WATER GARDENS

Jeff Pilla, Jessica Dodd, Kurt Schrader and Kevin Barry

Waterscapes continue to grow in popularity across the country. Gardeners are discovering that a garden is not complete without some type of water feature designed within the landscape. It is natural to incorporate a water feature in the garden since water is one of the basic elements to sustain life in nature. Water brings the landscape to life through sound and movement. Waterscape's helps create tranquility in a landscape and provides a calming effect to those it surrounds. Water within a landscape will also attract wildlife and quickly become a bird lover's sanctuary. The use of water in a landscape can be as basic as a freestanding fountain or it can be an elaborate waterfall. Once the decision has been made to incorporate water into the landscape, consideration must be given to design, construction, ecosystem balance and maintenance of the waterscape.

Free Standing Fountains

A free-standing water feature can be a simple bird bath or and elegant fountain. Proper placement of all free-standing water structures is necessary to reduce instability. Always provide a solid level foundation, and never place them directly on grass, soil or an uneven surface.

Cast stone or concrete is widely used with birdbaths and fountains. Pieces that have been painted with penetrating sealers are designed to resist the elements; however their luster will weather with time. Little or nothing needs to be done to protect the stained or natural finishes of cast stone statuary. The stain finishes are intended to create the illusion that the cast stone has already begun its natural aging process. Each piece will age at a different rate. Chemical sealers should not be used to inhibit this process. It's the natural aging process that gives cast stone its unique appearance.

The aging process is a chemical reaction between salts found in natural earth materials and water. This reaction is called efflorescence. The degree of efflorescence varies with weather conditions. Depending upon temperature, moisture and wind, the calcium carbonate contained in the natural earth materials, is drawn to the surface as a chalky white residue. This residue eventually washes away as more of the same weather conditions complete the efflorescence cycle. The efflorescence process occurs only once. Fountains that are granite or marble do not experience efflorescence.

Iron oxidization is another natural occurrence affecting pieces that hold water or are continually wet, like birdbaths and fountains. Minimal levels of iron exist in granite, marble or cast stone fountains. When the iron reacts with water, a powdery pink or orange residue can appear. Lime can also build up over time depending upon the levels of minerals in the local water source. To minimize the look of these natural processes, frequent rinsing will help, along with scrubbing the affected areas with a soft brush. If lime becomes unsightly, use a product called Lime Away to clean the unsightly surface. Be sure to follow all directions on the label because Lime Away can damage plant material.

All water features that hold water, snow or ice, or those that rest on the ground, can be damaged by winter freeze-thaw cycles. Fountains require winter care to protect them during those cycles. In order to minimize possible winter damage to any water feature, special protection must be provided as described below:

1. Store the fountain in a garage or shed to provide winter protection. If this is not possible, raise the bases off the ground to avoid any damage that may result if the product freezes to the surface. Fountains should never be allowed to sit in water or ice during the winter.

2. All above-ground water features should be covered with a waterproof cover that fits securely. Before covering the fountain, drain the bowls and remove any drain plugs. The concrete should be completely dry. Burlap or towels should be rolled up and put into the bowls or any other parts that might collect water or condensation.

Ponds, Waterfalls and Floating Islands

When determining the location of a water feature, begin by checking with the DNR and city ordinances. Many cities, counties or developments have regulations concerning any type of water feature.

It is important to consider the view of the feature from both outdoors as well as indoors. The feature losses its value quickly if one needs to search for the feature. Most ponds and fountains are readily used and identifiable, however, floating islands are a more recent pond improvement technology that adds to the popularity of water gardens.

A floating island is a living, floating garden on which a large variety of plants and wildlife can be supported. A nicely planted island can enhance the appearance of a backyard pond or an unattractive storm water retention pond. Although not a high maintenance garden, some attention and maintenance ensures that a floating island will thrive. Growth on the island depends on some of the same factors affecting a terrestrial garden, including the vigor of seedlings, weather, and selection of appropriate species for local conditions. Floating islands have demonstrated excellent growth of grasses, flowers, shrubs, small trees, vegetables and herbs.

Floating islands can reduce the concentration of nutrients in pond water. This limits algae growth, leaving the water cleaner and better oxygenated. Cleaner water contributes to a more stable ecosystem and promotes diverse, healthier plant populations. Thus, the vegetation present on the island can help maintain the stability normally present in natural systems.

Wetland wildlife species which benefit from floating islands include frogs, turtles, and aquatic and terrestrial birds. Aquatic invertebrates live among the plant roots, which provide food for fish. Proper planting, positioning and management of an island can influence the mix of wildlife in the pond and on the island. Placing the island off-shore with a mix of grasses and wetland plants will provide nesting habitat for ducks or other water fowl. Vegetating the island with plants that produce large root masses will provide abundant food and excellent hiding places for fish.

Design

When designing a pond or waterfall, an attempt should be made to create a natural landscape. It is best to follow the contour of the landscape with the waterfall terminating at the low point of the design. However, it is important to avoid fertilizer or herbicide runoff from other parts of the landscape. Fertilizer reduces the water clarity and both herbicides and fertilizers are detrimental to aquatic plants and wildlife. Unnecessary soil runoff will also lower the desired depth of the pond.

Sunlight, wind and surrounding trees are also critical considerations for the design of the water feature. Most aquatic plants prefer full sun; therefore the majority of the water surface should receive a minimum of six hours of light per day. Be mindful of windy areas as wind increases water evaporation and can also damage taller marginal plants, which both contribute to maintenance problems. Trees play a large role in the location of water features as fallen leaves and twigs frequently plug filters and pumps. In addition, as leaves decay in water, methane gas is released, which is toxic to fish.

Construction

Ponds and waterfalls can vary in materials and construction requirements. The extent of the construction will depend on the size, budget and location of the feature, as well as on limitations on materials chosen. The size and the shape of the feature are dictated by personal styles and maintenance requirements. Smaller features are relatively easy to maintain and keep clean; however, they do not provide a home for wildlife. Larger features require regular maintenance, but do provide an environment for plants and wildlife. If a large feature is desired, a minimum of 50 square feet of water surface should be established. Portions of the pond should have a minimum depth of 18 inches. This will provide a healthy space for the feature to establish a balanced ecosystem for aquatic life. Plants and fish do not thrive in hot water.

Materials used to construct a pond vary from rigid liners to concrete to flexible EPDM liners. Consumers commonly use rigid preformed pools to construct basic water features. These pools are relatively cost effective and easy to handle. Preformed pools require more precise excavation to provide a solid base to hold the structure. It is important that the base be level, free of sharp objects and no major gaps in the base that may promote collapsing of the pool. It is, however, difficult to establish a high-quality filtration system with the use of preformed pools.

Concrete features are permanent and require a higher level of expertise to construct. Constructing a firm foundation for both the bottom and walls is critical to prevent settling and cracking. Constructing a concrete feature allows for the feature to be completely submerged, partially submerged or completely raised above grade. Some designers believe it is easier to create a more naturalistic fountain with the use of concrete.

Flexible liners are quite versatile and will line any shape or contour excavated. High quality liners are desired and are typically made from EPDM or butyl materials. These liners are very flexible even in cold weather. A liner that is a minimum of 45 mil thick is recommended. Both EPDM and butyl liners have a high Ultra-Violet (UV) light resistance and generally have a warranty when sold. Liners can also be used to construct the most basic water feature, such as half barrels or clay containers. The use of an underlay is suggested to help prevent puncturing the liner. The most common underlay is polyester matting, felt or old synthetic carpet. Although flexible liners have a UV resistance, excessive exposure to sunlight does reduce the life expectancy of the liner. Any water feature should be filled to its proper water level at all times. Cover the edges with stone, sand or plant material to reduce the exposure to the sun.

Rocks and gravel are also helpful in establishing a balanced ecosystem. The rocks and gravel help create a natural-looking setting, but also provide a home for beneficial bacteria. Bacteria that live on the rocks and gravel in the pond feed on excess nutrients in the water, thus reducing the algae by starvation. The bacteria living on the rocks and gravel at the bottom of the pond also break down the waste and debris and convert it to nitrates for plant growth.

For best results in creating a natural habitat, a filtration system is recommended. Complete filtration systems can be purchased, which include a pump, tubing, mechanical skimmer, mechanical filters and biological filters. Good filtration systems circulate the water from the bottom of a pond through a skimmer to the top of a water fall, forcing the water through both biological and mechanical filters. With proper filtration, leaves, mosquito larvae, and floating algae are filtered from the pond, plus the pumping of the water generates oxygen with in the water.

When selecting a pump for water gardens, determine the demands required of the pump. As a general rule, pumps should be large enough to circulate the entire volume of water once per hour. Do not exceed ten times per hour if fish are present in the pond, as this does not allow bacteria sufficient time to break down ammonia and ammonium, thereby creating excessive levels within the pond. Pumps may be restricted on the output side of the pump, but should never be restricted on the intake side of the pump. Pumps require electricity, therefore, electrical service should be located near the pond. Contact a licensed electrician to ensure that a GFI outlet is used.

Ecosystem Balance

When envisioning a water feature, crystal clear water, healthy plants and fish are usually the desired vision. In order to achieve this, a pond or fountain must have a balanced ecosystem. There are two philosophies to creating a balanced ecosystem. The first is synthetic and the second naturalistic.

Synthetic – The synthetic approach utilizes ultra-violet or UV sterilizers and continuous chemical treatments. Although effective, UV sterilizers kill a variety of microorganisms, which are beneficial to the ecosystem. The use of chemical treatments in ponds frequently creates a dependency on chemicals to maintain water clarity. Chemicals are only recommended to seed the pond with microorganisms in the spring, balance the water pH, or treat the fish**.**

Naturalistic – The key players in a naturalistic approach are water, plants, oxygen, minerals, sunlight and wildlife. The proper balance of all these factors is important to maintain a healthy water feature. Water is the main element in the feature, but in order for that element to function as a healthy medium for plants and wildlife, a balance must be created between oxygen, sunlight, plants, and fish.

Floating Island International's definition of a healthy pond is as follows: "The water is clear. Sensitive animal species like newts, salamanders and frogs thrive. Fish grow big on a diverse population of aquatic invertebrates. Vigorous native plant communities work synergistically with microbes to keep the pond's "Circulatory System" in good order". Excess nutrients in pond water can be a leading cause of pond degradation. Nutrients such as nitrogen and phosphorus or their related compounds come from various sources including runoff water carrying traces of fertilizers and animal waste. With excess nutrients in the water, plants and other organisms including algae grow unsustainably. Excess plant and algae growth keep sunlight from penetrating the water, causing sub-surface plants and other organisms to die. Bacteria and fungi then decompose the dead organisms, further depleting the available oxygen supply in the process. This depletion of oxygen resulting in turbid and scummy water is called Eutrophication.

Oxygen concentrations are important not only for wildlife, but for plants as well. The easiest way to inoculate the water with oxygen is to have moving water. Moving water can be achieved by a fountain within the feature itself, a waterfall, or by a stand-alone aquatic sculpture or other piece of art. All

require a pump for re-circulation purposes which also increases oxygen levels in the water.

Sunlight is another factor that plays a role in water quality. Full sunlight helps aquatic plant growth. A diverse selection of plant material will also help keep water quality in check. Plants that shade the water provide shade for fish, but more importantly they shade the water surface. Shading the water surface is critical to reducing algae growth as algae also require sunlight for photosynthesis and to multiply. The general rule is to have at least 50 percent of the water surface covered by either free-floating plants or plants with surface floating foliage such as water lilies or lotus. Submerged plants, which are plants with foliage completely submerged under the water surface, also compete with algae for nutrients. They also release oxygen from the leaves and stems. Marginals and bog plants are plants that hold their foliage above the water surface, but are planted in moist boggy soils at the edge of the pond. They provide shade and shelter not only for fish, but also for wildlife that also dwell in a pond.

Fish are also an important element in the ecosystem of a pond. They are part of the serenity and balance that makes water gardening so enjoyable. Fish in the pond help control algae, eat mosquito larva and a host of other aquatic creatures that inhabit a backyard water feature. They also reduce the need for chemicals in the pond and improve water quality throughout the summer season.

There is no minimum number of fish that can be stocked in a garden pond, but there is a maximum number that any system can handle. The ideal ratio of fish to water is two inches of fish for every one square foot of water surface. Do not calculate every square inch of water surface to maximize the number of fish that can be placed in a pond. Base the calculation on the open water surface and not the marginal areas around the pond.

A pond should be set up and running in the spring before fish are added to the system. Let the pond water stand for forty-eight hours after it is filled before adding any fish. This waiting period allows any chemicals that may be in the water to dissipate, and it starts the process of warming the water to an acceptable temperature for the fish. Prior to introducing fish to the pond, the water should be tested to determine levels of nitrite, nitrate, and the pH levels. It is important to slowly introduce fish into a pond. Fish are usually transported in a plastic bag. It is important to have the bag filled half with water and half with air. This allows oxygen transfer to take place during transportation. The bag should be floated for about thirty to forty minutes, allowing the water temperature of the pond and the water in the bag to equilibrate. After the floating period, open the bag and add about two to three cups of pond water. Wait for a few minutes before allowing the fish to swim into the new pond. The fish will slowly find their way out of the bag and into their new home.

All ponds contain some type of algae as algae are one of the most basic forms of life. Most ponds undergo an algae cycle every year. Without competition from plants and bacteria, algae take full advantage of the sun and of available nutrients in the pond. Algae photosynthesizes the same as any other living plant, therefore, by reducing the amount of sunlight on the water surface, the algae bloom will be dramatically reduced. In colder climates, both the plants and bacteria will go dormant due to a lack of oxygen in cold water, creating advantageous conditions for algae growth. Do not be discouraged if the pond turns to pea soup or is full of string algae during the winter. When the warmer temperatures return and stabilize, and the plants and bacteria establish themselves once again, the ecosystem will become balanced and the algae growth will decrease. Some ponds do take longer than others to achieve this balance.

Below is an illustration of the Nitrogen Cycle in a pond:

Fish Food + Fish = **Solid/Liquid Waste**
↓↓
Hydrolytic↓↓ Activities
↓↓
Ammonia (NH_3^+) / Ammonium (NH_4^+)
↓↓
Oxidation by ↓↓ Nitrosomonas Bacteria
↓↓
Nitrites (NO_2)
↓↓
Oxidation by ↓↓ Nitrobacter Bacteria
↓↓
Nitrates (NO_3)
↓↓
Plant Protein

Another factor often overlooked is the pH level in the water. The pH is the degree of acidity or alkalinity in a solution, in this case, the pond water. A balanced pH in a pond helps maintain disease free fish, vigorous plant growth, and the proper pH is critical to the natural biological filter of a balanced ecosystem.

To obtain a balanced ecosystem, the ratio of water surface to fish to plant life is described below. Aerating the pond will increase this ratio. In general, every ten square feet of water surface will support the following bio-activity:

One water lily, plus

Two bog plants, plus

Two floating plants, plus

Two oxygenating plants, plus

Ten inches of fish length.

Pond Maintenance

Water quality and a healthy balanced ecosystem are very dependent on the factors listed above, but also a weekly or semi-weekly and a seasonal maintenance is required. Skimming the water surface for leaf debris, cleaning pumps or filters and patching holes or leaks in equipment, are requirements that keep a water feature and its ecosystem functioning properly. Cleaning a water feature on a regular basis is necessary, but it is not recommended to fully drain a pond on a regular basis. Well-established ponds only need to be drained completely every two years. Regular cleaning of surface debris will help reduce the build up of bottom sludge which decreases the need to drain the pond often.

Biological filters create a large surface area for microorganisms. The microorganisms break down the waste products produced in the pond. Ponds that are lacking in biological filtration will quickly build a large population of algae, turn green and lose water clarity. A new biological filter will be more effective if it is given a start up dose of these microorganisms. Consideration to replace biological filters should only be made if fish develop fatal diseases.

Mechanical filters and skimmers should be cleaned on a regular basis. The frequency will depend on the amount of debris, leaves and twigs, which fall into the pond along with the amount of algae that blooms. To clean the mechanical filters simply rinse them with water. Replace these filters after two years of use.

Pumps should also be cleaned regularly to maintain water flow. Cleaning also extends the life of the pump. To remove calcium deposits and lime, soak the pump in a solution consisting of two cups of vinegar in a gallon of water. After soaking for five minutes, plug in the pump and let it run in the solution for 30 minutes.

Water levels should be checked daily to assure efficient pump operation and filtration. Adding large amounts of fresh water at once often leads to a new algae bloom as the pond strives to rebalance itself. Pumps can be damaged if they are left running without being submersed in water. Even when the pump is not in use, keep it submersed in water. If the pond is left to freeze in the winter, remove the pump and store it indoors under water. A pump should never be allowed to freeze.

During the summer months, water levels will decrease and should be regularly re-filled. Increases in air temperature will cause higher rates of evaporation, as will high winds. Fountains and other water feature movement will also increase evaporation. The high temperatures during the summer months will also increase algae levels and free-floating plants will multiply quite rapidly. Thinning out the free-floaters will prevent overcrowding.

Skimming free-floating algae out of the pond is also a good practice. Barley mats have also been proven to reduce the algae in a pond. When barley comes in contact with water, barley begins to decompose. One of the by-products released into ponds from this decomposition is a series of natural peroxides, which break down the cell walls of algae. Peroxides reduce the capability of algae to form new cell growth. The peroxides work as a slow-release product thereby reducing the possibility of an over application.

For predators such as cats, raccoons and birds, a plastic net may be needed to cover the pond for a few weeks once fish are introduced to the pond. Once the new fish have found hiding places, and if the pond is deep enough, the netting can be removed. Fish should only be fed when the water temperature reaches 55°F; fish digestive systems are less active below 55°F, therefore, over feeding could be a problem. Once a day feedings are recommended with captive fish. The fish should only be fed what they can eat within five minutes. Overfeeding fish will increase the nutrients in the water that algae feed on and it will also cause ammonia levels to increase in the water, which is detrimental to the fish.

Ammonium, pH, nitrate and nitrite levels in the pond should be checked frequently to ensure a healthy environment for aquatic life. Test kits and chemicals are available to correct pH, nitrate and nitrite levels.

Winter Care
Stop feeding fish by mid-September. All water features that do not have a natural soil bottom need to be partially drained and cleaned each season either in the fall or spring. Remove all sludge from the bottom of the pond. Scrub the sides of the pond with a soft brush. Once the water temperature reaches 50°F, tropical fish should be moved indoors to an aquarium. Hardy fish can stay in the pond as long as it does not freeze solid. The use of a water pump and a stock tank heater can keep the pond open in the winter. If fish remain in the pond during the winter it is recommended to also provide them with a tank heater and additional water as necessary.

Whether or not the pond should be left filled with water will depend on the type of pond structure. Concrete ponds should be drained, dried and tarped to keep water from accumulating. All remaining ponds should be left to freeze. Floating a large block of styrofoam in the water will keep the ice from pushing at the sides. If the pond is left empty, the expansion of the ground beneath the liner can cause it to lift as the ground freezes. Rodents have also been known to chew holes in liners during winter months if left empty.

Water Plants
A pond without plants is not complete and the ecosystem is incomplete without plants. Growing plants in ponds and bogs is enjoyable once a few basic concepts are understood.

Most water plants thrive in direct sunlight and require a minimum of six hours of light per day. Like many other plants, water plants have the ability to adapt and survive under less than ideal conditions, but they will not be as lush or full and they will not bloom as well. Plants that are suitable for water and bog gardens are grouped according to the depth of water in which they thrive. These groups of aquatic plants include the following five groups, which are described below:

1. Free floating.
2. Submerged.
3. Marginal or Shallow.
4. Bog.
5. Deep-water plants.

Floaters
There are several plants that simply float around the surface and do not need soil. The easiest floaters to grow are water hyacinths and water lettuce. Floaters usually multiply rapidly and require thinning throughout the summer to ensure they do not cover the entire surface of the pond. They require dividing every 12 to 14 days. Floaters are also great at filtering water and providing shade for fish. Examples of floating plants are described below.

Azolla caroliniana (Fairy Moss) – A delicate filigreed floating fern; never fertilize; grows in shade; turns purple with cool weather; provides a dense cover, thereby, inhibiting mosquito larvae development.

Salvinia minima (Caterpillar Plant or Water Velvet) – A floating fern one inch long, very effective in controlling algae by covering the water surface, which reduces surface light. This fern must be thinned often.

Salvinia rotundifolia (Caterpillar Plant or Water Velvet) – A larger form of a floating fern, which requires state approval; spores drop in fall and resurface the next spring; Zone 9, but is eurythermal.

Lemna minor (Duckweed) – This is one of the smallest flowering plants and it is native to Minnesota; it must be thinned often.

Eichornia crasspipes (Water Hyacinth) – This is the preeminent tropical pond plant; lavender flowers in May with waxy bulbed leaves; excellent water clarifier; requires water temperature above 65°F.

Pistia stratoides (Water Lettuce) – Floating rosettes of light green pubescent leaves; needs some shade and tolerates moving water; will double in size every 12 days in a proper environment; requires water temperature above 65°F.

Submerged Plants
Submerged plants are frequently referred to as oxygenators, but they actually use as much oxygen as they produce. Their real value is that they filter out excess nutrients in the water that could cause algae problems. Submerged plants will also provide a place for the fish to spawn and for young fish to hide. Examples of submerged plants are described below.

Elodea canadensis, Egeria densa (Anachris) – Handle gently; plant in a container anchored to the pond floor; grows vigorously, even though fish eat this plant.

Ceratophyllum demersum (Hornwort) – Shade tolerant; avoid moving water; Zone 5; place weighted wire at the bottom of the stem and completely submerge in the water, however this plant can also float.

Vallisneria spiralis (Ribbon Grass) – Good in moving water; submerge container six inches to 24 inches below the water surface; Zone 4, but should not freeze in water.

Marginals

Marginal plants mean plants that grow on the pond edges, both in and out of the water. Marginals prefer wet roots and dry foliage. They provide some of the best upright accents with striking foliage and bloomers. Examples of marginal plants are described below.

Sagittaria montevidensis (Arrowhead, Aztec) – Two to three feet tall; blooms July to October; plant in soil one to three inches below the water surface; showy foliage, but brittle stems.

Sagittaria latifolia (Arrowhead, white flowered Wapatoo) – Native to Minnesota; prominent arrow leaves, one to two feet tall; plant in the soil zero to three inches below the water surface; Zone 3.

Sagittaria graminea (Arrowhead Narrow Leaf) – Native to Minnesota; narrower leaves, grows nine to 12 inches tall, plant in the soil zero to three inches below the water surface.

Zantedeschia aethiopica,'Crowborough' (Bog Arum) – Forms dense clumps and confines itself; one to one and one-half feet tall; glossy arrow like leaves; white calla-like flowers in summer followed by seedpods, which can provide food for waterfowl; prefers shade, plant in soil zero to three inches below the water surface; Zone 10.

Menyanthes trifoliate (Bog Bean) – Native to Minnesota; spreading; crawling habit good for edges; grows nine to 12 inches tall; pink bloom; opens in April; becoming rare; requires acidic fertilizer; plant in soil zero to one inch below the water surface; Zone 3.

Veronica beccabunga (European Brooklime) – Modest, but intense blue blossoms all summer; low spreading habit; four to six inches tall; good at edges; plant in soil zero to one inch below water; may over winter, but unlikely north of Zone 5.

Typha latifolia (Cattail) – Establishes strong vertical accent in pond; in fall, catkins release fluffy seeds; reaches four to five feet tall; plant in soil zero to twelve inches below the water surface; native to Minnesota; Zone 3.

Typha minima (Cattail Dwarf) – Same as above except plants are 12 to 18 inches tall; plant in soil one to four inches below the water surface; Zone 4.

Eriophorum angustifolium (Cotton Grass) – Native to northern temperate bogs; member of the sedge family with tufted spikes of green foliage; seed heads resemble tuffs of cotton from late summer to fall; plant in soil zero to two inches below the water surface; Zone 3.

Lysimachia nummularia 'Aurea' (Creeping Jenny-Golden) – Excellent ground and pond edge cover; especially good at edge of falls; plant in soil zero to one inch below the water surface; Zone 4.

Myosotis scirpoide (Forget-me-nots) – A small plant for the pond's edge or submerged; prefers shade and cool water; plant near falls or fountain; plant in soil zero to two inches below the water surface; Zone 3.

Cyperus Papyrus (Egyptian Papyrus) – Marginal; triangular stems eight feet tall, tropical water plant; can be wintered indoors with adequate light and humidity; plant in soil zero to four inches below the water surface; Zone 9.

Myriophyllum aquaticum (Parrot Feather) – Good oxygenating plant that provides habitat for fish spawning as well as some cover to hide; stems float on the surface and arch upward; plant in soil one to four inches below the water surface.

Pontederia cordata (Pickerel Rush) – Native to Minnesota; thick petioles; spikes of star-shaped flowers in late summer and fall; plant in soil one to six inches below the water surface; keep containerized to restrict unwanted spreading.

Hydrocleys nymphoides (Water Poppy) – Oval leaves float like a miniature lily; yellow poppy like flowers appear in June to July; water that is too shallow or too deep discourages bloom; plant in soil six to eight inches below the water surface; Zone 8.

Bog Plants

Bog plants prefer the extra moisture of a wet area, but perform best when not in the water. Hardy bog and marginal plants can stay in a pond all year. As the weather begins to cool, the foliage will begin to turn yellow or brown. This may happen before or after a killing frost. When it happens, trim all the foliage off the plant, one or two inches above the soil level. Hardy bog and marginal plants can be dropped to the bottom of the pond in their original containers where they can stay until the water begins to warm up in

spring. Cattails should not be pruned until spring as the foliage acts like a snorkel, supplying the root system with oxygen.

Several non-hardy bog or marginal plants can be brought inside for the winter. Papyrus and Taro can be kept growing in a sunny window. They do not have to be submerged in water; however, they should be placed in a flat container that will hold some water. Water cannas can be stored bare root. Examples of bog plants are described below.

Ruellia brittoniana 'Compacta' (Bluebells) – Lavender blue petunia-like flowers from July to September, one to two feet tall, purple-green leaves. Soil should be zero to three inches above the water surface; Zone 8.

Crinum americanum (Bog Lily) – Tropical exquisite fragrant white flowers with long petals held above strap-like foliage; grows from an onion-like bulb; 12 to 18 inches tall. Soil should be zero to two inches above the water surface; prefers shade; Zone 8.

Canna (Canna) – Many different varieties and colors are available; grows two to six feet tall depending on variety; blooms late June until frost; prefers soil three to four inches above the water surface; the variety 'Erebus' will grow in soil zero to one inch below the water surface.

Elettaria cardamomum (Cardamom) – A tropical spice with large tuberous rhizomes and long dark green leaves similar to tropical ginger; grows four to five feet tall in dense shade; plant at pond's edge with soil two to three inches above the water surface; Zone 10.

Lobelia cardinalis (Cardinal Flower) – Deep red blooms August to September; foliage is deep maroon to green; good shade plant; Zone 3.

Cyperus haspan (Dwarf Papyrus) – Tropical water plant; can be wintered indoors with adequate light and humidity; will grow in two to three inches of water.

Equisetum fluviatlie (Horsetail) – Native to Minnesota; good accent plant for edges or between rocks; will naturalize if not kept in a container; plant in soil zero to three inches above the water surface; Zone 4.

Equisetum hymale (Horsetail) – Can be planted in dry solid soil or in a pond. Prefers part shade; provides an oriental look; will naturalize if not kept in a container; plant in soil zero to three inches above the water surface; Zone 3.

Iris (Iris) – Some varieties can tolerate up to six inches of water above the container; quick spreading plant with sword-like upright foliage and bright flowers in spring; Zones 4 to 5.

Eupatorium purpureum (Joe Pye) – Native moisture loving perennial that prefers moist meadows and swamp edges; whorls of green leaves and pink or purple flower clusters; plant in soil zero to three inches above the water surface; Zone 4.

Saururus cernuus (Lizard's Tail) – Found on marshes or pond edges; large, coarse, hairy stems and heart-shaped leaves; racemes of tiny white flowers in summer; plant in soil zero to three inches above the water surface; Zone 4.

Caltha palustris (Marsh Marigold) – Prefers boggy, muddy soil; can withstand shallow or running water; bright yellow flowers in early spring; foliage goes dormant by midseason; plant in soil zero to four inches above the water surface; native to Minnesota; Zone 3.

Mentha crispa (Mint) – European mint that thrives in wet places; has an odor similar to bergamot; found in shallow margins and marshes; lilac pink flowers in summer; plant in soil zero to two inches above the water surface; keep in container to control unwanted spreading; Zone 4.

Phragmites (Reed Pampas) – Slender stems of interesting foliage resembling bamboo; forms dense colonies along pond edges and bogs; stand ten to 12 feet tall; plant in soil zero to three inches above the water surface; keep in container to control unwanted spreading; Zone 3.

Juncus effuses 'Spiralis' (Rush Corkscrew) – Forms clumps of interesting vertical growth; can form large clumps, 12 to 15 inches tall; plant in soil zero to three inches below the water surface; Zone 5.

Scirpus zebrinus (Rush Zebra) – Horizontal pattern of light and dark; very unique contrasting pattern; grows four to six feet tall; prune old stems to promote strong variegations; plant in soil zero to three inches below the water surface; Zone 5.

Colocasia 'Black Magic' (Taro Black Magic) – Tropical, marginal plant with velvet black-maroon heart-shaped leaves; ruffled leaves that resemble an Elephant's ear; flowers do not develop in northern

climates; prefers warm water, warm air temperatures, and afternoon shade; plant in soil zero to one inch below the water surface; Zone 8.

Colocasia 'Green Stem' (Taro Green Stem) – Tropical, marginal plant with green heart-shaped leaves; ruffled leaves that resemble an Elephant's ear; flowers do not develop in northern climates; prefers warm water, warm air temperatures and afternoon shade; plant in soil zero to one inch below the water surface; Zone 8.

Cyperus alternifolius (Umbrella Palm) – Strap like umbrella leaves; stiff foliage on long, slender stems; fast growing; three to five feet tall; plant in soil three inches above to six inches below the water surface; Zone 8.

Cyperus alternifolius 'Gracilis' (Dwarf Umbrella Palm) – Dwarf cultivar of species; one to two feet tall.

Calla palustris *(*Water Arum) – Trailing, thick vigorous stems; spaeth-like calla flowers in summer; native to Minnesota; Zone 3.

Physostegia leptohylla (Water Obedient Plant) – Grows three to four feet tall; pink flowers; plant in soil zero to three inches above the water surface; Zone 3.

Deep Water Plants

Water Lilies and Lotus are deep-water plants. To be successful with water lilies, 12 inches of water above the crown of the plant, and lots of sun are necessary. Lilies do not do well in quickly moving or splashing water. There are two types of water lilies: hardy and tropical.

Hardy water lilies are available in every shade of red, yellow, pink, white and peach. The blooms usually float on the water and have 25 or more petals with subdued or no fragrance. The pads are usually sturdy and green. These lilies can tolerate cooler temperatures. The hardy lilies will survive winter if they are placed at the bottom of a pond that is over 18 inches deep.

Tropical lilies display a range of red, yellow, pink, white and orange, but they also provide shades of blue to purple. The blooms have fewer petals than the hardy lilies, but they are held six to ten inches above the water and they produce subtle to strong fragrances. A few tropical lilies open only at night, when they rapidly unfold to reveal fluorescent colors. Tropical lilies require a water temperature of at least 70°F.