, livestock, or overpopulation of carp, bullheads, and occasionally channel catfish. However, if the mud remains suspended, the problem is likely soil chemistry. Often the problem is a combination of several factors. In some cases, the soil particles will stay suspended indefinitely.

MUDDINESS DUE TO SOIL EROSION

The best way to keep pond water clear is to prevent or reduce the amount of soil entering the

pond from the watershed. This can be done by:

- grading and terracing the land above the pond
- installing sediment retention basins or soil traps at the pond inlet
- routing muddy water around the pond through diversion ditches
- establishing buffer strips around the pond and in waterways leading into it.

It is much easier to limit soil erosion and prevent excessive surface runoff than it is to remove sediment once it has entered the pond.

Reporting Excessive Runoff Problems

If a landowner is experiencing excessive sediment runoff from a neighbor's property that may be in violation of Nebraska's Erosion and Sediment Control Act, the local NRD or NRCS offices should be contacted. If the excessive sediment runoff and/or suspected associated pesticides cause further environmental damages, such as crop loss or a fish kill, the U.S. Department of Agriculture's Plant Industry Section should be contacted within 24 to 48 hours at (402) 471-2394. The Nebraska Department of Environmental Quality's Agricultural Section should be contacted at (402) 471-4239 when problems arise from excessive runoff containing livestock waste.

MUDDINESS DUE TO WIND AND ANIMAL ACTIVITY

If wind is causing shoreline erosion and waves are stirring up bottom sediments in shallow-water areas, windbreaks should be planted to block prevailing summer winds and protect shorelines. Establish emergent aquatic vegetation (such as bulrushes, sedges, and cattails) and water-tolerant grasses (such as prairie cordgrass and/or switchgrass) along the shoreline and in shallow-water areas, or by the dam if erosion is occurring there. If erosion isn't severe, these plants will facilitate healing of the shoreline and, in time, eliminate erosion. See **PG08-2** for details.

Rock rip-rap may have to be used along the dam if erosion is severe. Football-sized rocks or pieces of broken concrete can be placed along the dam, or other eroding shorelines, several feet above and below the waterline. A steep, eroded bank may first have to be graded and engineering cloth laid to create a stable base for the rip-rap; otherwise, erosion could persist and possibly cause rip-rap to collapse into the pond.

Logs, rocks, or trees placed several feet out in the water and parallel to the shore will absorb the energy of waves and prevent shoreline erosion, or facilitate healing of eroded areas. Emergent plants and willows should be used to expedite healing. During early spring, rootstock from emergent plants can be dug up, cut or pulled apart into sections (two nodes/new shoots per section) and planted in combination with 18-inch long willow sections between the shoreline and wave-absorbing materials.

Some of the shallow-water problems, including those on mudflats, can be resolved or avoided by deepening these areas, preferably during construction. Cover crops (such as millet, oats, or sorghum) can be planted in shallow areas or on excavated banks following construction or a drawdown to hold the soil in place during the filling process.

Turbid or muddy water in ponds is often the result of cattle activity in the pond or feeder stream. Cattle trample shoreline areas, causing the banks to erode. They also wade in shallow water, which destroys fish spawning and nursery areas and stirs up the mud. The pond should be fenced and auxiliary watering techniques utilized. See **PG08-1** for details.

When carp or bullheads are overpopulated, their feeding activity stirs up the bottom sediments. Eliminating the carp or bullheads and restocking with appropriate species will alleviate the problem. See **PG08-5** for information regarding removal or control of unwanted fish species.

MUDDINESS DUE TO SOIL TYPE

Water that stays muddy is likely due to the type of soil in the watershed. This is the most difficult problem to resolve. Clay particles in suspension actually repel each other, rather than clumping together and settling out. Surface application of certain chemicals or organic matter causes a chemical reaction that makes the clay particles clump together and settle out. These treatments typically only provide temporary relief. The pond will likely become turbid again when the next major storm runoff event occurs. The sources of sediment should be eliminated through proper land management practices.

Ponds with chronic clay turbidity problems shouldn't be treated. Instead, they should just be stocked with channel catfish and minnows and provided with artificial feed, since turbid ponds produce limited natural food. See **PG08-3** for further stocking and management information.

Chemical Treatments:

Alum *(hydrated aluminum sulfate)*

Alum is the most effective treatment to remove colloidal clay. If the water doesn't clear within a day after an initial application of 25 pounds per acre-foot of water, a second 25-pound application should be made. Alum causes the clay to flocculate and settle out. It also produces an acidic reaction. Alum should be dissolved in water and then applied on a calm day. Windy conditions cause mixing that prevents formation of floc and settling out. Alum should be sprayed over the pond surface from boat or shore. On large ponds, a dissolved solution can be sprayed or poured into the prop wash of an outboard motor. If the pond is acidic (pH below 7.0) or has soft water, a similar application of hydrated lime (calcium hydroxide) should be applied first to protect fish from alum's acidic reaction. Occasionally, the liming process alone causes the clay particles to settle out.

Agricultural Grade Gypsum
(hydrated calcium sulfate)

Gypsum is also used to remove colloidal clay and is available at many fertilizer dealers; however, it is less effective than alum or hydrated lime. It can be applied at rates of 100 to 525 pounds per acre-foot of water. It can be applied in 100-pound increments, waiting a few days between applications, until the desired visibility is achieved. Gypsum should be applied by the same techniques described for alum. It has a neutral reaction in water and doesn't require a lime treatment. It also doesn't affect the use of treated water for livestock or aquatic plant and animal life in the pond. Finely ground **agricultural limestone** can be used as a substitute for gypsum and applied at a rate up to 500 pounds per surface acre. It can be applied using similar techniques as gypsum and it has a similar reaction and low environmental risks. Scrap sheet rock containing gypsum can be broken up into small chunks and also used.

Organic Matter Treatments:

Hay Bales

Muddy water caused by suspended clay particles can sometimes be corrected by spreading broken bales of high-quality alfalfa, clover, or prairie hay along the shallow, near-shore areas. About 100 pounds of hay (two small bales) should be applied per surface acre of water at 14-day intervals. As bacteria break down the hay, the resulting by-products form a weak acid, causing clay particles to clump together and settle out. Since decomposition uses up oxygen, this method shouldn't be used during the summer when water temperatures are high and dissolved oxygen levels are low or widely fluctuating. Dry hay bales should be used to facilitate a slower rate of decomposition. Monitor clarity changes. No more than 5 applications should be made during a year. This treatment is preferred over the use of alum or

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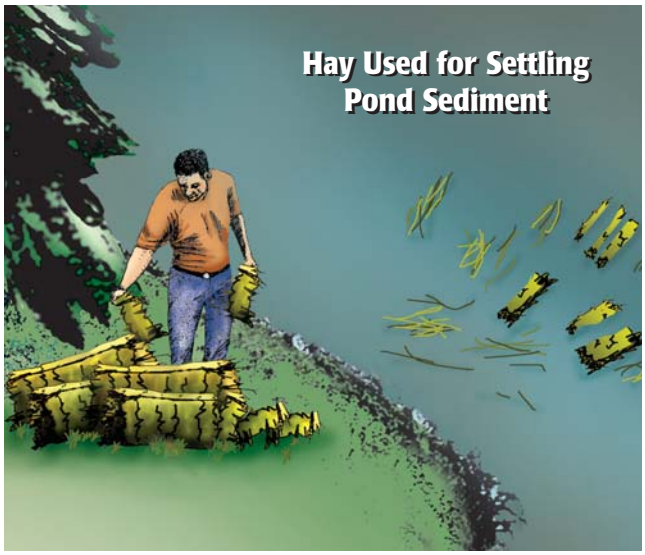

gypsum since it can increase a pond's productivity instead of decreasing it. Hay bales shouldn't be used in ponds with a history of fish kills resulting from low oxygen levels unless an aeration system is present. Dry manure or weeds can also be used by utilizing similar application techniques and concerns as with hay.

Contacts: Jeff Blaser, Private Waters Specialist
Nebraska Game and Parks Commission
2200 North 33rd Street
Lincoln, NE 68503
402-471-5435
or area Commission fisheries biologist.

Surface area/volume calculations and diagrams are on the following pages.

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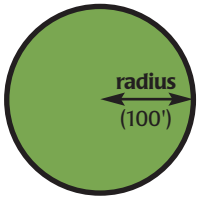
CALCULATING THE SURFACE AREA AND VOLUME OF A POND

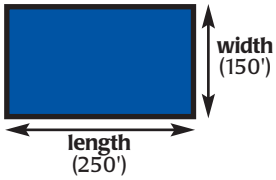
Presented below are formulas for calculating the **surface area** of a pond. Pick a shape that most closely resembles the pond and measure the necessary distances in feet. Put these measurements into the appropriate equation and multiply to find the surface area in square feet. Surface area in acres is simply obtained by dividing the surface area by the number of square feet in an acre (43,560). If a pond is irregular in shape, the best thing to do is divide it into workable shapes and then add the areas of the smaller units together to get the area of the whole.

CIRCLE = 3.14 x radius^2



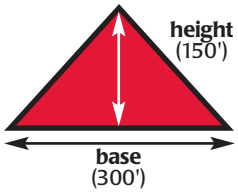
EXAMPLE: pond radius 100 feet x 100 feet x 3.14 = 31,400 square feet total surface area ÷ 43,560 = .72 surface acre

RECTANGLE = length x width



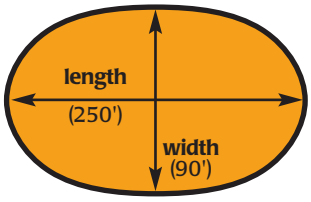
EXAMPLE: pond length 250 feet x width 150 feet = 37,500 square feet total surface area ÷ 43,560 = .86 surface acre

TRIANGLE = $\frac{\text{base x height}}{2}$



EXAMPLE: pond base 300 feet x height 150 feet = 45,000 square feet ÷ 2 = 22,500 total surface area ÷ 43,560 = .52 surface acre

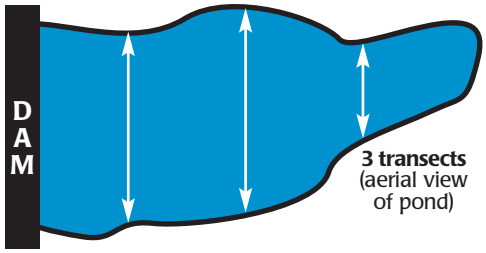
ELLIPSE = length x width x 0.8



EXAMPLE: pond length 250 feet x pond width 90 x 0.8 = 18,000 square feet total surface area ÷ 43,560 = .41 surface acre

The formula for calculating a pond's **volume** is surface area (acres) x average depth (feet). Average pond depth can be estimated by measuring the depth of the water in a number of places throughout the pond, adding these measures together to get a total, and then dividing the total by the number of measurements. Several transects should be established across the pond (from one side straight across to the other side). Depth measurements should be taken/recorded every 40 feet with an electronic depth finder or a weight attached to a string marked in feet.

VOLUME (acre-feet) = surface area (acres) x average depth (feet)



EXAMPLE: forty measurements were taken while conducting three transects across the surface of a .75 acre pond; average depth calculated to be 4 feet; therefore, .75 x 4 = 3 acre-feet

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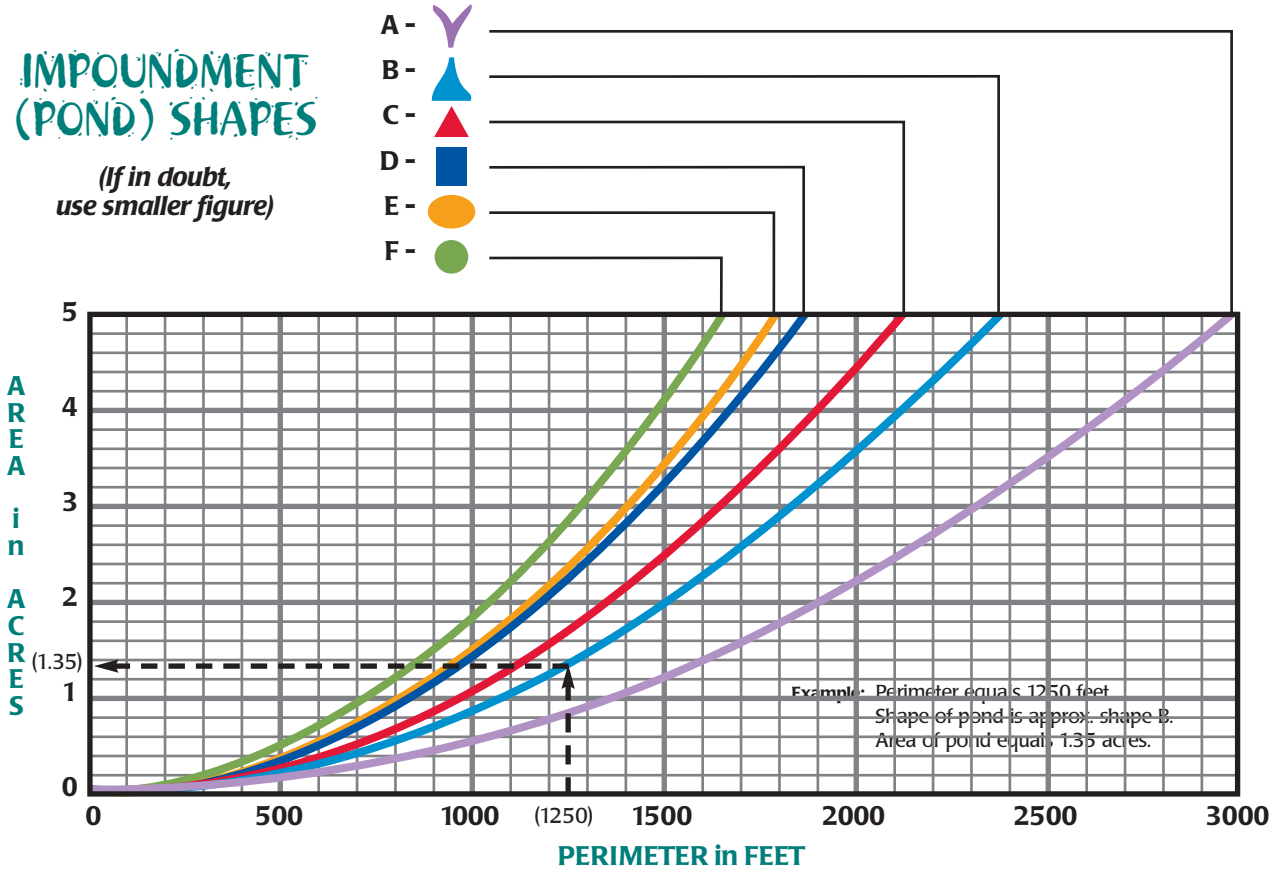
POND AREA ESTIMATOR

If the distance around the entire pond can be measured, this pond estimator can be used.



TECHNICAL ASSISTANCE CONTACTS

Nebraska Game and Parks Commission (Commission)
2200 N 33rd Street PO Box 30370
Lincoln, NE 68503
Private Waters Specialist 402-471-5435
Natural Heritage Program 402-471-5419

Northwest (NW) District - Alliance
Game and Parks Commission
299 Husker Road PO Box 725
Alliance, NE 69301
308-763-2940
Fisheries Division or
Wildlife Habitat Partners Section

Northwest (NW) Field Office - Valentine
Valentine State Fish Hatchery
HC 13 Box 15B
Valentine, NE 69201
402-376-8080 or 402-376-2244

Southwest (SW) District - North Platte
Game and Parks Commission
301 East State Farm Road
North Platte, NE 69101
308-535-8025
Fisheries Division or
Wildlife Habitat Partners Section

Northeast (NE) Field Office - Bassett
Game and Parks Commission
524 Panzer Street PO Box 508
Bassett, NE 68714
402-684-2921
Fisheries Division or
Wildlife Habitat Partners Section

Northeast (NE) District - Norfolk
Game and Parks Commission
2201 N 13th Street
Norfolk, NE 68701
402-370-3374
Fisheries Division or
Wildlife Habitat Partners Section

South-central (SC) District - Kearney
Game and Parks Commission
1617 First Avenue
Kearney, NE 68847
308-865-5310
Fisheries Division or
Wildlife Habitat Partners Section

Southeast (SE) District - Lincoln
Game and Parks Commission
2200 N 33rd Street PO Box 30370
Lincoln, NE 68503
402-471-7651 or 402-471-5561
Fisheries Division or
Wildlife Habitat Partners Section

United States Department of Agriculture - Natural Resources Conservation Service (NRCS)

Federal Building, Room 152
100 Centennial Mall North
Lincoln, NE 68508
Statewide Wildlife Biologist
402-437-4100
or contact Local County Office

University of Nebraska - Lincoln, Cooperative Extension

211 Agricultural Hall - UNL East Campus
Lincoln, NE 68583
Main Office 402-472-2966
or contact Local County Office;
Water Quality Questions 402-472-7783

Nebraska Department of Natural Resources (DNR)

301 Centennial Mall South, PO Box 94676
Lincoln, NE 68509
Water Storage Permits 402-471-2363 or
Dam Safety Guidelines 402-471-1222

U.S. Army Corps of Engineers (ACOE)

8901 S. 154th Street, Suite 1
Omaha, NE 68138 402-896-0723
or contact the Kearney office at:
1430 Central Avenue
Kearney, NE 68847
308-234-1403

Nebraska Department of Environmental Quality (NDEQ)

1200 N Street, PO Box 98922
The Atrium, Suite 400
Lincoln, NE 68509
402-471-0096

Nebraska Association of Resources Districts (NARD)

601 S. 12th Street, Suite 201
Lincoln, NE 68508
402-471-7670
or contact your local Natural Resources District (NRD)
listed in White Pages of the phone book