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Comprehensive AQUATIC THERAPY

second edition

BUTTERWORTH HEINEMANN

Contents

Chapter 3
Facility Design and Water Management

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DESIGN PROCESS

Before embarking on a major facility design project, an aquatic therapist should learn the basics of how to design a patient- and therapist-friendly warm water pool and have the knowledge necessary to select appropriate equipment and features to complement the programming and therapy goals. The therapist should be able to make informed decisions as to which products, chemicals, pieces of equipment, and surface and construction materials are best suited for use in warm water therapy pool environments. He or she should have a basic understanding of the therapy pool design process, know the advantages and disadvantages of constructing a pool versus purchasing and installing a prefabricated pool, have an understanding of space requirements, and be able to estimate costs of building a therapy pool.

POOL DESIGN TRENDS

Today, the trend in the United States is to build multiple pool facilities that include leisure concept pools and special-use pools designed specifically for a single purpose such as fitness, competition, diving, recreational swimming, or therapy rather than single, multipurpose pools.

In general, pools are becoming shallower overall. They often incorporate water features that involve moving water. Incorporation of a theme is a widespread trend and, in addition, the environment is made more aesthetically pleasing through the use of natural and artificial light, plants, and graphics. The facilities are designed to be accessible to disabled users and incorporate multiple means of ingress and egress to accommodate user preferences and needs. Many aspects of the operation and maintenance of pools are becoming automated.

Special-use pools serve a broader community base than traditional swimming pools. They are often used by individuals with little or no swimming ability. Usually they are designed to be financially self-supporting, and, if they are managed efficiently, capital costs as well as operating expenses will be covered, and profits will be generated soon after the initial start-up.

POOL DESIGN PROJECT PHASES

Following a logical sequence of planning stages will allow the design process to progress smoothly. The project should be analyzed thoroughly, and objectives and goals should be set before the design process actually begins. The design process consists of nine phases:

- Site analysis
- Determination of programming requirements
- Preliminary design and project feasibility
- Selection of a project design team
- Production of construction documents
- Obtaining of permits and plan check
- Bidding and awarding of contracts
- Construction phase
- Turnover and acceptance of the completed facility

Pool Site Analysis

The first phase of the project, pool site analysis, includes determining whether a particular site is an appropriate location for building a therapy pool facility. During this phase, marketing and demographic surveys should be conducted. The therapist should visit similar nearby facilities to check on the competition and identify design features he or she would like to incorporate, eliminate, or improve upon. Zoning regulations should be investigated thoroughly to make sure there are no prohibitions or restrictions to building the desired facility at a particular location. An environmental impact study may be required. The availability of utilities and access to the site from major roads should be verified. Otherwise, the cost of building access roads or bringing natural gas pipelines or electrical lines to the site may make the project cost prohibitive.

A geotechnical engineer or soil specialist should be hired before the land is purchased to conduct topographical and soil surveys, evaluate ground water table conditions, and identify earthquake potential and seismic zone restrictions to determine whether the proposed site is an appropriate location for pool construction. Although a pool can be built almost anywhere, costs will be substantially higher in some locations. The geotechnical engineer or soil specialist should do test borings to determine soil stability. Inappropriate soil conditions or unstable ground can lead to settling, sinking, cracking, or floating of the pool; heave from freezing or wet, expanding soil; hillside erosion and landslides; and ground creep from seismic activity. The engineer will identify ground conditions and load-bearing capacity and determine whether there is suitable drainage and whether installation of hydrostatic relief valves or drain tile or the use of sump pumps may be necessary. He or she will analyze soil samples for moisture content and composition and differentiate soil by particle size into four categories (gravel, sand, silt, or clay) to determine whether the soil will need to be modified or stabilized by compacting or dewatering. Groundwater or water table level conditions, along with springs, flood plains, and tidal variations will be identified. He or she will look for underground hazards or unexpected obstacles such as large buried rocks that may need to be blasted away or for subterranean cavities that will have to be filled before construction. Retaining

wall construction or major changes in the topography or earthwork before construction may be necessary.

Demographic Survey

A demographic study should be undertaken to determine whether there is interest in the project or a real need for the facility. Who will use the facility, and why will they select your facility over other existing therapy facilities? Will there be competition from other nearby aquatic facilities that provide similar programs and services or cater to the same clientele? Are the existing aquatic facilities overcrowded, unsafe, aging, or obsolete? What impact will your facility have on the neighborhood? Will nearby residents object to the facility based on the impact on the environment, traffic congestion, availability of parking, or noise or light pollution?

Programming Requirements

Pool design should be program driven if the goal is to generate profits while serving the aquatic therapy needs of the community. When designing the facility, determine how much space is needed to accommodate both current and future programming needs. Prioritize your areas of programming. Which programs are most important and will generate the most revenue? Who is your patient population? What type of patients will you see—general population, older adults, pediatric population, or athletes with sports-related injuries? What treatments or techniques will you provide? How long will treatment sessions be? What are the space and depth requirements for particular therapies? Ranking program importance helps ensure that the aquatic facility will be designed to meet program needs, that certain pieces of equipment and materials will be specified, and that design or operational conflicts will be solved logically.

Preliminary Design and Project Feasibility

List and prioritize desired equipment and design requirements based on an awareness of activities and programs that are planned for the pool. With your consultant, fill out an aquatic facility design checklist and prepare a "design program" to help prioritize program offerings and determine pool and equipment requirements to meet anticipated needs. The design program will specify the number, size, dimensions, tolerances, type, brand names, markings, location, color, technical data, and performance standards for all pool components and equipment.

When initially planning the size of the facility, determine in-water space needs for various therapies and programs and the maximum number of patients who would be in the water at the same time if your facility is successful beyond your wildest dreams. Depending on the activity, space needs per individual range from 60 square feet for stationary activities to more than 500 square feet for activities that involve swimming, water walking, or moving up and down the length of the pool. For instance, if you wanted to run a small group wellness activity that involved no more than 20 participants standing vertically in the water and not moving more than one step in any direction, each participant would need a minimum of 64 square feet

of space in the pool. The minimum amount of usable space (not counting steps, ramps, seating tiers, etc.) would be 1280 square feet. Assume that the actual pool size is 30 by 50 feet or 1500 square feet. Suppose that at the same time, one-on-one therapy is taking place in an adjacent 12 foot by 15 foot, 180 square foot prefabricated therapy pool. Decks area is usually 1.5 times the size of the pool area. The space needed for men's, women's, staff's, and families' locker rooms is at least equal to the size of the pools. Auxiliary spaces needed to run the pool, which include pump rooms, chemical rooms, storage rooms for therapy devices and equipment used in the pool, a first aid room, and maintenance closets, are at least equal to the size of the pools. The minimum size of the building that will accommodate the pool, decks, locker rooms, and auxiliary spaces can be estimated by taking the area of the pool, in this example 1680 square feet, and multiplying by a factor of 4.5 for a minimum building size of a little over 7500 square feet. Space for offices, reception areas, meeting rooms, saunas and steam rooms, waiting rooms, patient screening rooms, and therapy treatment rooms may also be needed.

Review all applicable health and safety, building, fire, electrical, and plumbing codes; state and local statutes and regulations; federal regulations; and industry standards and guidelines to make sure your facility design complies with all of these.

Develop a financing plan that identifies funding sources and includes cost projections and a budget. Determine costs of construction, and review the financial viability of the project based on available resources. Costs of building a therapy pool facility range from a low of about $85.00 per square foot for outdoor facilities to more than $400.00 per square foot for high-end, indoor facilities. Develop a contingency plan for cost overruns. Refer to industry cost books that can be purchased at technical bookstores or may be available at your local library. Apply geographic cost modifiers to help determine actual construction costs in your region of the country. You may want to hire an economic research consultant to conduct studies and prepare projections for costs and income potential.

Design Team

Assemble your design team. An aquatic facility design team should consist of the facility owners and their representatives, including aquatic programming, maintenance, and management staff who will be working in the facility; your architect, engineers, and builders/contractors; your aquatic consultant; and local regulatory or health department officials.

The architect is the individual who prepares the specifications and drawings from which the contractors work. The architect estimates project costs, supervises the construction, inspects the completed project, and certifies that the work was completed in compliance with the specifications. The architect must be licensed in the state in which the facility is constructed.

The engineer designs the operation and layout of the mechanical equipment, machinery, and building systems. He or she makes sure systems work in compliance with performance standards. An engineer who is competent to work on an aquatic facility design project should have knowledge and experience in designing hydraulic, heating, ventilating, and air conditioning (HVAC), electrical, plumbing, and mechanical systems.

The builders and licensed contractors purchase building supplies, materials, and equipment that conform to the specifications. A general contractor and several subcontractors are likely to be involved with a complex project such as a therapy pool facility. It is unusual to find one company that specializes in construction of both buildings and pools and employs all the various tradesmen needed to complete the project. The contractors construct the facility, install the equipment, provide the tools and construction equipment, schedule workers and jobs to be done, obtain building permits and schedule inspections, and guarantee that the facility is built to specifications.

The aquatic consultant is the specialist familiar with pool design trends, equipment, and codes. He or she helps establish priorities and goals based on your program needs. The consultant assists the architect in writing or revising specifications and is responsible for educating the design team about equipment options and comparing the costs and effectiveness of various products, materials, and systems. The aquatic consultant reviews and critiques the construction documents for common design errors, safety hazards, code compliance, appropriateness to stated goals and primary facility usage, and compliance with common and acceptable practices of the aquatic industry, manufacturers' recommendations, and design guidelines.

State or county health officials who have jurisdiction over the facility should be invited to participate in the design process so that plans and specifications move smoothly through the plan check process and gain swift approval. This is especially important if the facility or specified equipment is of an unusual, innovative, or controversial design or if code variances are being requested.

When selecting members of your facility design team, make sure the firms or individuals have experience working on comparable projects. Find out if they are open to input from consultants, consulting architects, and other design team members. Are they willing to try innovative design ideas, or do they basically build the same facility project after project? Do all their projects look the same? Make sure that they capable of discussing and providing advice on the advantages and disadvantages of various pool systems and equipment. Have they had problems obtaining approval for past aquatic projects? Ask if they are independent, or if they are affiliated with a specific aquatic product, retailer, builder, or design group. Ask about the number of current projects the firm is involved in and plans to work on simultaneously. Make sure they have the time and staff necessary to devote to your project. Request references and a client list.

Construction Documents

Construction documents that must be prepared include construction diagrams or drawings (commonly, but incorrectly, referred to as blueprints), "as built" plans, specifications, change requests, and change orders. They may also include models and aerial photographs.

Drawings or construction diagrams graphically depict the work to be done. They include floor or site plans that depict the building itself, structural details, elevations, grading, pool orientation, water supply, sewer, and utility connections. Detailed construction plans show the location of inlets, drains, hydrostatic relief valves, perimeter overflow systems, surge chambers, piping, decks, drains, hose bibbs, water fountains, walls, ladders, stairs, rails, ramps, lights, diving boards, starting blocks,

bulkheads, filtration and circulation equipment, and locker rooms. Landscape drawings show trees, plants, and irrigation systems. Other schematic diagrams include those that show pool piping; electrical, mechanical, and plumbing details; and cross-sectional and longitudinal views of the pool.

Specifications are the written instructions for the contractor that provide technical information for the various building tradesmen and subcontractors on the work to be completed. Specifications describe materials, size, and type of equipment; standards of workmanship; the quality of materials, options, alternatives, or acceptable substitutions; installation methods or procedures; and inspection and testing requirements. Specifications usually include details that are not found or duplicated on the drawings. If there is a discrepancy, specifications take precedence over the drawings.

The contractor is responsible for ensuring compliance with design specifications, drawings, and codes. Selected equipment must meet the performance requirements specified or the contractor must replace the defective materials.

Today, specification writing and the arrangement of technical information for the trades are computerized using the industry standard CSI MasterFormat system. The CSI Format for Building Specifications has 16 basic divisions, with each division representing several trades. It is used to provide a better and faster method of construction estimating. The 16 divisions include the following:

1. General requirements: Permits, fees, liability bond, insurance, supervision, clean-up, temporary facilities, security, tax, plan check, general contractor, summary of work, responsibilities, items furnished by owner, work to be performed at a later time, applicable codes, abbreviations or symbols, reports, storage and protection of materials and equipment
2. Site work: Clearing, grading, excavating, drainage, utilities, roads, landscaping, demolition, earthwork
3. Concrete: Formwork, reinforcing, material, finish, deck, grout
4. Masonry: Material, reinforcing, grouting, placement of rigs, mortar, and stone
5. Metals: Structural, steel, metal, joists, ornamental iron
6. Carpentry: Millwork, casework, walls, framing, rough carpentry, finish carpentry, adhesives, wood, and plastics
7. Moisture protection: Roofing, weatherproofing, insulation
8. Doors, windows, glass: Doors, windows, skylights
9. Finishes: Drywall, tile, flooring, interior and exterior painting, plaster, tile. carpeting, acoustic ceilings, wall coverings
10. Specialties: Toilet accessories, chalkboards, lockers, signs, clocks, fire-fighting equipment, prefabricated products, pest control, fireplaces, flagpoles, telephones
11. Equipment: Athletic or recreational equipment, theater equipment, spas. saunas, snack bars, cabinets, kitchen and office equipment
12. Furnishings: Seating, artwork, drapery, blinds, shades, carpeting, furniture. plants
13. Special construction: Swimming pools, filtration equipment, wave generators. courts, special purpose rooms
14. Conveying systems: Elevators, escalators, lifts, hoists
15. Mechanical systems: Water supply, fixtures, sprinklers, heating and air conditioning, waste water, fountains, plumbing, air handling systems
16. Electrical systems: Lighting fixtures, communications systems, controls

As the project progresses, the specifications will be appended with addenda and change orders to clarify procedures, correct errors or omissions, and change the scope or quality of work. Upon completion of the project, the owner should request at least two sets of as-built plans. As-built plans reflect changes that occurred during construction and show the work that was actually done. One set of as-built plans should be kept on site and available for frequent reference. The other set of as-built plans should be stored in a safe location for future retrieval when necessary.

Obtaining Permits

An application for construction of a new swimming pool, drawings, and specifications must be submitted to the appropriate authorities for review and approval before construction is begun. The plans must be prepared by and bear the seal of a registered professional engineer or architect licensed to practice in the state. Plans must be accompanied by the required fee. Fees may or may not be waived for nonprofit agencies.

Each state has specific requirements for how applications for construction will be processed and what materials must be submitted for review. Usually though, the person planning to construct, alter, or modify a pool, except for routine maintenance, must submit plans to the county health officer for review and approval. Occasionally, plans must be submitted to other regulatory agencies such as the department of water quality, department of agriculture, or state department of health and rehabilitative services.

Typically, a completed construction permit application form and three sets of plans and specifications prepared and signed by an engineer or architect must be submitted. The package usually includes construction plans (blueprints) drawn to scale and in sufficient detail to completely illustrate the proposed construction, including plan views, cross-sectional views, plans showing the pool in relation to other facilities in the area, dimensional drawings, a detailed view of the equipment layout, a piping schematic showing piping configuration, pipe size, valves, inlets, drains, outlets, water flow pattern, make-up water, and water disposal. Decks, fences, barriers and alarm systems, pool components, pool appurtenances, steps, ladders, rails, ramps and handicap accessibility equipment, bottom markings, depth markings, signage, equipment rooms, chemical rooms, first aid treatment rooms, lifeguard stands and location of rescue equipment, food and beverage service facilities, heating and heat retention, air distribution, ventilation, and dehumidification system components, locker rooms and sanitary facilities, and lighting and plumbing fixtures must be shown. Information on the approved source of potable water that will be used to fill the pools and the method of chemical neutralization and water disposal must be submitted. Information must be provided to show that there are no cross connections between the domestic water supply, the pool recirculation system, and the sewer system and that appropriate backflow prevention and air gaps have been provided.

Detailed written specifications must be submitted to permit a comprehensive engineering review. The name of the manufacturer and model number of all equipment must be provided, along with proof of NSF International listing or approved equivalent for filters, pumps, pipes, valves, disinfection, and other listed equipment. The volume, water surface area, and linear footage/perimeter, construction and surface materials, and color of the pool must be provided. The filter type, filter media,

filter surface area, design flow rate, recirculation pump capacity, velocities, turnover time and flow rate, and total dynamic head and pump curves for the filtration and circulation system components must be provided. Detailed descriptions of treatment chemicals and systems and of chemical feeders, controllers, and related equipment that will be used must be provided.

The application, plans, and specifications will be reviewed by the regulatory agent, and at the completion of plan check, the agent will forward written approval or rejection or may require modifications or additional information to be submitted. When all conditions are met, the regulatory agent will issue a construction permit.

The construction permit must be posted in a conspicuous place on the construction site. The permit is typically valid for a period of time of between 12 and 18 months. Changes in plans or specifications during construction require that the documents be resubmitted for approval. The facility owner must ensure that any modification or alteration is completed according to approved plans and specifications.

Bidding and Awarding of Contracts

Advertise the opportunity to bid on the project. Construction documents, including the schedule of drawings and specifications, should be made available to prospective bidders. The bid package should also include an invitation to bid, instructions explaining how the bid is to be submitted, how the contract will be awarded, conditions for which bids will be rejected, sample proposal forms so all bids are submitted in a similar fashion, conditions of the contract, and the agreement. Identify a time frame for project completion and specify a penalty if work is not completed within the scheduled time. Allow a reasonable amount of time for contractors to prepare their bids and hold a pre-bid meeting at the site to answer questions potential contractors might have. Review and accept or reject the bids, negotiate fees, and award the contract.

Construction Phase

During the actual construction phase, a construction manager will supervise the subcontractors, tradesmen, and laborers. The architect or engineer should be on-site as often as necessary but at least once per week to make sure that the facility is being built in compliance with the approved plans. If possible, the owners or their representatives should visit the site regularly to observe and photograph or videotape the progress of the project.

Turnover and Acceptance of the Completed Facility

When construction is completed, conduct a pre-opening walk-through and inspection of the facility. Thoroughly inspect the pool and all of its equipment before it is put into use, and either accept, reject, or conditionally accept the project. Obtain an operating permit from the regulatory agency. Make sure that all operations manuals, instructions for proper preventative maintenance of all equipment, as-built drawings, and warrantees are turned over to the owner. Train the aquatic facility staff in the proper operation and maintenance of the facility and equipment.

Inspect the facility again approximately 120 days after the initial start-up to determine if the equipment is operating as specified and whether systems are performing to expectations. Be sure to conduct a final inspection within 1 year after start-up, and make sure all defects have been corrected or have been identified and are in the process of being fixed before taking final control of the facility. When everything is working properly and the owner is satisfied that the work has been completed, the architect or registered professional engineer certifies that construction was completed in compliance with the approved drawings and specifications.

PREFABRICATED THERAPY POOLS

Very early in the design process, a decision should be made as to whether the therapy pools are going to be designed and constructed from scratch or whether prefabricated pools are going to be purchased and installed. There are, of course, advantages to each.

Constructed pools are permanent and long lasting. They can be custom designed to meet your unique programming needs and can be built to fit specific size and space requirements. By designing and building a pool, you can select from a wide variety of equipment and material options not available when buying a prepackaged system.

Prefabricated therapy pools have the advantage of portability. You can take the pool with you when you move to a new location or a larger facility. There is less of a financial commitment if you are just entering the field or expanding your rapidly growing aquatic therapy practice. The speed of installation allows you to be up and running very quickly. A therapy pool design and construction project often takes 2 to 5 years from the time of the first design meetings to actual occupancy. A prefabricated pool facility can be in operation in less than 1 year. Most prefabricated therapy pools have been classified as Food and Drug Administration–approved class II medical devices. There is a tax advantage with installation of a prefabricated pool. A prefabricated pool is usually considered a piece of equipment rather than part of the building, and, like any other piece of business equipment, it can be depreciated over 5 to 7 years.

Remember though, when comparing prefabricated pools to constructed pools, not to just compare the stated cost of the pool to construction costs. Work typically not contained in the base price stated by manufacturers of prefabricated pools includes site preparation and excavation, electrical or plumbing hook-ups requiring work by licensed professionals, finish work, decking and floor drains, sump pumps for pools without plumbed suction outlets, and HVAC units. Payments for permits and inspections, taxes, and the cost of shipment and delivery of the prefabricated pool to your location will probably be your responsibility. Travel and lodging expenses for the manufacturer's installation crew may or may not be included in the quoted price.

Do not forget the weight-load on the floor. Floors other than ground floors may not be able to support the weight of the pool. Water weighs 8.33 pounds/gallon or 62.4 pounds/cubic foot. Your floor will need to safely support from 200 to 500 pounds/square foot. Floors will probably have to be reinforced to support even a small prefabricated pool.

If you are seriously considering the purchase of a prefabricated therapy pool, be sure to compare features of several pools that are on the market today so that you

can make an informed purchase. Each manufacturer includes special or unique features. Features may include movable floors, treadmills, lifts, handrails, exercise bars, parallel bars, seating tiers, underwater windows, hydrotherapy jets, counter-current jets to provide laminar resistance, built-in work stations, underwater cameras, current resistance gauges, treadmill speed gauges, angled plyometric boards, and attachment points for stabilization and support devices. Some manufacturers provide access to all pool functions through waterproof hand-held remote control devices. Some models include computer monitoring, tracking, and documentation of patient treatment, which allow you to repeat treatment protocols, demonstrate progress toward achieving functional goals and outcomes, and show that skilled intervention is taking place and functional gains are being achieved. Some provide printed progress reports for your records and third party reimbursement.

Factory response time to repair equipment breakdowns, the availability of service contracts, and limited warranties should also be considered.

COMMON DESIGN ERRORS

Design errors that are overlooked in the early stages of the design and planning process can cause astronomical cost overruns and may influence the expense and time involved in maintaining and operating the facility for years to come. To avoid typical pool design errors, examine common mistakes made by other therapists when designing their aquatic facilities.

The biggest mistake many therapists make is designing an aquatic therapy facility that is not program driven. One size does not fit all. Know how you plan to use the facility before you design it and prioritize your programming needs. Do not try to make a single, traditional, multiuse pool fit your needs. Make sure you include necessary features in the original design of the pools. If the feature or piece of equipment does not appear on the construction drawings or in the specifications, it will not be part of your facility. Know which items you are not willing to compromise on when a budget crunch occurs and cuts have to be made.

Do not undersize the facility. No one ever complains that their facility is too big. The facility is undersized if it is at maximum capacity within 1 year of opening and the therapist is turning away patients. Common sizing errors include not enough shallow (or deep) water, crowded pump rooms that do not allow proper air circulation around components or provide easy access for maintenance and repair, no provision of off-deck viewing rooms, inadequate storage space, limited convenient parking, and small, poorly laid out locker rooms, which lack amenities and privacy, are inaccessible, and do not accommodate caregivers of the opposite sex.

Just because a therapy pool is relatively small does not mean that only design professionals familiar with small, residential pool construction are qualified to work on your facility. Do not hire local pool contractors, architects, or engineers who have no commercial pool design/building experience, are unfamiliar with therapy programming needs, and have little familiarity with the demands placed on the facility by a successful aquatic therapy practice.

Pay attention to the work environment and the comfort and health of your employees. Poor design of the HVAC and air handling systems, inadequate illumination, and poor acoustical quality will make the facility an unpleasant and unhealthy place of business. Employees will develop health problems related to sick building syndrome and the facility and equipment will rapidly deteriorate.

Hire a qualified, experienced, certified, and/or licensed pool operator to run the facility. Someone must take care of the ongoing day-to-day routine operation and maintenance of the facility. You need a trained operator on site. Having a pool service firm come in once or twice a week to perform minor maintenance is not adequate. Depending on the size of the facility, this may be a full-time job. Do not expect to take care of daily and preventative maintenance on the pools during the hour before you see your first patients of the day.

Do not select and purchase inexpensive residential quality equipment and components just because the pool is small in size. Install commercial grade equipment. The heavy use of warm water therapy pools puts extreme demands on materials and equipment. Frequent breakdowns and repairs can be costly to a business in which therapy cannot be provided when the pool is out of service.

Size equipment and circulation system components to accommodate peak bather loads. Many therapy pools have insufficient water turnover times and flow rates, even though the equipment may comply with minimum code requirements. Chronic water clarity and water quality problems develop as a result of improper filter sizing, media selection, and filter maintenance.

A good rule of thumb is to keep the bather load to total filtered water (in gallons per day) ratio at 1 bather to 1400 gallons or less. The onset of turbidity is constant and related to the number of bathers, not just to turnover time. If debris, including airborne dirt, dust, plant matter, pollen, rain water, and bather waste, is added to the pool water faster than the filter can remove it, turbidity will increase. Here is an example of the calculation of bather load and clarity:

24,000 gallon therapy pool (20 feet wide × 40 feet long × 4 feet deep)

250 actual bathers per day × 1400
= 350,000 gallons/day ÷ 24 (hours/day) ÷ 60 (min/hr)
= 243 gallons/min (flow rate needed to maintain clarity)

24,000 gallons ÷ 243 gallons/min
= 98 min ÷ 60
= 1.64 hours (required turnover time)

Oversized, commercial-quality filter tanks should be installed to remove particles, to keep the nephelometric turbidity unit value below 0.25, and to help keep the water crystal clear. A particular type or brand of filter should be selected based on several considerations, such as the type of filter media used, the cost of purchase, operation, and replacement; the pool size and required flow rates; filter surface area and space requirements in the pump room; ability to get the filter into an existing room; plumbing requirements; filtering capability (size of particle the filter is able to remove from the water) and clarity achieved; the availability of water for backwashing; water disposal restrictions; and the time requirements and ease of maintenance. In addition to filtration, knowledgeable use of flocculents and clarifiers, sequestering and chelating agents, enzymes and absorbent foam products, and secondary nanofiltration or granulated activated carbon filtration systems will help maintain proper water clarity.

Because of lack of education and experience in the area of water chemistry, many therapy pool designers inadvertently install inadequate and unsafe water treatment systems. Stand-alone halogen systems with no auxiliary or supplemental treatment systems are likely to be inadequate. Minimal automation of the chemical treatment process, improper dispensing methods including hand feeding of chemicals directly

into the pool, undersized chemical feed pumps, ignoring water balance, unsafe chemical storage practices, poor choice of chemicals for use in warm water, high bather-load-to-water-volume-ratio pools with heavy organic loading, and estimating rather than calculating precise chemical adjustments all contribute to the water quality problems experienced by many therapy facilities. Many therapy pool operators are not familiar with appropriate chemical ranges or routine or preventative maintenance practices and do not know how to deal with common pool problems such as algae, mineral staining, excessive chloramine buildup, or fecal contamination.

Select appropriate chemicals after a review of your source water chemistry, costs of purchasing bulk chemicals from local distributors, dispensing methods, storage capacity, and safety considerations. Purchase properly sized chemical feeders and top-quality pH/oxidation-reduction potential controllers, and maintain the oxidation-reduction potential at greater than 750 mV at all times to assure proper sanitation and oxidation of pool water. Monitor mineral saturation and keep the water balanced at all times. Purchase good field-quality water testing instruments, test kits and reagents, and air monitoring equipment; test water regularly and record all results. Send samples regularly to the laboratory for microbial testing and analysis to prevent disease transmission through pool water. Learn proper disinfection and decontamination procedures. Use the flowmeters, influent and effluent pressure, and vacuum gauges installed on the circulation system to provide information on the system status. Learn to read a chemical log, to identify common water problems before they get out of control, and to make adjustments as necessary.

Design a facility that is accessible to all patients. The building itself, the therapy pools and services provided, and auxiliary facilities such as locker rooms must be accessible to all users. Many therapy facilities are designed with unintentional barriers. Often decks are too narrow to accommodate users and their conveyances. The need for off-deck space for stowing wheelchairs and walkers and securing guide animals is overlooked.

The purchase and installation of specialized pieces of access equipment may be needed to accommodate participants covered under the Americans with Disabilities Act. Disabled individuals should be able to enter, use, and exit a pool with little or no assistance and without drawing undue or unwanted attention to themselves. Various means or methods of providing safe, comfortable, and dignified ingress and egress for all pool patrons are available. Because of individual differences, more than one modification or piece of equipment may be needed to make aquatic facilities accessible to the entire population.

Follow the swimming pool accessibility guidelines developed by the U.S. Architectural and Transportation Barriers Compliance Board. When only one means of accessibility to the pool is provided, it must be a swimming pool lift, wet ramp, or zero depth entry. Swimming pools with more than 300 linear feet of pool wall should have at least two accessible means of water entry and exit located on accessible routes. The second access method should not be the same as the first method and may include lifts, movable floors, wet or dry ramps, transfer tiers, zero depth entry, or accessible steps.

Many therapy pool designers make poor choices when selecting materials for surfacing pools, decks, locker room floors, and adjacent hallways. Slip-and-fall accidents are the most common reasons for lawsuits being filed in the aquatic environment. It makes sense to install slip-resistance surfaces and provide sturdy handrails in all wet areas of the facility. The coefficient of dynamic friction when wet should not be less than 0.6, regardless of materials chosen. All walking surfaces

should slope $\frac{1}{4}$ inch/foot toward drains and should be designed to prevent water accumulation or puddling. To prevent biofilm growth and the resulting slipperiness, surfaces should be both cleaned and disinfected daily or as needed, using either steam or pool water–compatible cleaning and disinfecting products.

With the rising cost of energy, designing an energy-efficient aquatic facility should be a priority. After staffing costs, energy will be your largest operating expense. Design errors and energy-wasteful choices in the selection of equipment have made the difference between profit and loss for many therapy facilities. Design the layout of the pump room for energy efficiency. Locate the pump room near the pools. Provide space inside the pump room to allow straight pipe runs whenever possible and to eliminate the need for installation of many 90-degree elbows. Oversize the filters. Size the circulation pipe to prevent extreme velocities greater than 7 feet/sec. Reduce head loss and resistance to flow, and select a pump that operates at peak efficiency on its pump performance curve. Install high-efficiency pool water heaters. Natural gas heaters with thermal efficiency ratings of more than 90% are available. Replace energy-wasting, 500-watt incandescent, underwater pool lights with efficient, long-life fluorescent bulbs. Provide windbreaks, and use thermal insulating pool covers or monomolecular film products to substantially reduce energy loss due to evaporation off the water surface.

ESSENTIAL DOCUMENTATION AND OTHER CONSIDERATIONS

Before the facility is opened, staff must be hired and trained, standard operating procedures must be established, and operations manuals must be developed.

In addition to therapists and therapy assistants, other instructors, lifeguards, a pool operator, housekeeping staff, an office manager, and receptionists must be employed. All employees should have training in basic water rescue, cardiopulmonary resuscitation, and first aid; should participate in rescue drills; and should be familiar with the emergency communication system and how to obtain assistance in an emergency. Employees should have the appropriate prerequisite current certification or licensing, attend pre-employment training sessions specific to the facility, and participate in regular in-service training.

A comprehensive policies and procedures manual should be developed for the facility. It should include general information such as the mission statement, a map and directions to the facility, phone listings, general program information and a menu of services, customer service principles, hours of operation, admissions requirements, facility rental information, facility description, facility diagram, and a list of employees.

Employee policies and procedures should be clearly defined. Written job descriptions for each position, an explanation of employee responsibilities, and a list of required certifications and licenses should be included. Pre-service and in-service training requirements, testing procedures, in-house and independent staff auditing, uniform guidelines, staff use of facilities, and employee performance evaluation procedures should be explained. Information on employee benefits, resources and equipment support, absence, vacation, employee substitution, rotation and breaks, and payroll information and procedures should be provided. Employee protection policies dealing with employee accidents and on-the-job injuries, universal precautions, use of personal protective gear, skin and eye protection, and critical incident stress assistance should be described.

Chemical, biohazard, and electrical safety guidelines and procedures for injury prevention should be explained in detail. Closure procedures for inclement weather and weather-related emergencies, natural disasters, fire, chemical spills, and electrical power outages should be outlined.

Explain all therapy practices and protocol. Include lesson plans and details concerning each therapy, program, or procedure provided. List the required qualifications of therapists or employees providing each therapy or type of instruction. Explain patient contact procedures, and list contraindications and prohibited practices.

Maintenance practices and standard operating procedures for each pool and piece of equipment should be enumerated.

Patron surveillance procedures for each area of programming should be spelled out. Include information on scanning and surveillance techniques, surveillance during special activities, guarding zones, the 10/20 supervision rule, rotation procedures, victim recognition, and a drowning overview and timeline. Explain how patients will be supervised, how capacity limits will be enforced, how established facility rules will be enforced, how more serious incidents or undesirable behavior will be dealt with, what circumstances will bring about expulsion from the pool, and when security or police will be contacted for assistance in diffusing an explosive, dangerous, or out-of-control situation. If surveillance of the pool area includes use of electronic or remote devices (alarms, video cameras, closed circuit TV monitors, drowning detection systems, or other security system components) in addition to that provided by personnel, the equipment and its operation should be described.

A list of all facility use rules should be included along with the rationale for each rule.

Emergency procedures and emergency action plans for life-threatening and non–life-threatening emergencies should be explained in detail. Describe your communication system, how to call for help in an emergency, and how to activate the emergency medical system. Provide information on filling out accident report forms, notifying relatives of an injured patient, providing information to the media after an emergency, and emergency follow-up procedures.

Accountability, cash register controls, and loss prevention procedures should be explained. Copies of revenue receipts, deposit slips, fee schedules and waivers, billing codes, and claim forms should be provided.

The final section of the policies and procedures manual should include copies of all forms used at the facility. Numerous records and reports must be kept to provide data for making decisions regarding equipment, personnel, and procedures; to provide data used to determine costs of operation, patron satisfaction, causes and prevention of injuries; as a basis for budget recommendations and justification for future expenditures; to ensure the proper operation of the facility; and to comply with state, federal, and local ordinances. Employees should be familiar with all forms used at the facility and should know how to properly fill them out. Employees should be reminded that records should be completed accurately and on time and never forged or filled out in advance. Records should be stored for an extended period of time in case documentation or retrieval of information is necessary as part of a legal defense if an accident results in litigation.

Examples of the following forms should be included in the policies and procedures manual:

- Employee procedures
- Operating manuals and procedures

- Chemical safety procedures
- Evacuation procedures and emergency plans
- Safety literature and posters
- Model release form
- Request for leave of absence
- Work schedule sheet
- Daily cash receipt
- Pool rental agreements
- Fee waiver forms and log
- Accident report form
- Victim and witness statement forms
- Minor injury report form
- Incident report form
- Agreement to participate
- Liability release forms and waivers
- Patient assessment
- Refusal of emergency medical treatment form
- Blood/bodily fluids contact report
- Notice to our guests
- Verification of employee certification and licenses
- Employee training log
- Staff audit forms
- Employee substitution form
- Daily pool log
- Chemical additions log
- Daily maintenance checklists
- Preventative maintenance checklists
- Seasonal maintenance checklists
- Facility safety inspection checklist
- Swimming pool inventory form
- Equipment disposal form
- Maintenance request form
- Code compliance checklists
- Marketing brochures, advertisements
- Phone call log

CONCLUSION

Aquatic therapy has become a mainstream component of rehabilitation. It is now being used extensively in sports and orthopedic rehabilitation, as well as in the management of many neurologic disorders. The establishment of an aquatics program can be a therapeutically beneficial addition to a continuum of patient care. It can also be economically beneficial to a clinical practice.

As seen from the preceding chapter content, these benefits do not come without effort. The planning and development of an aquatics facility requires foresight, diligence, and care. The maintenance of such a program requires continuous oversight, careful documentation, and meticulous discipline on all matters of safety and hygiene. The rewards are high in terms of patient satisfaction and clinical benefit,

but such a project should not be undertaken lightly. An inadequately constructed pool can be an economic disaster, requiring constant cash infusions and frequent downtime. A poorly managed maintenance program can put patients, staff, and the facility at risk. But with an understanding of the tasks needed to build a successful aquatic therapy program, and consistent attention to the details of program and facility management, the rewards are great.