Small Homes Council—Building Research Council, University of Illinois at Urbana-Champaign

RESIDENTIAL SWIMMING POOLS

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Office of Recreation and Park Resources

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Twenty-five Cents
Why build a pool?
Swimming is one of the most wholesome family activities, an all-round recreation activity for maintaining a healthy body. And it is fun, too! Many times, however, a public pool is not conveniently located for some families, or, if it is, is usually extremely crowded, thus reducing real swimming pleasure for families.

With a private swimming pool in your yard, you can swim at your convenience, never be crowded (unless you want to be), control the water temperature to your preference, and can extend the swimming season beyond that of public swimming pools. Because of the likelihood of more swimming by family members, each should become a better swimmer. Thus, you will be able to undertake a fitness program for the entire family which truly combines healthy exercise with family fun and privacy.

In areas not served by a public water system, fire hazards and insurance rates may be lowered by using the pool as an emergency water source.

However, before you conclude that, yes, it would be best to have a private pool for family use located in your yard, you must first consider whether you can afford a pool.

The appeal of a private family pool must be affected by a reasoned appraisal of its feasibility in terms of your financial capability; it is easy to overextend your budget for such a project.

Operating Costs
In addition to the initial construction costs, pool operating costs should be considered before building a pool. The contractor should be able to supply comparable operating costs for similar pools located in your area.

Liability
You should consider increasing the liability coverage of your homeowners insurance policy before constructing a pool. A minimum of $500,000 to $1,000,000 in coverage is recommended. Be sure to check with your insurance agent for his advice.

Locating Your Pool
When you have decided to build a pool, the next decision is “where”? If possible, the swimming pool should be situated to take advantage of any existing concrete patio, thus saving something on swimming pool deck costs. However, the aesthetic appeal of a pool should not be neglected. For safety, it might be desirable for the pool to be clearly visible from the kitchen (or other room occupied in many hours of the day); from this location it is possible to see if there are any problems with the pool, or if uninvited guests are using it.

Above-ground vs. Deck-level Pools
An above-ground pool is usually less expensive than a deck-level pool, and is an excellent first pool for a family undecided on what type to purchase. Above-ground pools are safer than deck-level pools because the access ladder can be removed, requiring an unauthorized user to scale a three- or four-foot pool wall.

A deck-level pool is usually more attractive than an above-ground pool, though it is possible to attractively landscape both types.

Again, it is important to check local and state ordinances concerning swimming pools. Code requirements must be met or your pool could be closed by legal action if it is not constructed in accordance with these requirements.

The bottom of the shallow end should be about two and one half feet to three feet deep. The

### Typical Maintenance Costs*

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>$180</td>
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<td>pumps</td>
<td></td>
</tr>
<tr>
<td>lighting</td>
<td>30</td>
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<tr>
<td>Gas (pool heater)</td>
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<td>Chlorine</td>
<td>90</td>
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<tr>
<td>Soda ash or acid salt</td>
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<tr>
<td>Orthotolidene</td>
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</tr>
<tr>
<td>Phenol red indicator</td>
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<tr>
<td>Water†</td>
<td>75</td>
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<tr>
<td>Pool repair††</td>
<td>100</td>
</tr>
<tr>
<td>Equipment replacement††</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$711</td>
</tr>
</tbody>
</table>

* 1970 operating costs for 18' x 36', 22,000 gallon in-ground pool operated in central Illinois from May 1 to November 1.
† Includes initial fill—less when water is left in pool for succeeding year.
†† Amount set aside each year for major repairs and replacement of equipment, pool liner, etc.
Typical above-ground rectangular pool

Typical above-ground circular pool

Typical in-ground pool
water should be eight to ten feet deep under a diving board that is less than one meter from the water, and deeper for higher boards. Care should be taken to ensure that adequate diving depth exists for eight to ten feet on each side of the board and for 15 feet in front of the board.

**Inlets.** Inlets for water returning from the filters should be located one foot or more below the water’s surface. This will allow both for better circulation and for chlorine to remain in the water for a longer period.

**Decks and Coping.** A minimum sized deck around a swimming pool should be three feet wide. The sun deck should be large enough for sunning without requiring foot traffic on the grass or ground. The deck around the diving board should extend a minimum of 10 feet from the end of the pool.

An insulative deck material should be used in hot areas of the country to prevent the deck from becoming too hot to be touched by bare feet. Concrete decks should be finished with a broom so the surface is rough enough to prevent falling. The decks should pitch away from the pool and to the low point of the yard if deck drains are not installed. If deck drains are installed, they should feed into the sump pit, enabling deck water to be pumped to the sewer.

Deck coping around the sides of the pool may be brick, concrete or stone, or may be formed of the same metal or materials as the pool walls. The finish of the coping surface should be rough to prevent slipping on the deck.

**Shapes and Sizes**

It is important to consider the following points when selecting a pool from the many sizes and shapes available:

1. Adaptability for new swimmers
2. Adaptability for physical fitness swimming
3. Adaptability for competitive swimming practice
4. Size relative to the largest number of persons expected to use the pool at any one time
5. Adaptability for diving

The non-swimmer is a very important consideration for any swimming pool; hence the pool should have a portion devoted to shallow water of 2½ to 3 feet deep. There should be enough water at this depth so a child can push off from the bottom in a prone glide, kick a few feet, recover, and still be able to stand in shallow water with his head out of the water.

Fitness swimming and competitive swimming practice are most easily done in pools which are rectangular, so that swimmers can swim lengths. Most competitive and fitness swimmers prefer pools that are more than 30 feet long. Diving is an important consideration. If a diving board is not desired, it is recommended that the maximum depth of the pool be five to six feet. If a diving board is to be constructed, the pool must be of adequate depth. A minimum depth of 10' under a one-meter diving board is a safe standard.

Some of the basic swimming pool shapes and sizes are given below:

**Oval**

Dimensions similar to rectangular except for corners.

**In-Ground Kidney**

Usually comes in widths from 16' to 24'. At the widest point, lengths from 24' to 40', depths from 2½' to 10'.
The In-Ground Rectangular

Usually comes widths from 12' to 28'; lengths from 20' to 45'; and depths from 2½ to 10'.

The Above-Ground Rectangular

Usually comes varying widths of 12' or more; varying lengths of 20' or more; varying depths from 2½ to 8'.

The In-Ground L

Usually comes in lengths, widths, and depths similar to overall rectangular pool dimensions.

Materials

Swimming pools can be constructed with various materials—vinyl, concrete, shot-crete, steel, aluminum, and fiberglass. Above-ground pools usually have vinyl liners. The vinyl-lined above-ground is the least expensive pool to install, and is increasing in popularity for moderate-income swimming pool projects. The liners are constructed in a factory to a prescribed size and installed over rigid walls of steel or pressure-treated wood. Usually the base for a vinyl-lined pool is constructed of six or more inches of sand, molded to the shape of the bottom.

Vinyl liners are also used for in-ground swimming pools. After the hole is dug, walls of steel (usually galvanized), masonry, or pressure-treated wood are set. The bottom of the hole is shaped to fit under the base of the liner with a minimum of six inches of sand. The liner is attached near the top of the wall with a friction fit. Vinyl liners have been known to last for five years or more without replacement. Should a hole occur in the liner, it can be patched underwater with ease using a repair kit provided by the distributor.

Water can be left in a vinyl lined pool on a year-round basis. In fact this is recommended, especially where a high water table exists beneath the pool, enabling the weight of the pool water to offset water pressure beneath.

Vinyl liners do not require painting. With proper maintenance and upkeep, the liner can be replaced for the cost of painting other types of pools over a five- to seven-year period. Because of the sand base under the vinyl liner, the floor of this type pool may appear rough in certain spots. (Where the sand base is shifted by jumping into the pool and hitting bottom, etc.) This is particularly noticeable when the pool is idle in evening hours and the underwater lights are turned on. This feature is not usually noticeable during the daylight hours, except when the pool is not properly maintained and dirt collects in depressions.

Concrete pools are poured into forms with reinforcing rods for in-ground installations. Concrete should be poured with proper expansion joints and finished with a smooth finish. Separate pourings are made for walls and bottom sections.

Shot-Crete. Shot-crete swimming pools are concrete-type pools constructed from concrete applied to pre-positioned reinforcing rods through pressurized hoses. The shot-crete method makes possible a continuous application of concrete without expansion joints. Both the concrete and shot-crete pools are subject to cracking from various causes. Cracks are often difficult to repair satisfactorily and usually require the pool to be completely emptied to patch the cracked area.

Steel. Steel pools are welded together on the job from prefabricated sections. These pools can be more expensive than concrete pools. Continual maintenance of the steel is required, including painting, and repainting of the steel surface when the pool is emptied.

Aluminum. Aluminum swimming pools are also constructed from prefabricated sections welded on the job site. The aluminum is thin and may look as if it will not hold when the
lapped welded sections are viewed without water in the pool. However, once water is put in the pool the aluminum sections settle properly against the gravel base underneath the pool bottom. Aluminum pools should be painted and may require repainting every one to three years.

**Fiberglass pools.** Some swimming pools constructed with fiberglass walls and concrete or shotcrete bottoms have proven successful, as has an all-fiberglass pool built of pre-formed sections cemented together on the site.

**Pool Construction**

**Above-Ground Pools.** These are usually constructed in the factory and assembled on the job. They are normally installed by factory representatives. Turf should be removed from the site selected for the pool. A six- to eight-inch sand base should be shaped to the form of the pool bottom.

**In-ground Pools.** The hole dug for the pool must be oversized to allow for forms, or for assembling the pool walls. Room is also needed for the piping extending to and from the filtering and recirculating equipment.

**Swimming Pool Walls.** Pool walls should be perpendicular to the surface of the pool and have a smooth finish.

**Swimming Pool Bottom.** The pool bottom should have a gradual slope where feasible. Sufficient area for non-swimmers should be available in the pool, with the start of the slope to deep water marked with a life line. A steeper slope is required in a smaller pool where both shallow water and a diving area are wanted.

**Pool Equipment**

**Ladders.** Swimming pool ladders, a minimum of two for an in-ground pool, should be located so divers may exit the pool with ease after making a dive without crossing in front of the board or doubling back to the deep end of the pool. The shallow water ladder should be located on the shallow side of the pool nearest the house. Ladders should be installed on the side of the pool so they will not be in the way of swimmers who are swimming lengths and wish to turn at both ends of the pool.

**Skimmer and Lint Strainer.** The swimming pool should have a skimmer located near the pool's top edge on the side opposite the direction of the prevailing wind. The skimmer should be connected to the suction side of the filter pump and should clean the surface of the pool continuously. A removable basket strainer should be located in the skimmer and be cleaned at least once a day.

A metal lint strainer basket should be located in the suction line before the water reaches the pump so larger pieces of dirt, bugs, hair, lint, stones, or other objects coming through the deep drain are caught before entering the impellers of the recirculation pump. This lint strainer should be cleaned at least once a day.

It is important the pool level be maintained at the proper height so water is constantly flowing through the skimmer. Pool operators will note the accumulation of dirt on the surface when the skimmer is not operating properly.

**Vacuum System.** Most filtering systems have provisions for the attachment of a vacuum hose to the skimmer so the pool may be vacuumed when needed. The suction on the skimmer line may be increased by nearly closing the deep-drain valve while vacuuming the pool bottom.

**Pool Cleaning Systems.** The amount of time spent in maintaining the pool can be reduced substantially through the use of one of the several types of pool cleaning systems. All operate on the basic principle of using water jets to push sediment and other debris toward the deep drain and the skimmer, where the material is removed by the leaf trap, lint strainer, or filtering system. All obtain the water pressure needed to operate through the inlet piping system, with most of the water which is returned from the filter being directed through the cleaning devices. There are a number of proprietary systems, most involving some system of plastic hoses which wave through the water, directing a high-pressure stream throughout the pool, keeping the sediment suspended and moving toward the deep drain. The hoses may be built into sides of the pool, either retractable or fixed, or attached to a float in the pool. The system may also include a water jet system directed at the edge of the pool to remove the “ring” of oils and minerals which may accumulate. Other types of systems use water-powered mechanical devices which travel at random on the bottom of the pool to do the cleaning.

Pool cleaning systems are operated manually or by automatic timer during times when the pool is not in use.

**Swimming Pool Heater.** The length of your swimming season may be increased considerably by installing a heater. The heater should be
thermostatically controlled to a water temperature which is most comfortable for your needs. The heater will also permit swimming during cool summer periods.

**Lighting.** Lighting is an important consideration for swimming pools. Deck lighting may be provided with spotlights placed at suitable locations around the pool. The bulbs should be located high enough so no one can touch them, and far enough away from the pool so water will not splash on them.

Underwater lights can be used, but should be installed only by a qualified electrician. A low-voltage (12 to 15 volts) type underwater lighting system is recommended rather than a system which uses regular house current. Generally, underwater lights are designed to be water cooled and should be located far enough below the surface so that they will not be exposed to air at any point. The wiring systems of underwater lights should be safety-checked annually.

**Diving Boards.** A diving board may be made of wood, fiberglass, or aluminum. The diving board mountings should be installed in the concrete decking, with the board attached by two anchor bolts to the rear mounting. Bolts and nuts should be checked daily for security.

**Accessories**

Certain accessory equipment is almost a necessity for private swimming pool owners:
- a vacuum pole holder
- a vacuum hose
- a vacuum cleaner
- a wall brush
- a deck brush
- hose to wash the deck
- life buoys
- a life line
- a sufficient supply of chlorine
- a sufficient supply of acid salt or soda ash
- a swimming pool cover
- pool ladders (with extra rubber cups for the ends of the ladders where they fit the walls of the pool.)
Pool Enclosures

Plastic enclosures may be purchased to enable the swimming pool to be used during the winter. Air pressure provided by a fan holds up the roof of the enclosure. Outdoor swimming pools should be constructed with the possibility in mind that they may be covered later with a permanent or semi-permanent enclosure. Swimming pools built into the house can cause major moisture problems in areas with cool weather, and the heating and ventilation systems for such installations must be designed by an experienced ventilating engineer.

Fencing

Decisions on the type of fencing you want should be made early in the project. Fencing should be used initially to protect anyone from injury during construction of the pool, as well as later, when the pool is completed. Adequate fences should be constructed around the yard whether the pool is above ground or below ground. You should check local or state ordinances about fence construction, especially their location in terms of property lines and height limitations.

A swimming pool might be considered an attractive nuisance by some. It is not surprising to find many neighbors becoming more friendly when they see a swimming pool constructed in your yard. Therefore, it is important the fence be a minimum of six feet high, and constructed to be unclimbable. Young children have been able to climb chain-link fences because their feet fit into the sections as if they were a ladder. This possibility can be considerably reduced by weaving plastic or wooden fillers into the chain-link fencing. Installing fillers in the chain-link will also enhance privacy. Another type of fence effective for both safety and privacy is wooden fencing. Privacy with this fence is accomplished by turning the 2 x 4 cross braces a quarter turn from the usual installation.

Fence gates might be eliminated if there are adequate provisions for bringing the lawn mower, pool supplies, and other equipment into the yard. Without gates, the problem of inadvertently leaving one open is eliminated. Even if access to the pool is only through the house, front doors should be locked so unwanted guests are unable to use the pool.

A tight fence with well-fitted gates will also prevent small animals such as dogs or rabbits from falling or jumping in and drowning, or, in the case of a friendly muskrat, taking up residence.

Water Quality Control

There are two basic types of swimming pools, the fill and draw, and the filtered pool. The fill and draw pool is constructed and filled with water but is not filtered. The water may be chemically treated to reduce bacteria, but in time, the water becomes turbid and the pool will have to be emptied and cleaned before refilling.

The fill and draw swimming pool may be more economical to purchase, but might be more expensive and troublesome in the long run because of the expense of adding new water and the time...
and effort involved in emptying, cleaning, and refilling the pool. The filtered pool can operate so the water is continually filtered. With proper chemical treatment, the water will be free of harmful bacteria and will not become turbid except under unusual circumstances. It is possible that local building or health codes might require all swimming pool water to be chemically treated and filtered.

**Filtration and Water Purification.** Ideally, swimming pool water should be filtered continuously. A filter and pump should be obtained with a rating such that it will filter all the water at least once every six hours.

There are two types of filters usually used in residential swimming pools: a pressure sand filter and diatomaceous earth. The sand filter receives the pool water under pressure from the deep drain and from the skimmer. The filter tank has layers of filter sand and fine gravel. The water is pumped through the filter and is cleaned and returned to the swimming pool. As dirt collects on top of the sand, the pressure of the water on the sand becomes greater and is usually registered on a gauge near the filter tank. When it reaches a pressure (specified by the filter manufacturer) it is a signal to clean and back wash the filter, washing the dirt to a separate sewage system away from the pool.

The diatomaceous earth filter can also work under pressure. Water enters the filter and flows through a precoat of diatomaceous earth on the filter elements. As the dirt builds up on the elements, a pressure differential is produced, indicating that backwashing is necessary.

A third and popular type of filter is called the vacuum diatomaceous filter. In this system, water flows to the filter box by gravity, passes through precoated diatomaceous earth filter elements under suction, then through the filtration pump and is returned to the pool.

Automatic backwashing systems are available for all three types of filters.
Pool Disinfection. It is important your swimming pool maintain a minimum of 3 parts of chlorine to one million parts of water at all times. If this blend is maintained, harmful bacteria in the water will be killed and algae will not grow in the pool. It also is important to remember that chlorine residuals will decrease greatly during the hotter, sunnier parts of the day, thus requiring the addition of more chlorine at those times.
Chlorine is usually added automatically as granular hypochlorite or through chlorine gas supplied under pressure, which liquifies when released through a chlorinator. Chlorine should be added on both sides of the filter (pre- and post-chlorination). In smaller pool operations, granular chlorine can be distributed by hand as needed.

The amount of chlorine present may be tested with a test kit which is readily obtainable from most swimming pool supply companies. A few drops of orthotolidine is added to pool water in a test tube. The water will turn to a yellowish-brown if chlorine is present. The amount may be easily determined by a comparison to a color scale provided.

Also of importance for water purification is the amount of acid present. It should be kept on the basic side, in the 7.2 to 7.5 pH range. A test kit for acidity is also available and soda ash or acid salts are used to maintain the acid balance.

**Maintenance**

A minimum of an hour a day should be devoted to swimming pool maintenance. If automatic pool cleaners and filter systems are used, this can be reduced substantially, but at a considerable increase in initial cost of the installation. Decks should be washed down each day and scrubbed with a disinfectant once each week. The walls and bottom of the pool should be brushed at least once per day. The pool bottom should be vacuumed when necessary. Usually it will be needed at least every other day during regular use. The lint strainer and skimmer strainer should be cleaned daily. The filter pressure should be checked daily and the filter backwashed when necessary. Water should be added to the proper height (with relation to the skimmer) each day. This is to stop a bathtub-type ring from forming on the walls of the pool.

Ladders should be checked daily to make sure the buffers against the wall are in good repair. The fulcrum on the diving board and the diving board anchor nuts and bolts should be checked daily.

**Winterizing the Pool**

**When water is left in the pool**

Drop the level of the pool below the inlet lines and skimmer. Drain all feed lines, recirculation lines, filter, heater, and all other lines. Plug the inlet lines and skimmer line in the pool. Remove underwater lighting equipment which might be damaged by the pressure. The pool may be filled, but it is better if it is allowed to remain at a level below the inlets. The pool should be superchlorinated by hand feeding granular chlorine, and then covered with a vinyl cover.

**When water is drained from the pool**

- Drain the pool
- Wash the pool down
- Drain all feed lines, recirculation lines, sewer lines, filter, heater, and all other lines including the pump. Open the hydrostatic relief valves

**Pool Safety**

The accident will always happen when you least expect it, so here are some suggestions for safe operation.

Do not construct an in-ground pool unless every child in your family knows how to swim.

Do not allow swimming in the pool unless an adult is watching the pool or a qualified life guard is on duty (certified by the American Red Cross or Y.M.C.A. Life Saving Course).

Require that persons swimming in deep water be able to swim a minimum of 25 yards.

Divers should go straight off the end of the board, and then swim to the nearest ladder.

Do not allow running on the decks around the pool.

When guarding the pool check and know your head count at all times; when in doubt, check the bottom immediately.
Selecting a Contractor

Make sure that the swimming pool contractor you select has extensive swimming pool construction experience with the type of pool you select. Ask for a tour of some of his installations. Try to visit pools that have been installed for five years or more. Talk to the owners about their experience with the pool. Make sure that the contractor personally supervises the construction of your pool, that he is service-minded, and will service your pool when needed during the first year of operation without any additional cost.

It is imperative that all items covered by the following checklist be included in a written contract between you and the contractor or responsibility specifically determined if the owner wishes to provide some items himself.

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**SWIMMING POOL CONTRACT CHECK-LIST**

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<thead>
<tr>
<th></th>
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<td>1. Type of pool</td>
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<td>In-ground</td>
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<tr>
<td>2. Size of pool</td>
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<td>Capacity in gallons</td>
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<td>3. Shape of pool</td>
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<td>4. Depths of pool</td>
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<td>14. Recirculation pump size</td>
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<td>18. Vacuum system and equipment</td>
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**TOTAL**