Design Handbook for Recreational Boating and Fishing Facilities

SECOND EDITION

STATES ORGANIZATION FOR BOATING ACCESS

Design Handbook For Recreational Boating And Fishing Facilities

Second Edition

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SPORT FISH RESTORATION

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Acknowledgement

Publication of this handbook is made possible by a grant to the States Organization for Boating Access (SOBA) from the Fish and Wildlife Service, U.S. Department of the Interior, with support from the Association of Fish and Wildlife Agencies.

In 1989, SOBA published the *Handbook for the Location, Design, Construction, Operation, and Maintenance of Boat Launching Facilities.* This was followed in 1992 by *Guidelines for the Design of Barrier-Free Recreational Boating and Fishing Facilities.* In 1996, SOBA consolidated and updated the material from the earlier two books and published the *Design Handbook for Recreational Boating and Fishing Facilities.* The publication of this new handbook is an update of the previous handbook, which integrates the guidelines to define accessibility requirement for recreational boating and fishing facilities.

A task force was appointed by SOBA that consisted of members having extensive experience in boating and fishing facility design. The task force members were:

- Terry Boyd (Chair), Alabama Department of Conservation & Natural Resources
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Introduction

SOBA is an organization devoted to the acquisition, development and administration of public recreational boating facilities nationwide. SOBA provides a forum for the exchange of views, ideas, concepts and experiences related to all aspects of recreational boating facilities.

SOBA was formed in 1986 primarily by a small group of state boating officials who wanted to promote the acquisition, development, and administration of recreational boating facilities nationwide. Membership is available to all 50 states and territories and includes not only state boating officials, but also consultants, engineering firms, manufacturers, suppliers, publishers and other businesspersons interested in boating access.

> Our Mission
> *To encourage, promote and support federal and state programs that provide safe, high-quality and environmentally sound public recreational boat access to the waterways of the United States and its territories*.

Among the services this organization provides to the states and boating public is the publication of documents dealing with boating access. This handbook is about the design of recreational boating access facilities and provides information on how to accomplish their construction. It also discusses design of barrier-free access to boating and fishing facilities, breakwaters, and certain marina components.

The handbook is not to be used as a design manual or a substitute for the preparation of a design for a specific facility. Each site is unique and requires specific evaluation to determine the most appropriate facilities as well as their design.

This publication is designed to be a learning tool. Although it is addressed primarily to the reader who is new to the field of boating and fishing access and dealing with a broad program established at the state level, it will be invaluable to anyone involved in boating and fishing access in either the public or private sector.

History of Recreational Boating and Fishing Programs and Barrier-Free Access

Boating and Fishing Program Funding

Federal funding for programs to enhance and protect fish and wildlife resources began with the enactment of the Federal Aid in Wildlife Restoration Act of 1937, also called the Pittman-Robertson Act in recognition of its sponsors. The act is administered by the Fish and Wildlife Service (FWS) of the U.S. Department of the Interior (DOI) and provides funding to the states for wildlife restoration projects. The source of funding is federal excise tax revenue.

The popular Pittman-Robertson program has been successful in achieving its goals. To provide similar assistance in a related field, in 1950 Congress passed the Federal Aid in Sport Fish Restoration Act, better known as the Dingell-Johnson Act in acknowledgment of its sponsors. This act, also administered by the FWS, provides that excise tax revenue collected from the manufacturers and importers of fishing rods, reels, and related equipment be distributed to the states for programs to improve and promote sport fishing. The funds are allotted in accordance with a formula based on the number of licensed anglers and the land and water area of the individual states.

In 1984, Congress amended the Dingell-Johnson Act and created the Aquatic Resources Trust Fund through passage of the Wallop-Breaux Act, which provided two new federal sources for funding the acquisition, design, and construction of recreational boating facilities. One source is the Boating Safety Account administered by the U.S. Coast Guard and disbursed to the states to help finance their boating safety programs, of which access (the ability to reach water with a boat) is one element. The second source is the Sport Fish Restoration Account, administered by the FWS. In 1998, Congress mandated that 15 percent of the revenue accruing to this account from various user taxes and the federal marine fuel tax must be expended by the states for facilities from which motorboats are launched for recreational fishing. The states may expend these funds on facilities they develop, own, and/or operate, or they may make grants to local units of government for facility development, ownership, and/or operation. Many states do both. Both the boating safety and sport fish programs require that states match funds received from the accounts, but local as well as state monies may be applied.

These programs provided a considerable incentive to the states to begin or accelerate boating access programs, which, in turn, stimulated interest in the best way to build such facilities. Some information about designing and constructing boat launching facilities is available from states with active programs, but until the States Organization for Boating Access (SOBA) published its *Handbook for the Location, Design, Construction,*

Operation, and Maintenance of Boat Launching Facilities in 1989, there was no comprehensive resource addressing all aspects of the subject, including how to select suitable sites. In the 1989 handbook, barrier-free considerations were not specifically addressed because at that time there were no national design standards for accessible boating and fishing facilities. In 1996, SOBA published the *Design Handbook for Recreational Boating and Fishing Facilities*, which integrated considerations and design efforts in providing barrier-free access.

Barrier-Free Access

In 1964, the historic Civil Rights Act became law. Many people hoped its provisions would be applied to persons with disabilities, but subsequent court decisions established that this was not to be the case. To address this inequity, in 1968, Congress passed the Architectural Barriers Act, which required that most federally owned or leased buildings must be accessible to persons with disabilities.

Pressure continued to build for action to fully establish and protect the rights of persons with disabilities, and Congress responded with the passage of the Rehabilitation Act of 1973. Although this act primarily addressed vocational rehabilitation, it also established new facility access requirements and modified old ones. For example, the Architectural and Transportation Barriers Compliance Board (Access Board) was created to develop standards for the design of barrier-free buildings, walkways, and parking areas constructed with federal funds and to ensure that federal agencies complied.

Section 504 of the Rehabilitation Act extended the mandate for barrier-free access to any facility, program, or activity receiving federal assistance and required federal agencies to adopt implementing regulations. Unlike the 1968 legislation, Section 504 applied not only to buildings, but also to recreation facilities—including those used for boating and fishing. In 1982, the DOI regulations, in compliance with Section 504, went into effect. These regulations, which are contained in 43 Code of Federal Regulations (CFR) 17.200, cover acquisition of new sites, construction of new facilities, and modification of existing facilities.

In 1984, the Access Board published the *Uniform Federal Accessibility Standards* (UFAS), which govern publicly owned facilities. These standards applied principally to buildings and related facilities but did not specifically address recreation facilities. To address this need and to provide assistance to the states as well as to other governmental entities, in 1992, SOBA published its *Guidelines for the Design of Barrier-Free Recreational Boating and Fishing Facilities*.

In July 1990, the Americans with Disabilities Act (ADA) became law. This act amends the Rehabilitation Act by extending the Section 504 regulations and the protection of persons with disabilities to all public facilities and programs, regardless of how they are funded. It also extends coverage to many privately owned commercial facilities, and it confirms and reinforces earlier legislation and regulations concerning barrier-free access.

The ADA mandates that:

> ". . .no qualified individual with a disability shall, by reason of such disability, be excluded from participation in or be denied the benefits of the services, programs, or activities of a public entity, or be subjected to discrimination by any such entity."

As a member of the Access Board put it, "The ADA provides for access by persons with disabilities, not assistance." A qualified individual with a disability is defined by the act as:

> ". . . one who, with or without reasonable modifications to rules, policies, or practices, the removal of architectural, communication, or transportation barriers, or the provision of auxiliary aids and services, meets the essential eligibility requirements for the receipt of services or the participation in programs or activities provided by a public entity."

In 1999, the Access Board issued proposed guidelines for recreational boating facilities for public comment. Many comments were received from around the country, and these comments were incorporated into proposed rulemaking, which was issued in September 2002 and again in July 2004. These guidelines are in the process of being published into final rules to define accessibility requirements for recreational boating and fishing facilities.

The ADA permits recourse against public or private entities by anyone discriminated against by reason of personal disability; government immunity is removed. Successful complainants may collect costs as well as damages. In addition, the U.S. Attorney General is authorized to initiate suit against units of government, a person, or groups of persons where a pattern of discrimination is detected. These penalty provisions mean that the burden of compliance is placed squarely on facility owners, whether public or private. Furthermore, approval of facility plans by a federal agency does not necessarily constitute compliance or automatically provide immunity from prosecution.

Decisions regarding site design under the ADA should be guided by the law's definition of a qualified individual with a disability and also by the requirement that qualified persons be eligible to receive the services or participate in the programs or activities provided. For example, to use a boat launching ramp, an unaccompanied person with a disability must be legally able to operate a vehicle with a boat trailer. This means that access and interior roadways, turning radii, and other components leading to parking areas do not require special design. Special design is necessary, however, for designated parking spaces in areas in which boats are made ready for launch and/or departure, for

access ways to the launching area and other site components, and for **boarding dock**s[1]. Fishing facilities and marinas are similarly affected.

Chapter 7 provides additional information about ADA program requirements.

Photo 1-1 Bank fishing, Roaring Springs, MO

[1] Words in **boldface** type are defined in the Glossary, beginning on page 117.

Chapter 2

Site Master Planning

Master Plan Process

The boating access program must consider upgrades to existing facilities and the development of new facilities. This chapter provides an overview of the site development planning process. The process can be tailored to both a statewide and a local review of boating access facilities and needs, which is commonly referred to as a "boating access needs assessment."

The needs assessment should include an evaluation of the existing facilities, an analysis of potential demands, an assessment of supply to meet those demands, and a study of site-planning concerns related to the development of the required facilities.

Demand Analysis

Demand is usually determined by surveying boaters about where they currently boat, why they boat there, if they prefer to boat elsewhere, where their boating trips originate, and the purpose(s) of their boating. Surveys traditionally query only a sampling of the population of interest, but this sample must be selected in such a way that the results can be generalized to the entire population with a high degree of confidence. For example, people who currently do not own a trailerable boat but would like to own one cannot be surveyed by sampling existing boat owners. Surveys may be conducted by mail, telephone, or personal interview, or by a combination of these methods. Mail surveys tend to be the least expensive, but all types require that the questions be designed with great care and tested on small groups before being used with the full sample.

Reliable survey results are imperative, and reliability of results depends upon two factors: (1) the correctness of the sample population and (2) the accuracy of the questions. Since both factors require a good deal of expertise, it is best to work with people who have experience and skill in designing and conducting surveys. Such individuals often can be found in certain state agencies, universities, colleges, and the private sector.

See Appendix 1 for samples of a Public Boater Survey.

Accommodating Differing Demands

More than one type of water body may exist in an area under study. There may be tidal waters, **impoundment**s, reservoirs, rivers, or streams. The watercraft using these water bodies may include canoes, kayaks, personal watercraft, fishing boats, sailboats, sailboards, rafts, pontoon boats, houseboats, and other vessels. The extent to which specific types of watercraft are involved should be considered when planning a site.

For example, facilities used only to launch canoes or other car-top craft (boats small enough to be transported in or on a vehicle), generally are small and are less expensive to construct than those used to launch boats from trailers.

The potential use patterns revealed by surveys also help determine the types of water bodies on which access facilities should be located. Knowing how boats are used and on which types of water bodies helps determine location, quantity, and capacity of required access facilities. For example, canoes are used mostly on rivers and streams. Since canoes and other car-top craft generally comprise only a small segment of the boating population, the demand for access facilities on rivers and streams may not be as great as for facilities on lakes and tidal waters.

Taking an Inventory of Existing Access Facilities

To determine where boating access facilities are needed, an inventory of existing access sites must be taken. The following survey questions regarding existing sites may be useful:

(1) Where are they?
(2) Are they publicly or privately owned?
(3) What is the anticipated remaining service life of the facilities?
(4) Do they meet appropriate design standards?
(5) If they do not meet appropriate design standards, can they be upgraded?

Questions one and two can be answered by referring to existing lists of facilities. If an inventory is not available, one may be assembled from information obtained from local government agencies, boating organizations, boating magazines, and boating-related businesses. In some instances, a site-by-site survey may be necessary.

Question three is difficult to answer; estimating the remaining service life of the facilities helps in determining their future access capacity. Access facilities might be removed from service due to their age or the transition of the site to an alternative use. As the competition for waterfront property increases, boat launching facilities are likely to remain in operation only as long as there is not a more profitable alternative use of the property.

Photo 2-1 Boat trailers near launching ramp, Green Lake Public Water Access, MN

Questions four and five are best answered by site visits. Those investigating the site should determine whether or not existing facilities meet appropriate design standards, including barrier-free access, and if they can be suitably upgraded if not.

Deciding Upon the Number and Size of Sites

The purpose of conducting a survey and inventorying existing sites is to help boating program planners decide the number, size, and desired location of boat launching facilities required to meet the determined demand. The size of the current boat population and its projected growth must also be considered. Referring to state boat registrations of the past several years helps establish a trend and can project growth. However, where the public does not have the opportunity to engage in boating because few launching facilities are available, surveying a sample of the general population rather than one comprised of only boat owners will yield more accurate results.

Facility size can be determined by establishing such standards as the minimum water frontage desired, the area needed for the intended launching ramp(s) and amenities, and the area required to buffer the site from neighbors. (Additional acreage is required for buffering.) Some boating programs recommend minimum frontages of 50 feet for launching canoes and other car-top craft and 100 feet for facilities accommodating launching larger boats.

If non-boating use (e.g., camping, picnicking) is to be permitted at a site, provisions for such use must be included early in the planning process to assure that proper funding and adequate land is acquired to accommodate it.

If demand cannot be met at a single site on a water body, multiple sites may be considered. To reduce traffic and noise in a developed residential area, it may be necessary to set a limit on the number of craft to be accommodated at a single site. Michigan, for example, limits the size of launching sites on other than the Great Lakes to 100 vehicle-trailer units and assures no greater use by prohibiting parking except in designated areas at the sites. Limitations must be enforceable or they are of little value.

For canoes and other car-top craft, it may be possible to satisfy demand for launch sites through access at arbitrarily specified intervals. For example, if a demand has been established on a river, this demand might be met by establishing new access sites at intervals of four, ten, or more water-miles. Once these sites have been set up, their use can be evaluated and the program modified as necessary.

Photo 2-2 Residential boat dock

A similar approach may be taken on inland lakes. It may be determined that the public should have access to every lake or only to lakes that meet established standards. Site size will depend on the number of boats to be accommodated at one time, which may reflect constraints adopted in recognition of **riparian**s' rights to use the water surface. If this approach is taken, consideration should also be given to whether the configuration of the body of water warrants additional sites.

Locating a site on unprotected shorelines presents special problems. The best sites are those that provide natural protection, such as bays and inlets. Construction of access facilities on unprotected sites usually requires additional structures to provide adequate protection, and additional structural requirements may impact the feasibility of the project.

Making location and size decisions helps a boating program estimate costs and apportion them between land acquisition and facility development. These estimates can be compared with anticipated income or used to request program funding. It is probable that the cost of developing facilities required to meet established demand will have to be amortized over a period of years.

Ownership and Selection of Sites

Publicly or Privately Owned Facilities

Once it has been established that a boat launching facility demand exists, the next step is deciding how the demand will be met. A program might be developed that provides for state or local support, or a combined partnership, to develop the facilities. In making this decision, it must be kept in mind that regardless of the soundness of the program, riparians may prefer that no public boat launching sites be located on "their" water body. They may bring pressure on local government officials to oppose such development. Because of this riparian opposition, a program dependent entirely on local actions often will not succeed in meeting overall boating needs. In such cases, a program that allows for facilities to be administered at the state level, together with a local grant-in-aid program, might be considered.

If there is local support for the boating access development program, needs may be met by providing a partnership or state grants to local agencies. (When local agencies can develop their own facilities, it relieves the state of having to provide them. However, if local agencies simply do not apply for program grants or wish to restrict use of facilities they own to the degree that boating needs are not met, state-owned sites should be developed.)

In some states, grants can be awarded to private facility owners in exchange for a commitment that their facilities operate for a minimum stipulated period. This helps keep existing facilities in long-term operation, reduces state operating and maintenance costs, and brings facilities into the program without the state expense of acquiring land. This approach undoubtedly would require legislative authorization.

Private enterprise generally is not attracted to the development of boat launching facilities because such facilities are not profitable. However, if a launching facility can be combined with the operation of another business, such as a campground, bait shop, restaurant, marina, or general store, the combination may be sufficiently profitable to attract a private investor. Often a group of sites located relatively close to one another may be attractive to a private investor, whereas a single site may not.

Partnerships should be formed to maximize the number of facilities built with available resources. Partnerships between federal, state, and local governments and private corporations, such as utilities, can work together to provide more facilities to the boating public. An opportune time to acquire additional facilities is when power companies are re-licensing hydro dams. New boating facilities can be required as part of the permitting conditions.

Ranking of Water Bodies

Water bodies can be ranked based upon demand and suitability for boating. An important consideration in determining facility location is the proximity to population centers. A larger population presupposes more boat owners and an increased demand for boating access. Population proximity can be expressed in terms of travel time, distance, or both. For example, Ohio establishes site priorities based upon 30-mile intervals from population centers, whereas the Fish and Wildlife Service uses a one-hour travel time.

The potential of a body of water to meet boating needs should also be considered. This may be influenced by the presence of specific natural resources, islands, water depth, water body configuration, navigational hazards and road access to the site. Riparian use also should be considered since it will influence the capacity of the water surface to sustain public boating use.

Competing for Access

The factors that make a body of water desirable for public access make it attractive to private access as well, with the result that property surrounding top-ranking water bodies is rarely available for purchase. This does not lessen the importance of having a systematic approach to deciding on potential sites, but means the state boating program must be realistic about the likelihood of acquiring the most desirable property. A ranking also can be used to show objectors why access is being sought on a particular body of water.

Photo 2-3 Three types of watercraft, Green Lake Public Water Access, MN

Carrying Capacity

The process of determining the **carrying capacity** of a body of water is a complex one. Carrying capacity takes into account social, economic, environmental, and aesthetic considerations in addition to the water body's physical characteristics. There is no single methodology or mathematical formula that yields an absolute and unchallengeable carrying capacity for boating. Nevertheless, many states have developed formulae and methodologies for examining this question on a case-by-case basis. For further information about carrying capacity, refer to reference services maintained by the U. S. Fish and Wildlife Service, Suite 110, 5430 Grosvenor Lane, Bethesda, MD 20814-2158 and SOBA, 50 Water Street, Warren, Rhode Island 02885.

In Minnesota, the maximum number of vehicle/trailer parking spaces permitted under Department of Natural Resources guidelines depends on the size and use of the body of water and its proximity to population centers. For a public boat access site on a moderately sized lake, the minimum is one vehicle/trailer parking space per 20 acres of lake surface area on an unregulated lake (without surface use limitations). If water surface use regulations such as boat speed limits are adopted, additional parking spaces often are added. Such constraints assure riparians that there is a limit to the public access that will be permitted on a given body of water. Access limitation guidelines are suitable for a state like Minnesota that has many inland lakes, but may be too restrictive for states with less water surface.

Michigan, like Minnesota, has a well-established public access program but uses a different approach. In Michigan, state facilities are installed on inland lakes of less than 100 acres only after a determination has been made that the lake can support such uses. On lakes larger than 100 acres, the size of a launching facility is determined by a formula that relates the size of the facility to the size of the lake, although this criterion can be modified to suit local needs.

It should be noted that in Minnesota and Michigan, state law gives the public the right to use the water surface for certain purposes. In disputes over whether public recreation and boating facilities shall be allowed or expanded, the outcome rests on the state's responsibility to provide access to the water surface so that the public right may be exercised. This legal designation may not exist in other states. Boating program managers should become familiar with riparian and water access laws in their own states. For further information, see *Putting the Public Trust Doctrine to Work*, Second Edition, Coastal States Organization, 444 N. Capitol Street N.W., Suite 322, Washington, DC 20001, www.coastalstates.org/pages/pub.html.

How much boating use a body of water can sustain depends on its physical characteristics and the types of boating activity involved. For example, water skiing requires a lot of space, but if it is limited to certain hours of the day and/or days of the week, the water can also be used for other boating activities. Regulating use may influence the capacity of a given area of water for increased boating activity while it may ease the fears of riparians.

Preliminary Site Evaluation

Sufficient preliminary information should be gathered about bodies of water that are potential sites for boat access facilities. Such information can usually be obtained and evaluated without the expense and time involved in having to visit the potential site. See Appendix 2 for Samples of Preliminary Site Evaluations.

Identifying Land Use Opportunities and Constraints

State, county, and area maps provide information about the roads servicing a body of water. Ideally, public access sites should be located as close as possible to an improved road to reduce the expense to the boating access program of constructing and maintaining an access road.

Information from U. S. Coast and Geodetic Survey topographic maps, U.S. Forest Service quadrangle maps, state agency resources, local plat or tax maps, internet sites, Global Information Systems (GIS), or equivalent information can assist in identifying suitable parcels. Most areas of the country have been photographed from the air by federal or state agencies or by private firms. These photographs often are in color and of a scale that makes them useful in determining land dimensions and, in some instances, water depths.

Site Protection

Waves

A boat launching ramp needs to be protected from wave action and, the larger the body of water, the more this is true. The unprotected shorelines of oceans or the Great Lakes are not desirable boat launching sites because of **surf** and **surge**, which can make boat launching and retrieving hazardous. In addition, **shoal**s may occur at such locations.

If natural protection is not present, it may be provided artificially by constructing **breakwater**s or **wave attenuator**s. Since breakwater construction is expensive, cost savings can be realized, particularly on inland lakes, if property can be obtained that is protected by such natural features such as an island or a peninsula.

Wind

If a lake does not offer natural protection, or the most desirable property is not available, an alternative is to acquire property on the shore from which the prevailing wind blows *(See Figure 2-1)*. Prevailing wind data and other information about seasonality of winds may be obtained from the local weather bureau. Since boating is the activity served, information about wind action during the boating season is a primary factor. For example, if the prevailing winds are westerly in the spring, southwesterly in the summer, then westerly again in the fall, property should be sought on the southwest shore of the lake. If no property is available there, the search should be extended to westerly or southerly shores.

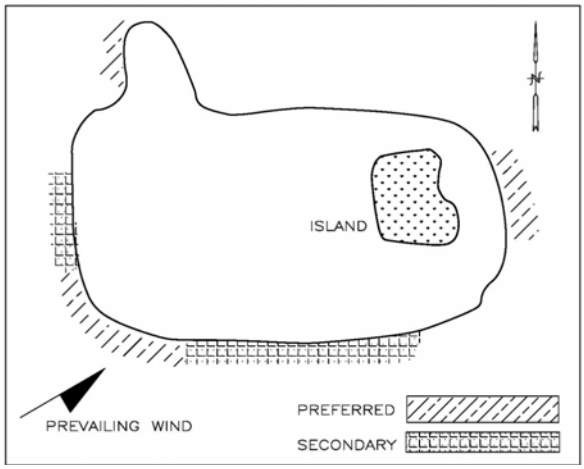


Figure 2-1 Suitable locations for a boat launching site in relation to prevailing winds

The significance of wind direction becomes apparent when looking at the **fetch** for a given water body. (If a lake is nearly round, the fetch will be equal from all directions.) A boat access facility on the shore from which the prevailing wind blows will have no fetch from winds from that direction and will provide safe use for more of the boating season than a site located elsewhere on the lake. *See Figure 2-2* for a table showing the wave heights for a given wind velocity for various fetch distances.

Wake

Consideration must also be given to the effect of wakes on a site, especially if the site is located near commercial or recreational vessel traffic. Wakes affect a location in much the same manner as waves, and avoiding their impact is very difficult to accomplish without constructing costly protective structures.

Fetch (miles)	Significant Wave Height (feet)
1	0.50
5	1.10
10	1.60
25	2.50
50	2.75[a]

SOURCE: Shore Protection Manual, U.S. Department of Army.
[a]Limited by six-hour duration.
NOTE: The givens for this example are (1) constant wind speed of 15 mph, (2) simple water-body geometry, (3) water sufficiently deep to avoid drag being created, (4) wind duration equals hours.

Figure 2-2 Wave height with respect to fetch
(for illustration only and should not be used as a design aid)

Current

The preferred boat access site on rivers and streams is on the **cutting side**, as opposed to the **depository side**. As a river or stream matures, bends may develop or existing bends may be altered. The side of a bend with the strongest current is the most active, and this side is preferred for a launch site because the water is generally deeper and the flowing water reduces shoaling *(see Figure 2-3)*. However, the area where the cutting action is strongest must be avoided because a site located there could be eroded by the natural flow of the river. Observing site stability and erosion during a visit to the site, especially in late spring or early summer, generally will reveal the extent of the cutting action of the current and the best location for the site insofar as the current is concerned.

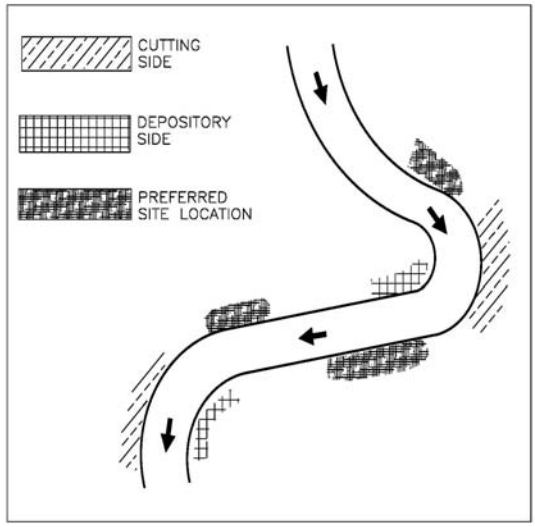


Figure 2-3 Cutting and depository sides of a river that result from the river's current configuration; preferred locations for a boat launching site are indicated

Rivers and streams also are subject to seasonal changes in water elevation and velocity. As the current loses velocity, and/or as **eddies** occur, silt is deposited. A boat launching ramp on a waterway subject to such changes can require expensive, regular maintenance. Currents also can undercut ramps, carry debris, and hamper safe launch and retrieval, factors to be considered in site selection as well as in design.

Water Depth and Fluctuation

In most jurisdictions, charts are available that indicate water-depth contours. The National Oceanic and Atmospheric Administration (NOAA) prepares charts of coastal and Great Lakes areas. River flow and surface elevation information is available from the U.S. Geological Survey. **Bathymetric charts** may be available from state agencies, hydropower authorities, the U.S Army Corps of Engineers, the Bureau of Reclamation, and the U.S. Forest Service. If maps or charts are not available, some information might be obtained by

Photo 2-4 Boat Launching Ramp, Lake Powell, AZ

talking to people familiar with the body of water (e.g., marina operators, local property owners). Aerial photos and dredging records can be used to discover trends. If the body of water is an impoundment, the owner or operator of the dam may be contacted and queried about depths, fluctuations, and water management policies.

The minimum water depth at the end of a launching ramp shall be designed to correspond with the **design low water** for the water body. If a particular location is the only potential site on the shoreline of a highly desirable boating lake, but the design water depth is not available, the location still may be acceptable if it is dredged. Reference should be made to **mean high water** to determine upper limits and to **mean low water** for information about depth history and cycles.

There are instances in which water elevations fluctuate regularly, but predictably, such as in areas influenced by tides and sometimes in connecting water bodies. Also, hydroelectric dams usually cause fluctuations in water levels at least once a day. Schedules may be obtained from the power authority operating the dam or the agency regulating the power company. In impoundments, the water level drop is gradual but usually continuous, with the high generally occurring in late spring or early summer.

Natural water depths fluctuate according to prevailing influences. Precipitation and inflow raise water levels. Evaporation, outflow, and riparian consumption lower water levels. Water levels are normally highest in early summer and gradually drop in the fall or winter.

Virtually all water bodies fluctuate as a result of storms, wind action, and even **seiche**s. Wind blowing directly at a site often causes the water level to rise in proportion to the velocity, fetch, and duration of the wind. Conversely, wind blowing over and away from a site generally causes the water level to drop. In extreme situations, these changes may be significant, resulting in water level fluctuations of five or more feet, up or down, and these water level fluctuations should be taken into account in evaluating a site's suitability.

In general, some fluctuation in water level can be accommodated in the design of an access facility, but where fluctuations are extreme, constructing a launching facility that is functional at all water elevations may not be feasible.

Bottom Conditions

Bottom conditions usually are broadly indicated on charts of a body of water and should be noted, especially shoals, shallow water, rocks, snags, submerged structures, wrecks, piles, thermal springs, unusually deep water close to shore, or any other conditions that can affect facility design and construction. Although the bottom condition of a site can be evaluated by studying charts prior to visiting the site, it should be examined on-site to the extent possible because charts are often out-of-date.

Ice

The northern latitudes are annually subjected to damaging ice uplift forces and thermal expansive forces on fixed and floating structures caused by changing water levels beneath the ice and by wind-driven ice formations. Fluctuating water levels cause the ice sheet to move up and down, resulting in what is referred to as "ice jacking." The ice freezes to the piles or structure, and, when the water level changes, the fixed structures are damaged by being pulled apart or pulled out of the ground.

Photo 2- 5 Ramp damage caused by ice jacking, Steamboat, MN

In northern climates where ice conditions are a factor, it is advisable to check the area for evidence of ice thrust or movement along the shoreline for indications of previous damage from ice forces. Severe ice damage can also be caused by wind-driven ice floes in areas of substantial wind fetch. In such areas, it is advisable to attempt to locate the launching ramp or mooring pier in protected areas. Rapid ice expansion caused by rapid increases in temperature can also do serious damage to mooring pier structures.

Photo 2-6 Ice damage to ramp planks, Steamboat, MN

Launching ramps such as precast concrete-type planks where ice can form between the planks, attach to the planks, and then is subjected to wave or wind-driven forces from open water areas can be damaged when the ramp is uplifted. Floating piers used for temporary mooring in ice areas are generally safe from harm if they are pulled out of the water at the end of the boating season and prior to any ice formation.

Water level changes, which occur due to barometric changes or in areas where waves can be driven beneath the ice cover, can cause uplift forces capable of doing considerable damage to fixed or floating structures left in place without some type of ice-suppression system. Such uplift forces can range from 10,000 to 60,000 pounds or more on an individual pile or equivalent area.

The estimated ice thickness can be computed by calculating the total number of freeze-degree days based on previous weather reports. The following formula can help estimate what is likely to occur during a winter season:

$$h = a\,(FDD)^{1/2}$$

Where: a = locality factor (0.33 to 1.00)
h = estimated ice thickness
FDD = Number of degree days below freezing

As an example, if the average daily temperature is 10° F, this would be a 22° F departure from freezing temperature, which is 32° F (32° F - 10° F = 22°). Totaling these values for every day of the winter, taking the square root of the sum, and then multiplying by a locality factor provides a good estimate of the expected ice thickness. The uplift forces are a function of ice thickness--the thicker the ice, the greater the uplift forces. The foregoing is a simplified example of expected ice thickness estimation.

Fish and Wildlife

The presence of fish spawning or mollusk beds offshore may render a site unacceptable for construction of a boat launching facility. The presence of such areas can be ascertained by checking with the area fish and wildlife agency. The presence and extent of fish spawning areas should be confirmed onsite.

Rookeries or bird nests may occupy potential sites, and if law or policy protects such habitats, the property cannot be developed. Because nesting activity is readily apparent only during the nesting season, it is prudent to ask the area fish and wildlife agency if a potential site is a bird breeding area. Area fish and wildlife agencies also will be able to provide information about the presence on or near the site of game trails and deer yarding (wintering) areas. Site desirability is influenced by the extent to which it hosts such wildlife habitats and how these would be affected by development of the site.

Environmental and Historical Conditions

Environmental factors may influence the utility of a site. Information needs to be gathered about former landfills or toxic disposal sites in the area. Protected plants or other living organisms at or near a site (see “Protected Species” below) need to be investigated and taken into consideration. In addition, wetlands may be present in any area where water meets lands, and a determination needs to be made as to whether or not such wetlands are protected under federal and/or state law. If they are, mitigation may be required.

A potential site may contain features that are listed, or eligible for listing, in a state register or in the National Register of Historic Places. Because features of historic, cultural, or archaeological significance may not be obvious, a state’s historic preservation officer should be contacted for information on the possible historic or archeological significance of a site. Information regarding the National Register of Historic Places is available from the National Park Service, P.O. Box 37127, Washington, DC 20013-7127, www.ncshpo.org/stateinfolist/fulllist.htm.

Protected Species

Potential sites should be investigated for the presence of or proximity to plant and animal species specifically designated as threatened or endangered by, and under the protection of, federal and/or state law. Information about protected species is available from state endangered species programs, the U. S. Fish and Wildlife Service, and private conservation organizations such as the National Wildlife Federation, which have access

to databases of known locations of protected species. If there is a possibility that a protected species is on or near a potential site, a site visit by a qualified biologist may be necessary to make the final determination.

The presence of a protected species may render a site unusable, but not in every case. With proper understanding of the biological needs of the species involved and appropriate modifications in design and construction, it is sometimes possible to develop and operate a boat launching facility without impacting a protected species. In such cases, an ongoing management plan and monitoring program may be necessary to ensure the continued viability of the protected species after the boat launching facility becomes operational.

Barrier-Free Access

New construction and alterations to facilities must be designed and constructed so that they are readily accessible to and usable by individuals with disabilities. This is an important consideration, and any person evaluating a site should be familiar with federal and state accessibility standards (see Chapter 7).

Field Evaluation of Potential Sites

When the Preliminary Site Evaluation described earlier has been concluded, the next step is onsite evaluation. The characteristics of the land and the water at a site should be examined and noted and a rough sketch of the site showing its physical features should be made. This process will reveal characteristics that may render the location unsuitable and characteristics that can be corrected in the design and development phases. A thorough site evaluation conducted in advance of the acquisition process will minimize the risk of acquiring an inappropriate or troublesome site. Samples of evaluation checklists are provided in Appendix 3.

Landside Features

Roads

When evaluating a site, road data acquired earlier and the condition of the roads and their suitability for use by vehicles towing boat trailers should be confirmed. The appropriate transportation authorities should be consulted to assure that adequate sight distances and approach grades exist at the intersection of the entrance roadway and the public highway. If the roadway geometrics are not adequate, it needs to be determined whether the roadway can be improved or developed in an appropriate location.

A site bisected by a public highway should be avoided if it will result in the launching ramp being located on one side and the parking lot on the other. Such an arrangement creates high risk to the safety of both site patrons and highway users.

Obstructions

When entering the property, conditions on and over the site, such as railroad tracks or power lines crossing over the land or the water, need to be noted so that appropriate action can be taken when designing a future project. Many states require a minimum clearance, and some will not allow any overhead power lines on a site.

Environmental Hazards

The site should be investigated to detect evidence of documented or undocumented former uses. For example, if fuel was stored on the site, buried storage tanks may still exist. The tanks may contain petroleum or other toxic products or they may have deteriorated to the point where their contents have saturated the soil. This could preclude development of a site unless the contaminated soils are cleaned up or removed to a suitable disposal facility. It is advisable to conduct soil tests if there is any suspicion that contaminants are present.

Easements and Other Uses

The evaluator should make note of any pipelines, pathways, or other physical evidence of site uses. Pipelines or utility crossings require legal title, and the property title should be reviewed to establish the existence of such rights. If established pathways are noted, try to discover how long and for what purpose they have been used. (This is most easily accomplished by asking the property owner or neighbors.) If the pathways have been used long enough to be deemed **prescriptive**, attempts to close them may result in litigation.

Efforts should also be taken during evaluation to verify the property lines of the site and note any encroachment by neighbors or use of the frontage by others. A survey will likely be necessary to confirm property boundaries. If boats are stored at the location, do recorded easements exist or do the present or former property owners have issued permits for such use?

Natural Features

The site evaluation should include the site's topography and analysis of whether or not it can accommodate its proposed use. For example, it can be difficult and/or expensive to construct launching ramps on very steep slopes, and such topography makes it more expensive to provide barrier-free access.

Evidence of springs, wetlands, marshes, or drainage during heavy precipitation or spring runoffs needs to be uncovered. If the area is known to have seismic activity, a check for fault lines needs to be made, and the presence of trees, other vegetation, and rock outcroppings or boulders should be noted. The suitability of the soil for site development should also be evaluated.

Structures

If structures exist at the location, their presumed use, condition, and size should be noted as precisely as possible. Based on the findings, certain sites may require formal historical evaluation.

Waterside Features

The preliminary site evaluation of a body of water provides data on prevailing winds, the extent and source of natural and artificial water fluctuations, and other factors. The site evaluator may wish to review this information with the property owner or neighbors to detect any hidden problems.

When evaluating the water frontage, the presence of boulders or rock outcroppings on the shoreline or offshore should be investigated. Any aquatic vegetation should be noted. Since such growth often is visible only in mid-to-late summer, this may be another topic to discuss with the property owner or neighbors. The presence of algae or algae blooms often indicates water-quality problems.

Water depths and bottom conditions offshore need to be confirmed and compared with data previously obtained. If the area is known to contain unfavorable soil types, special testing may be required. If ice is normally present during the winter, the water frontage needs to be checked for evidence of ice action, and ice conditions need to be discussed with the property owner and neighbors. Additional topics of discussion may include how a body of water has been used, especially by boaters and even by floatplanes, and whether or not underwater cable and/or pipeline crossings, moorings, and other objects exist.

As previously mentioned, the action of the current should be examined. If a site visit cannot be conducted when the effects of the current will be most evident because of higher water and velocity, it may be desirable to query the property owner or neighbors.

Acquiring Property

All states have policies and procedures relative to acquiring property. At a minimum, a title review or search is required to reveal impediments such as easements, rights-of-way, and permits. Zoning should also be checked. In most states, local zoning does not bind the state, but if the intended use of the location conflicts with local zoning, local officials can be expected, with some justification, to oppose the project. It is a good idea to diffuse this by acquainting local officials with the program and the planned facilities and their operations.

Purchase

It is usually best, and may be required, that an authorized state official do all negotiating with the property owner. Some federal and/or state laws or policies often stipulate that nothing less than the fair market value of the property may be offered to the owner. Some grant programs require that no option be taken and that no price negotiations occur until the project grant has been approved. Other restrictions may be imposed. Before an option is taken, agency personnel should familiarize themselves with all applicable federal and state laws and regulations; otherwise, acquisition may be jeopardized.

Taking an option has several advantages: It relieves the property owner of pressure from people opposed to the property's conversion to public use and it gives the agency time before the acquisition process is complete, to further gauge the property's suitability for the intended purpose by reviewing the project with authorities from whom development and other permits must be obtained. If the boating program determines that it is desirable to issue a public notice of the intended acquisition, an option protects the agency's interest in the property without implying that acquisition will occur without benefit of public input, and it allows time for required public notice and hearings while protecting the acquisition prospect.

It may be in the boating program's best interest to obtain the **fee title** to a property rather than limited rights to it, because the property may continue to be used for public access to water even if, in time, it no longer is used for boat launching. If federal funds are involved in the acquisition, federal program requirements may prohibit limited title rights. However, if something less than fee title is offered by the property owner, there are several possibilities, and each case must be evaluated independently. Most states with active boating programs consider the life expectancy of a boat-launching site to be about 20 years with normal maintenance, and therefore, any land right of shorter duration is of questionable value.

Lease

If full purchase is not possible, a lease of sufficient duration can be an acceptable alternative. A term of 20 years minimum should be sought. Conditions of renewal may (1) require that a specific action be taken by one party and accepted by the other, or (2) stipulate that extension is automatic unless contrary action is taken by either party. Automatic extensions may be for a year-by-year extension or for longer terms. Leases granted by utilities or other corporations to federal or state government agencies often are for a specific term and automatically renewed annually unless terminated by one of the parties.

Gifts

It may be possible to secure property through gifts from a variety of sources, including local hunting and fishing clubs, civic organizations, nature conservancies, private companies, corporations, private individuals, or partnerships. If the property is offered as a gift, it should be subjected to the same evaluation a purchased property would undergo.

Partnership

If a local government agency owns the desired property, it may be willing to be a partner in developing a boat launching facility. This means the property could be dedicated to boating access at little or no acquisition cost to the state. A development grant to the local agency is often an inducement to such participation. If a local agency is unwilling to sell or participate, other possibilities such as leasing the site from the local agency should be considered. Projects developed cooperatively between state and local government are viewed positively by state legislators and may result in increased program support.

If a body of water is an impoundment used for generating power, the Federal Energy Regulatory Commission (FERC) probably issued the operation permit or license. One condition of such licenses generally is preparation of a recreation plan. The licensee may be obligated to provide public access, including boating access, to the body of water. If such a requirement exists and is not yet being met, the state should contact the licensee. Some states have agreements with power companies or other licensees to provide, at the licensee's expense, access facilities on lands owned by the licensee. After the initial development, the state and the licensee operate the facilities on an agreed cost basis.

If a federal agency owns a potential access site, the agency should be contacted to ascertain the possibility of acquiring a permit, lease, or a conveyance of fee title to the property.

There are other alternatives to a state's having to directly acquire property. For example, various private environmental or recreation entities exist for the purpose of acquiring properties not otherwise available to government agencies, and such entities either lease the property to the agencies or hold the property until funds and/or authorizations to purchase can be obtained.

Photo 2-7 Park entry sign, Melford, DE

It may be possible to secure property with a **reverter** clause in the deed calling for return of the property if and when it is no longer used for the stated purpose. This is often the case when property is being offered as a gift. Before the property is accepted, legal counsel should review the reversionary language carefully to assure that it does not unduly restrict future development and use. Occasionally, property will be offered, usually by sale, with a life estate condition, that is, that the seller and/or another title holder be permitted to live out his/her life on the premises before possession can be

taken. This circumstance delays use and occupancy of the premises, but it also reduces the initial purchase price and assures that public use will ultimately occur.

Road rights-of-way may be available for use as boat launching sites, depending upon the language of the deeds and/or easements conveying the road interest. For example, Section 147 of the Federal Aid Highway Act of 1976 permits the Secretary of Transportation to authorize construction of public boat launching facility access roads adjacent to **bridge**s being constructed, reconstructed, replaced, repaired, or otherwise altered on federal primary, secondary, or urban systems. The Federal Highway Administration and the U.S. Department of Interior, with respect to such facilities, have adopted a formal *Memorandum of Understanding*. Copies of this document are available from the U. S. Fish and Wildlife Service.

Condemnation

The right to condemn property for public use may be a provision of the legislation that created the state agency or program administering boating access programs. If so, the specific procedures to be followed in exercising the provision are generally delineated by statute or court decision. The procedure usually requires a finding that no alternative exists and that there is a public necessity for the condemnation. Condemnation should be the alternative of last resort. It is a complicated and time-consuming legal process, and it is unpopular because it forcibly takes away property against the desire of its owner. Condemnation should be undertaken only after careful review of all options, including failure to secure access to a particular body of water.

Occasionally, there will be instances when both parties desire a friendly condemnation procedure. For example, the property owner may have title problems that would be best resolved through condemnation and may agree to, or even suggest that, condemnation proceedings be invoked to resolve them. In such cases, necessity and price may be stipulated, speeding the process.

Considering Objections to Boating Access

When the inventory has been completed and the need for boating access determined, how the demand for launch sites is to be satisfied can be decided. The views of those who oppose development of boating access must be considered in this process.

The most likely opponents to development of specific access sites are property owners with riparian rights to the body of water. They may view a public launch site as a source of boaters who will compete with them for the use of the water. They generally resent such competition, believing that they have greater rights to use the water because they purchased their property and pay taxes on it, built their own docks, were there first, etc. Riparians also fear that the public will overuse their body of water and that it will be difficult or even dangerous for the riparians and the public to use the water at the same time. Riparians may also feel that public use of the water devalues their investment and diminishes enjoyment of their property.

A boating program should consider input from all stakeholders, including those that may oppose the project. Persons opposed to a program supported with public funds have many opportunities to express their opposition. The boating program should consider project modifications that address objections raised by project opponents.

The following are typical objections that might be raised in opposition to the development of an access facility:

- New (or additional) public boating access facilities will overburden the lake's boat-use capacity.
- Outboard motors will pollute the water with oil, gas, exhaust fumes, grease, and battery acid.
- An access site will be an unacceptable intrusion on the shoreline vista, will result in an ugly eyesore, and during construction will pollute the water with concrete slurry sediment from erosion, and so on.
- Public boat access facilities will result in an undesirable introduction of nuisance aquatic vegetation, fish, parasites, disease organisms, and so on, transported on boat hulls, motor propellers, and trailer frames.
- Public boating facilities will attract all sorts of abuses (litter, trespass, teen parties, vandalism, and noise 24 hours a day, 7 days a week, all year).
- The wake from more boats will erode shorelines, damage shoreline structures, destroy aquatic vegetation/wetlands, disrupt wildlife, stir up sediment in shallow areas, and so on.
- Directly or indirectly, a public boating facility will degrade or destroy fish, wildlife, and other organisms (plant and animal), especially endangered or threatened species.
- "Our lake" is private, and the state has no right or obligation to make it accessible to the public by building and operating a boat access facility.
- Property values will decline if public access facilities are developed on "our lake."
- Developing the proposed site will mobilize and redistribute a host of toxic substances (pesticides, herbicides, industrial chemicals, and heavy metals) that will contaminate fish, wildlife, vegetation, water, and so on.

Riparians and others may employ various tactics to defeat development of a public boat launching site. Such tactics may include the following:

- Forestalling property sales to the state through lake community peer pressure and/or private offers to purchase for more than the fair market value offered by the state

- Claiming the water is not navigable and, therefore, the public has no legal right to use it

- Attempting to have various restrictions imposed on the use of public boat access facilities (e.g., a ban on motors, limitations on horsepower, boat size/type, or hours of use and/or requirements that fees be paid or permits obtained)

- Forming a special assessment district (SAD) under state and/or local laws, whereby the proposed boat launching site can be purchased by the district and any use thereafter is limited solely to property owners (the intent of the law permitting the formation of such districts usually is to provide for weed control or similar improvements to the water area of a lake, but many SAD statutes are sufficiently broad to allow them to be used to defeat public access).

While care should be exercised not to prematurely reveal the agency's interest in a parcel of property, the boating program should have in place and consistently follow a full public disclosure and input process on program activities and specific projects. This will encourage the exchange of information with stakeholders and can result in positive legislative reaction and public support. However, it is prudent to delay full disclosure until an option to purchase a specific parcel has been obtained.

Most public boat access programs are based on state constitution or law that vests in the public the rights to water, bottomlands, or fish and wildlife resources. It is on this premise that public use of a given body of water is justified.

Coordinating Boating Programs With Other Needs

Other state recreation or environmental agencies may have needs that can be incorporated into boat launching site plans, and the boating program should accommodate the needs of other agencies wherever possible. For example, a fisheries agency may need bank fishing sites or a wildlife agency may need waterfowl hunting access. Funds from other programs may be available to defray the costs of meeting joint needs.

Some states have a central planning process or a recreational planning agency, and only a single inquiry may be necessary to obtain information about the water access requirements of other programs. In other states, the administrator may have to individually query the agencies that might be interested in participating in a joint-use boat launching site. Whether or not they can be accommodated in a boat access site, the needs of other agencies should be identified and evaluated as to compatibility.

Chapter 3

Designing and Constructing Landside Facilities

This chapter provides an overview of the design and construction of landside components. Boat launching facilities must have at least four features to serve their intended function: (1) an access road, (2) interior roads, (3) parking, and (4) a launching ramp and/or **carry-down area**. Optional features include boarding docks, maneuvering areas, and **make-ready area**s. In addition, such user amenities as attractive landscaping, restrooms, pumpouts, dump stations, fish cleaning stations, walkways, and picnic areas may be provided. Facilities also may include such administrative amenities as a gatehouse, a maintenance garage or building, or an administrative building.

Fishing facilities require (1) an access road, (2) parking, and (3) access to the water. The latter may be from the shoreline or from a pier, dock, **bulkhead** (seawall), or breakwaters.

Photo 3-1 Bulkhead ramp site, Ocqueoc, MI

The Americans with Disabilities Act (ADA) requires most boating and fishing facilities to be barrier-free, that is, free of impediments for safe use and passage. Typical barriers are the absence of cuts in the curbs around parking lots, improperly surfaced walks and decking, steeply graded access ways, and poor transitions from pathways to such structures as **fishing pier**s, boat docks, and fee collection stations. Design details regarding accessibility requirements are addressed in Chapter 7.

Photo 3-2 Fishing pier, Woodland Beach, DE

In designing a boat launching or fishing facility, both the desired initial and the ultimate demand should be determined. Although total capacity may not be achieved initially, interior roadways and parking configurations may be altered to accommodate facility expansion more easily if the potential for it is incorporated into a facility's initial design.

Depending on the scope of the proposed project, qualified people should prepare plans and specifications. Many states have statutes requiring that plans and specifications for public projects costing more than a given amount be prepared by, or under the supervision of, registered engineers or architects. Federal agencies may impose a similar requirement.

Permits

To construct a boating or fishing facility, various federal, state, and local permits will be required. The conditions that must be met to obtain the necessary permits should be determined early and kept in mind during the site evaluation and facility design processes (see Chapter 2). Obtaining permits is a critical step in the implementation of the project. The permitting process can be lengthy and requires diligence from the onset. To terminate a project because of a permit problem wastes time, money, and credibility.

Access Roads

Entrance Locations

Contact your state or local road authority for requirements regarding safe sight distances from both directions. Such requirements may influence where an access road can intersect the public road. The need for a deceleration or left-turn lane for vehicles entering the site also may influence the location of an access road. Some states require a plan and permit application for this type of work.

Design

Access roads typically consist of two lanes totaling 20 to 24 feet in width, with recommended grades not exceeding 10 percent. Although a two-lane access road is preferable, a single-lane road may be adequate if the traffic is light and the approach is long. In such cases, the access road should be a minimum of 12 feet wide and have pullover areas at suitable intervals to allow other vehicles to pass. Adequate shoulders should be provided for emergency parking. If the road must cross drainage ditches, culverts or bridges will be necessary to prevent the road from acting as a dam.

The access road should be crowned (rounded upward toward the center) slightly to facilitate drainage of rain or melting snow. The normal crown is a minimum of 2 percent of grade for **asphalt concrete**, concrete, **chip and seal**, and similar surfaces and 3 percent of grade for gravel and other unpaved surfaces.

Materials

Photo 3-3 Geotextile fabric being installed

Access roads may be gravel or paved. Although it is more expensive, paving is preferred. Paving generally requires a 4- to 12-inch base of such material as gravel, crushed rock, cinders, or oyster shells, depending on local soil conditions. Where **soil strength** is low, it may be advisable to install a **geotextile fabric** over the natural soil before laying the base to improve bearing capacity and prevent soil separation. Because most paving materials are flexible, a surface will be only as good as its base. If the base is not properly drained, the weight of vehicles will cause water to be pumped from the base into the surface paving, which will quickly destroy it.

The typical surface treatment for access roads is asphalt concrete pavement. It is less expensive than Portland Cement Concrete, more durable than chip and seal, and may have a life expectancy of 15 or more years. Asphalt concrete, which requires a base as described above, should be 2 to 4-plus inches thick, depending on soil conditions, climate, drainage, road use, and availability of materials. Because the type of asphalt concrete, the size of the **aggregate**, and the thickness of a paving section vary to accommodate local conditions, local highway department pavers should be consulted about the best design specifications for a project. For example, a road in the Arizona desert, where summer ground temperatures often reach 160º F, will require different paving from that of a road in Maine, which is subject to snow, ice, and very cold temperatures.

Overhead Obstructions

To accommodate vehicles and vehicle–trailer units, an access road must be clear of overhead obstructions. Trees and structures such as bridges or pipelines should have 14½-foot minimum vertical clearances. For further information, see Overhead Clearances.

Information and Communication

Signs advising of regulations or communicating warnings and other traffic information should conform to the uniform sign system of the Federal Transportation Department's *Manual on Uniformed Traffic Control Devises* (MUTCD) to ensure consistency in the shape and wording. For more information on MUTCD, contact www.mutcd.fhwa.dot.gov.

It may be desirable to standardize the type, size, design, and construction materials for special signs to be used at boat launching facilities. Some granting authorities also impose sign requirements—some applicable during construction of the project, some applying upon completion of construction, and some covering both periods. These requirements should be confirmed with the granting agency before proceeding with project construction.

Facilities that are fully accessible or that have barrier-free components should be delineated by the presence of the international symbol of accessibility on the entrance sign. Travel planning for people with disabilities is greatly enhanced if statewide listings of barrier-free facilities and facilities with barrier-free components are available. States are encouraged to publish such directories and to describe individual facilities adequately, insofar as their barrier-free components are concerned.

Parking Lots

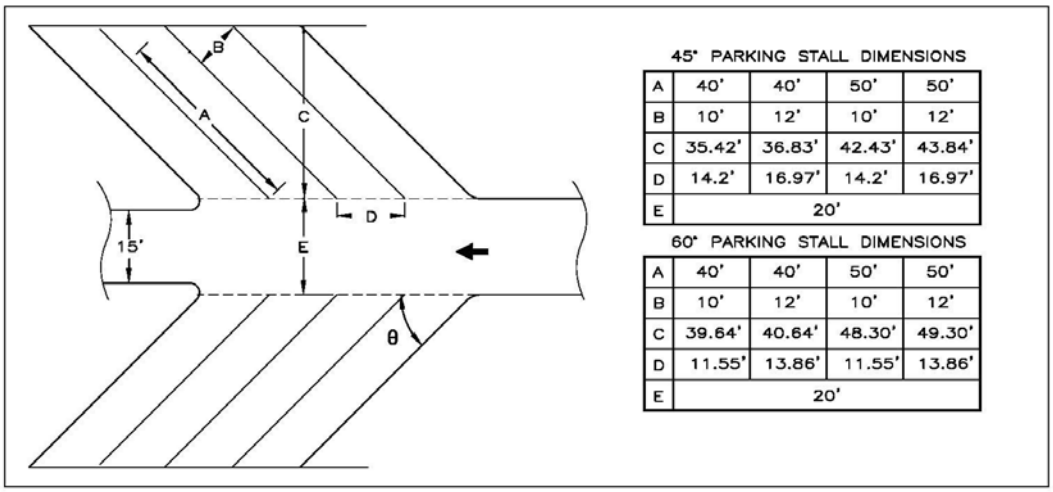
The parking area should be situated as close to the ramp area as possible. Topography will determine the most feasible location for the parking area.

This section will address the design issues related to drive aisles and number and size of spaces as well as site grading and material selection.

Photo 3-4 Aerial photo of parking area

Drive Aisles

One-way drive aisles should be a minimum of 15 feet wide, but within parking areas, they should be 20 feet wide *(see Figure 3-1).* Two-way drive aisles should be 20 to 24 feet wide. The grade of any roadway or aisle should not exceed 10 percent. The drive areas should be designed with sufficient room for turning maneuvers for these larger vehicle combinations *(see Figure 3-2).* A minimum outside turning radius of 30 feet should be provided at the end of every parking row to enable vehicle-trailer units to turn with ease and safety.



45° PARKING STALL DIMENSIONS

A	40'	40'	50'	50'
B	10'	12'	10'	12'
C	35.42'	36.83'	42.43'	43.84'
D	14.2'	16.97'	14.2'	16.97'
E	20'			

60° PARKING STALL DIMENSIONS

A	40'	40'	50'	50'
B	10'	12'	10'	12'
C	39.64'	40.64'	48.30'	49.30'
D	11.55'	13.86'	11.55'	13.86'
E	20'			

Figure 3-1 Dimensions for parking at 45-degree angle and 60-degree angle

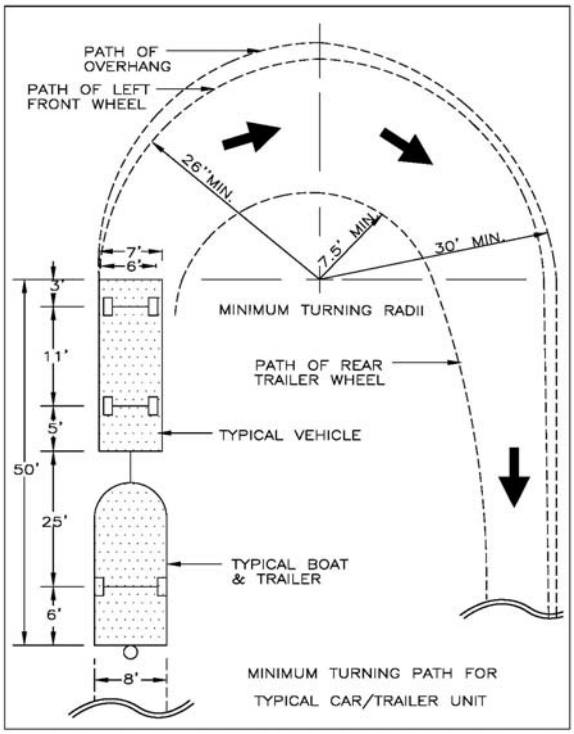


Figure 3-2 The minimum turning radius for a vehicle-trailer unit

Number of Spaces

At a recreational boating facility, projected user turnover is one criterion to use in determining the necessary number of parking spaces. High turnover occurs where the average boating use is relatively short-term and vehicle-trailer units are parked at the site for only part of the day. At such sites, 20 to 30 parking spaces per **launching lane** are usually adequate. Facilities with low turnover may require 30 to 50 parking spaces per launching lane because users' vehicles are parked longer. As a general rule, people use boats for shorter rather than longer periods of time, so at most facilities, parking, as well as all other features and amenities, will be actively bused.

Special facility features, such as boarding docks and make-ready/**tie-down area**s that ease and expedite launching and retrieval increase the number of parking spaces needed because more people can use the site.

At fishing piers that have both sitting and standing stations (the area used by one angler), the guideline is one parking space for every two fishing stations. If the pier is in a highly populated area or otherwise is expected to be popular, more parking capacity may be necessary.

See Chapter 7 for the number of accessible spaces required.

Dimensions and Delineation of Spaces

To accommodate standard vehicle-trailer rigs, boat access facility parking spaces have historically been a minimum of 10 feet x 40 feet. The average size of tow vehicles and vessels has increased over time; therefore, the minimum dimensions of 12-foot x 50-foot spaces should be considered and then confirmed with the anticipated use of the facility. If there are constraints on space available for parking, the design should consider a mixture of parking space sizes.

To accommodate recreational vehicles towing trailers, parking spaces should be 12 feet x 50 feet. In coastal areas where boats may be 30 to 40 feet in length, one should consider having some larger parking spaces (14 feet wide x 60 or even 70 feet long). At boat access fishing facilities and marinas, vehicle-only parking spaces typically are a minimum of 9 feet x 18 feet. The size and depth of the water body may also have a bearing on the size of boats using the facility.

Parking spaces may be designed so that a vehicle-trailer either can be pull-through or pull-in/back-out. The pull-through layout uses more space but is easier to use. If the parking configuration requires vehicle-trailers to make 90º turns, a 30-foot-wide drive aisle is required to allow ingress to and egress from parking spaces. Angled parking is typically used for pull-in/back-out configuration to provide more parking spaces in confined areas. The drive aisle widths in angled parking layouts are determined by the orientation of the parking spaces.

Parking spaces should be delineated to assure efficient use of the parking lot. If the parking lots are paved with asphalt concrete or other hard surfaces, markings can be easily painted on the surface with traffic paint (contact your local highway department for specifications). Heat tape striping is best but more expensive, although it is not recommended in areas where snowplows will be used. If gravel or similar material is used, marking is more difficult; concrete, metal, plastic, or wooden wheel stops may be placed at the head of each space to indicate the desired parking angle. Wheel stops are not as efficient as lines on the parking surface, which also delineate the sides of the parking space, and wheel stop installation and maintenance is expensive. Stops along the sides of the parking space are the most difficult of any delineation to maintain. Stops should be spaced at least 3 feet apart to permit passage of a wheelchair.

If a site is to be open to use during the winter and snow plowing will be necessary, or if silt and debris removal is anticipated due to high-water events, using wheelstops to delineate parking is not recommended. Wheelstops displaced and/or damaged by maintenance equipment may need to be replaced every spring.

Grading and Materials

Parking areas should be graded so that rain and snowmelt will run off. Whether the area is paved or unpaved, the preferred finished grade is a minimum of 2 percent, and within parking spaces designated for disabled people, the grade shall not exceed this percentage.

Parking lots can be surfaced using various materials such as gravel, chip and seal, asphalt concrete, Portland Cement Concrete, pavers, or other permeable materials. Permeable materials should be utilized, to the extent practical, to minimize runoff and protect the water quality of the adjacent water body. Refer to the Access Roads, Materials section for base and surfacing requirements.

Photo 3-5 Permeable pavers, Dauphin Island, AL

Overhead Clearances

Under most circumstances, overhead power lines should not be permitted across a site. Alternatives include burying the lines or realigning them around the property. Overhead, they are a particular hazard to sailboat users because if a sailboat is transported on a trailer, its mast must be raised before the boat is launched and lowered after it is retrieved. Underground utilities should be considered at sites that will be frequently used by sailboats.

If a power line does cross a site, even if it conforms to the minimum clearance prescribed by the state power regulatory authority, a sign clearly warning of its presence and the possible danger it poses should be conspicuously posted.

Curbing

Curbs have many valuable uses, not the least of which is to keep site users from parking in other than designated areas, particularly when a facility is being used to capacity. Curbs also are useful in controlling drainage, delineating medians and traffic islands, and controlling and directing traffic. When designing curbs at a facility, consideration must be given to environmental conditions such as snow, silt, or debris removal.

Photo 3-6 Cast-in-place concrete curbing

Curbs can be of various materials and installed using various methods: slip-formed, cast-in-place, extruded, and pre-cast concrete; asphalt concrete; rock slabs; or timber. Concrete curbs are common and are useful for medians, traffic control islands, and protecting landscape. Cast-in-place concrete curbs necessitate constructing forms on site. Mechanically extruded curbs, in sufficient quantity, may cost less per foot than cast-in-place curbs. Extruded concrete curbs are set in place by self-propelled machines and can be placed directly on asphalt concrete or concrete pavements.

Asphalt concrete curbs serve the same purpose as concrete but cannot take wheel loading because the asphalt concrete becomes soft in very hot or sunny climates. Rock or granite slabs are useful for medians, islands, and landscaping and they work well in any climate, although in northern areas they must be placed in such a way as to withstand ice action. Timber is useful for medians, islands, and landscaping. Alternatives to curbs include rocks, guardrails, posts, and posts linked with cables or chains.

Photo 3-7 Rock curbing, Pine Hill Lake

A ramp or curb cutout must be installed wherever an accessible route crosses a curb. See Chapter 7 for accessibility requirements.

Special Purpose Areas

Turnaround/Maneuvering

A turnaround or maneuvering area at a launching ramp facilitates the flow of vehicle-trailer traffic. If a circle is used, it is recommended that a 60-foot minimum outside diameter travel way be constructed. A turnaround can be part of the **vertical curve** at the beginning of the ramp and should be aligned with the ramp. This is recommended to provide maximum visibility to drivers. Traffic approaching the ramp area should be directed counter-clockwise, but whichever way ramp traffic is directed, the direction should be continued through the parking area for drivers' ease in using the facility.

Make-Ready/Tie-Down/Wash-Down

Make-ready/tie-down areas should be considered for sites having parking for 25 or more vehicle-trailer units. Boaters use these areas to prepare their craft for launching and after the boat has been retrieved, to tie it down for travel from the site. Such areas can be near the ramp or launching area or adjacent to the roadways leading to and from the ramp. They greatly enhance the efficiency of a launching facility because they help keep the ramp open for launching and retrieving boats. This is a convenient location for the placement of amenities such as trash receptacles, public telephones, and information kiosks.

Wash-down facilities, which may be separate from or combined with a tie-down area, are provided at sites to (1) prevent the transport from or to facility waters of exotic species of plants or aquatic species and pathogens, and (2) enable boaters at ocean sites to rinse the salt off their craft and flush their engines with fresh water. One disadvantage to wash-down facilities is that the local health code may require that potable (safe for drinking) water be used. Another disadvantage is drainage, which is discussed under the “Storm Water Control and Site Drainage” section in this chapter.

These special-purpose areas are most useful when located near the launching ramp and parallel to the ramp entrance and exit roads. They are appreciated by users and if the areas are as near as possible to such amenities as restrooms, telephones, and information signs, turnover time is reduced. The areas should be a minimum of 12 feet x 50 feet and have a hard or compacted, slip-resistant surface. If the areas are to be barrier-free, the dimensions should be 15 feet x 56 feet, providing clearance around a vehicle-trailer combination to allow enough room for a person to move around the trailer when making the boat ready for launch, tying it down for departure, or washing it.

Tournaments/Special Events

Photo 3-8 Fishing tournament, Joe Wheeler State Park, AL

Some states, counties, and/or local governments have begun providing tournament/special event sites. They have done this by constructing new sites and/or renovating existing sites to accommodate these activities. The parking lots for these sites should be large enough to accommodate a minimum of 200 vehicles with trailers. Some tournaments may require 300 or more. It is recommended that the ramps be 60 feet wide and divided into 15-foot lanes by using stripes. If provided, courtesy docks should be located along the outer edge of the ramp.

Large national tournaments require a weigh-in area, bleachers for spectators, a staging area with power and water to facilitate tournament trailers, spaces for vendors, pit crew areas, and ample parking for spectators. If restrooms are not provided, portable restrooms must be provided for these events. Some tournament sponsors will provide portable restrooms if the access owner is not able to do so. Those who are considering building such facilities should contact their local or national fishing clubs to solicit their advice.

Tournaments can provide a positive economic impact to the local economy, so partnering with a local government or organization to build such facilities may be feasible. These sites provide great access to the general boater as well as to the tournament or event user. The general public should not be denied use of these facilities during any event, and, if it is necessary to close the site to the general public, they should be notified and given directions to other boat ramps in the area.

Storm Water Control and Site Drainage

Water Quality

The need to protect our waterways is as important as providing access to them. The protection and preservation of water quality for a given location must be considered in the same manner as all other design aspects are considered. The storm water pollution control effort is the result of three decades of legislative effort beginning with the 1972 Federal Water Pollution Control Act, subsequently known as the Clean Water Act (CWA). For further information on this regulatory legislation and its history, see www.fws.gov/laws/lawsdigest/fwatrpo.html.

When discussing water quality protection measures, it is helpful to think about **management measures** regarding water flows and drainage of the site. These measures are generally referred to as Best Management Practices (BMPs), and they can be divided into two broad categories. Structural BMPs are those that represent physical structures and devices installed to treat, detain, or divert water flows at the site. Nonstructural BMPs are generally those design measures that are incorporated to reduce or redirect flows through the site.

For the purpose of this discussion, *water flows* refer to storm water flows and drainage patterns at the site.

Design

The design process should first determine if current permits are in place for the site that allow for storm water discharges in compliance with the National Pollution Discharge Elimination System (NPDES). NPDES permits issued by state or regional Water Quality Control Boards provide the most efficient and effective means of reducing storm water and urban runoff pollution and meeting area permit requirements.

Initial site planning and design efforts should identify those nonstructural BMPs best suited to reduce or improve site drainage conditions by minimizing the amount of runoff produced at the site. Reducing runoff includes selecting appropriate grading and suitable materials and being aware of drainage patterns. Runoff volumes must be kept as low as possible by minimizing the amount of impermeable surfaces while maximizing the use of permeable surfaces.

The next step in the process is to develop and incorporate structural BMPs to be included in a drainage system that treats water flows by removing pollutants prior to discharging the water flows into the water body.

Non-structural BMPs consider that the site grading plan should be modified or developed to ensure that the site drains away from the water body. Methods should be incorporated to ensure that drainage flows are not allowed to pass directly to the receiving water body. For newly developed sites, landscape areas should be included as a primary treatment of filtration process. Landscape areas with natural vegetation can filter silt, debris, and many chemical contaminants.

After collecting the flows from these landscaped areas, structural BMPs, such as the use of open channels, are implemented as the next stage in the conveyance and treatment process. Depending on the flow rates, a swale or open channel is useful for collecting further site flows. The swales or channels can be **bioswales** or revetted channels rather than a concrete channel to allow for further percolation.

The flows can then be collected in a **catch basin** to direct them to the outlet structure. The catch basins can be designed to include filtration devices for the removal of debris and other contaminants.

Storm Water Treatment

There are numerous methods and devices available for the treatment of storm flows, and the process for selecting the appropriate measures begins with identification of the pollutants of concern. This includes understanding the uses of the site, which pollutants are likely to be generated, and the capability of the receiving water body to deal with potential contaminants. It must also be determined if the receiving water has already been impacted by an individual or by a range of contaminants.

Photo 3-9 Settling Basin, Green Lake, MN

Based on the projected storm water flows, devices are included and sized to accommodate the anticipated flow rates and the estimated volume of material to be generated by the site. Local jurisdictions will have specific requirements for the flow rates that must be treated. For example, it might be a requirement that all water generated in the first 15 minutes of the **design storm** event or the first ¾-inch of water that falls must be treated. These requirements can very from region to region.

Various types of storm water treatment devices include the following:

Storm drain inlet filters – to trap debris and hydrocarbons
Settling basins – to remove suspended solids
Debris collectors – to remove trash and inorganic debris
Oil water separators – mechanical vault designs or filter media
Filter media – to remove target pollutants
Retention ponds – to control flow rates into the receiving water body

Construction

Photo 3-10 Construction of a storm water control basin, Green Lake, MN

Control of runoff during the construction process is very important. The construction contract generally requires that a Storm Water Pollution Prevention Plan (SWPPP) be developed either by the engineer or the contractor and implemented throughout each phase of the construction. The purpose of the SWPPP is to ensure that excessive pollutants are not generated during the construction process or by storm events that occur during construction. The areas of concern include, but are not limited to, the erosion of the site and runoff that would include high volumes of sediments. For projects in and adjacent to water bodies, contractors must control the site work to assure water quality and control turbidity. The contractor is also required to maintain the equipment and the construction yard in a manner that ensures that no oils, fuels, or other construction materials are introduced into the storm water runoff. The designer is referred to the EPA website for regulations regarding SWPPP: http://cfpub.epa.gov/npdes/stormwater/swppp.cfm.

Operations

While much effort goes into the design and development of the storm water and drainage systems, these facilities must be maintained and remain in effect for the life of the project. Maintenance crews must be trained to understand the functions and maintenance requirements of the devices—whether it is the maintenance of a vegetated bioswale, the cleaning and replacement of filter media in a storm water treatment vault, or the process of cleaning out storm drains.

The most important task for the area maintenance staff is the visual inspection of the site to remove trash and debris and to spot hazards before they can become a pollutant.

For more information, see *Guidance Specifying Management Measures for Sources of Non-point Pollution in Coastal Waters*, an EPA publication (EPA-840-B-92-002, January 1993) at www.americanboating.org/chapter5index.asp.

Access Ways

Access ways provide connections between site elements such as parking areas, restrooms, and ramp areas and are considered site elements themselves. The designer should carefully consider the routing of users through and around the site.

Access ways should provide hard slip-resistant surfaces such as concrete, asphalt, highly compacted gravel, or decking. Access ways should be evenly graded to provide easy walking access and drainage.

The route location should remain clear of obstacles such as overhead clearance restrictions or areas of poor visibility. Open and well-illuminated areas provide the best visibility as well as security.

Refer to Chapter 7 for additional requirements related to accessible pathways at a facility.

Site Preparation Considerations

Before construction can begin on roads and parking areas, the site must be graded to the design topography.

Controlling Runoff

Federal, state, and/or local regulations, through the SWPPP, require that silt be prevented from running into adjacent waterways during construction. There are several ways to control runoff, including constructing temporary dams in runoff areas or covering bare surfaces, which are particularly prone to erosion, with straw or similar material. Soil erosion and sedimentation control permits are often required before construction may begin and the regulating authorities should be asked for suggestions about preferred runoff prevention methods.

Photo 3-11 Slope erosion control, Stevenson, AL

Buildings

Buildings on a site that will interfere with facility use should be removed. If materials from the buildings are reusable, they should be stockpiled or sold to another user. Particular attention should be given to the possibility of hazardous materials such as asbestos, which requires special disposition. If materials are not reusable, they must be disposed of offsite in accordance with state or local regulations.

Wells

If wells are present on the site and they will not be used, they should be sealed. It is likely that state or local codes require that they be capped.

Clearing and Grubbing

Tree and brush removal should conform to the site plan. If a substantial amount of timber is to be cleared, it can be sold to a timber firm or firewood dealer. Because soil settles after grubbing (removing stumps and roots), land elevations may drop. The extent to which this occurs depends on how much soil is removed and is a factor to be considered when computing the quantity of earth material that must be moved or removed.

Excess Earth Material

At most sites, earth material must be moved around, or removed entirely, to accommodate the design of the intended facilities. Ideally, the amount that must be removed from one area of a site is equal to that required at another. Therefore, consideration should first be given to using excess earth material on site, either on land or in the water.

Excess material might be used to form breakwaters, **causeway**s, or **groin**s, especially if the material is rock or stone; in some cases, even material of a finer grade can be used for these purposes, but care must be taken to prevent it from being eroded by wave action. Whenever excess material is to be used in the water, it should be tested to assure that it does not degrade the water environment. It is probable that a permit to place material in the water will depend, at least in part, on the type and quality of materials. If removing earth material from the site is a logistical or budgetary problem, the landscaping plan should be reviewed to determine if it is possible to use the excess material for landscaping features such as **berm**s.

If excess material cannot be used, it must be disposed of offsite. Again, the material should be tested for contaminants. If "clean," it may be possible to dispose of the material on nearby public or private lands or to sell or give it to public agencies or contractors who can use it for **fill**. Wherever there is a demand for fill, surplus materials usually can be sold or a user found who will remove and dispose of the material at no cost to the project.

If excess earth material is contaminated, disposing of it is much more difficult and costly. Environmental authorities require that contaminated material be moved to a contained

and approved location. The greater the contamination, the greater the likelihood it will have to be transported some distance to an appropriate disposal site. In extreme cases, environmental authorities may require that an impervious containment area be constructed for the disposal of the contaminated material. This added expense can make developing a site too costly.

Fill Material

There will be instances when additional material is needed to fill deficient areas of the site. If dredging is necessary, the dredged materials may be suitable for use as fill material. Other options include purchasing fill from a public or private **borrow pit** or from area contractors engaged in projects involving excavation.

Photo 3-12 Construction using geo foam fill, Martinez, CA

Photo 3-13 Finished plaza with geo foam fill, Martinez, CA

Other materials can be used for project fill. Polystyrene foam or geofoam is an example of a very good material for this application that has been used worldwide. Geofoam is lightweight, compressive-resistant, inexpensive, and readily available. It is very good for lightweight fills to reduce stresses on underlying soils or lateral pressures on retaining walls, abutments, or foundations. It is produced in block form and is easily handled at the job site. Geofoam is unaffected by weather conditions and retains its physical properties under engineered conditions. The use of foam fill adjacent to water bodies must be engineered to accommodate groundwater effects on the buoyant properties of the foam.

Special Site Conditions

Occasionally, site conditions that require creative solutions might be encountered. It is often less expensive to accommodate special site conditions into the site design.

Rocks

If a site has a large quantity of rock, it may be possible to use it for **riprap** or to use it for delineating parking areas or for constructing causeways, groins, or breakwaters. If the rock is a large outcropping that would be unreasonably difficult or expensive to remove, it may be possible to incorporate the outcropping into the design as a unique and interesting feature.

Springs

Occasionally springs are found on a site and can be difficult to plug or divert, but it may be possible to include the spring as a landscape feature such as a small pond. If so, the overall site drainage plan should incorporate this feature in the design process.

Historical and Archaeological Features

As referenced in Chapter 2, significant historic, cultural, or archaeologically sites or features may be present on an access development property. It is recommended that studies to identify and evaluate the significance of these sites or features be completed prior to beginning formal site design. Because federal and/or state law may require that these studies be completed, it is further recommended that a State Historic Preservation Officer (SHPO) be contacted regarding applicable law.

An historic building, structure, or archaeological site may be identified within the access development property that cannot be destroyed, removed, or otherwise modified without appropriate mitigation. Historically significant buildings or structures can usually be identified early in the site selection process and methods developed to accommodate for their presence or mitigate their demolition, relocation, or modification before the land is acquired or the site planning process has advanced.

The presence of archaeological sites or features, such as Native American cemeteries and campsites, historic farmsteads and privies, and shipwrecks, can be more difficult to determine. A qualified archaeologist should conduct the identification and evaluation of these sites or features.

The presence of archaeological sites or features, however, does not have to preclude access facility development. Depending on soil conditions and the project size, it might be possible to mitigate for an archaeological site within the project area. In Minnesota, it has proven effective to construct small to moderate-size access facilities over significant archaeological sites or features by first overlying the sites or features with geotextile fabric and 12 to 28 inches of clean granular fill. It is also possible to incorporate the presence of significant historic, cultural, or archaeological sites into one of the facility's amenities. At the Minnesota Department of Natural Resources Lake Superior/Silver Bay Harbor of Refuge and Marina, the presence of a late 19th century shipwreck on the lake bottom approximately 100 yards beyond the facility's breakwater provided an opportunity to interpret local maritime history.

For further information, contact the National Register of Historic Places at www.cr.nps.gov/nr. The following is the web link to the National SHPO organization, which includes a list of all the state SHPO Officers/Offices: www.ncshpo.org/stateinfolist/fulllist.htm.

Flora

Desirable trees and other natural features of a site should be protected during construction. Because trees and plantings can be damaged or killed by having materials

piled around them or by being hit with equipment, it may be necessary to safeguard them and other natural features with temporary fences. If exotic plants exist, they should be removed.

Shoreline Protection

It may be necessary to protect the shoreline, either because it is being changed in the process of developing the site or to prevent erosion. Embankments, in particular, should be protected from runoff, waves, current, or wake action.

Natural Cover

Natural vegetative cover provides one type of shoreline protection. This is most appropriate where the shoreline slopes gradually and the soil will support its growth. Use of native species should be considered as primary materials in both salt and freshwater applications. The local Natural Resource Conservation Service office or state environmental department is a good source of information on plants suitable to local conditions.

Photo 3-14 Revetted slope

Riprap

If the slope of an embankment is 2:1 or greater, riprap commonly is used to protect it from erosion due to current, wave, or wake action. Riprap consists of stones of certain sizes, shapes, and types and requires careful placement. A geotextile fabric is placed on the embankment first and topped with suitably sized riprap. The fabric allows water drainage but prevents movement of the soil that makes up the sub-base supporting the riprap. For a more aesthetic appearance, cobblestones or commercial paving stones may be used. In addition to grading the embankment to achieve the correct slope and laying geotextile fabric, cement grout may be needed to fill the gaps between the stones.

Photo 3-15 Armor Flex slope

Other Sustaining Materials

There are alternative materials available to protect an embankment. Broken concrete, free of rebar, might be used for riprap, but it can be unsightly and does not blend well with the natural environment. Concrete-filled bags also may be laid on an embankment to protect it. **Gabion**s are commercially available and may be laid on an embankment over a geotextile fabric. Where saltwater is present, gabions should be galvanized or vinyl-coated, or both. They generally are not used where embankments will receive foot traffic, and they may be unsuitable where turbid water or high-energy waves could wear on the wire.

Photo 3-16 Gabion construction

Other slope stabilization products are commercially available and should be researched.

Seawalls

Walls commonly known as bulkheads can also protect shorelines. The walls can be constructed as sheet piles, cast-in-place gravity, pile supported structures, or even **rock crib**s. They can be constructed of metals, timber, concrete, or composite or natural materials.

Photo 3-17 Bulkhead at a boat launching ramp, Milford, DE

Because of their expense, bulkheads usually are considered only where the available property is at a premium, requiring use of all available land for site improvements. Bulkheads are typically more expensive than other shoreline protection options and should be used only when there is no reasonable alternative. Vertical bulkheads are poor energy dissipaters because they reflect rather than absorb waves. Wave energy causes water to move up and down the wall surface, and it may be necessary to place rock at the bottom to prevent **scour**. Protective treatment of the top surface immediately behind the bulkhead also may be necessary if waves or spray will reach this area. The 1981 U.S. Army Corps of Engineers publication, *Low-cost Shore Protection, A Guide for Local Government Officials,* is a good source document if such structures are being considered. For more information, see http:/chl.erdc.usace.army.mil/chl.aspx?p=s&a=publications;20.

Landside Amenities

Restrooms

Restrooms are optional in some jurisdictions and required in others. Toilet units generally are of four types: flush, vault, composting, or chemical. Constructing restrooms is expensive, especially if flush toilets are provided, and maintenance is costly. Also, vandals frequently target restrooms, which increases maintenance costs. State recreational boating and fishing programs should develop criteria to assist in deciding if and what type restrooms will be provided.

Capacity usually is governed by specific state or local health regulations, and when it is not, a reasonable guideline is to provide at least one toilet fixture for every 30 parking spaces. Unisex facilities are acceptable at launching and fishing facilities if permitted by

state or local codes. If restroom facilities are provided, they must conform to ADA /ABA accessibility standards for public facilities.

Photo 3-18 Restroom

Traditionally, facility planners have tried to locate restrooms in screened areas away from use areas, but when considering the needs of people with disabilities, good placement is more a matter of convenience than aesthetics. Planners must place restrooms on accessible routes conveniently located to use areas.

To facilitate use, restrooms should be located near the launching ramp, fishing pier, or marina, and the parking lot. They can be permanent or portable. If portable, they can be removed during the non-boating season, although off-season storage arrangements must be made, and if vaults are present, they must be capped. If constructed on a floodplain, toilet structures should be portable or the restroom building designed to withstand flooding.

Restrooms may be built onsite or prefabricated offsite and assembled at the facility. They may be constructed of wood, plastic, concrete, brick, metal, concrete block, or a combination of materials. Steel buildings are not recommended in saltwater environments, even if galvanized and painted, because they are prone to rusting and require special maintenance.

Buildings should be attractive and constructed of vandal-resistant materials. For example, polished stainless steel or chromed plates may be used in lieu of glass mirrors and metal, or plastic screens may be used for window openings. For skylights and windows, there are plastics available that are highly impact-resistant and allow good light transmission. Whenever specialty items are used, they may not be readily available from local resources and/or may be costly to replace. Keeping a reasonable supply of replacement items on hand will solve this problem.

Restroom roof materials can be wood, tile, metal, or composites. Factors to consider are local climate conditions and a roofing material's fire resistance, susceptibility to rot and moss growth, ability to withstand snow loads, appearance, life expectancy, and cost.

Safety must be a consideration in constructing restrooms that will be used by people of all ages and physical capabilities, and every effort must be made to design them for safe and convenient use. Hidden doorways, dark corners, and slick floors should be avoided. Safety features should include good lighting and locks on toilet compartment doors.

The design of a restroom depends, in part, on the availability of utilities. If lighted or heated buildings are desired, power must be available to the site, preferably underground.

Solar power may be a possibility, depending on climate, the amount of power needed, and cost.

If potable water is desired, it must be obtained by tapping into a public water supply system, by drilling a well, or by installing a system to treat water available at the site. If a well is the choice, it must be able to provide the volume of water needed and be equipped with necessary pumps, reservoirs, and other equipment.

Dump Stations

Stations where the portable toilets of recreational vehicles and watercraft can be emptied and cleaned may be considered desirable at a boat access site. These are known as dump stations. Such stations are commercially available at a reasonable price and can be connected to a gravity-fed sewer system or used in conjunction with a pumpout system, if one is available on the site. A freshwater supply to clean the portable toilet also is necessary.

Dry Hydrants

A dry hydrant is a non-pressurized, permanent pipe system through which water can be suctioned from a water body into a tank truck, usually for firefighting purposes. One end of the hydrant protrudes out of the ground to provide tank trucks a hose connection and the other end, which has a strainer on it, is placed in the water body.

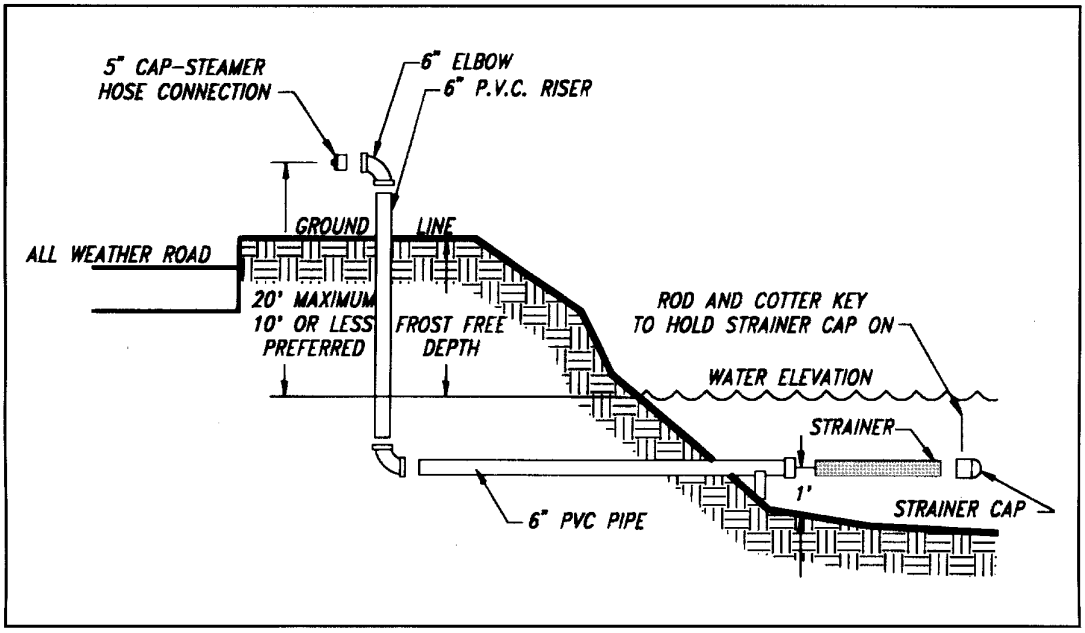


Figure 3-3 Illustration of a dry hydrant

A roadway capable of accommodating a tank truck provides access to the hydrant**.** In addition to their usefulness in fighting fires at the facility, dry hydrants can be used to obtain water to clean ramps and/or parking areas subject to spring flooding or in moving silt from the end of launching ramps. If a dry hydrant is to be installed at a facility, its

design and location should be coordinated with the local firefighting authority and funds for a portion or all of the cost of the hydrant may be available from the same authority.

Trash Receptacles

A wide variety of trash receptacles exist—from simple metal cans to steel dumpsters. The best type for a facility depends both on the trash load anticipated and the need to prevent misuse or theft of the receptacle. If metal cans with covers are used, they may be mounted on posts or placed in concrete block or timber enclosures.

Many sites do not provide any trash collection services and require users to adopt a "Pack-it-in / Pack-it-out" trash policy.

Lighting

A light on a pole 20 to 25 feet above high-water level works well for lighting because it is both easily visible from the water and illuminates the ramp area well. If the light is white, boaters will not confuse it with other night-lights aiding navigation. The use of focused, downcast lighting, possibly with motion-activated sensors, might be required to mitigate environmental impacts.

As a rule, lighted facilities are less subject to vandalism, nighttime parties and gatherings, and overnight parking or camping. Lights can be subject to vandalism, are a continuing operating cost, and usually require an automatic on-off mechanism.

Solar cell lights are a possibility when conventional electrical power is not available.

Landscape Design/Buffers

Boat ramps and supplemental facilities should complement the natural conditions present in an area. Parking areas and other facilities should blend with the natural features and should be designed so that they will not detract from the natural appearance of the area as viewed from the water or adjacent highway. The appearance of the natural shoreline should be retained as much as possible by careful design.

Buffers, which can be creatively designed to serve as effective devices for visual and noise screening and for enhanced security, are important for providing separation and screening of the facility and its users from adjacent properties. Effective buffers can be created within the layout design of the site and with the use of landscaping elements, which may include plantings and fencing.

Existing and native plantings should be used as much as possible when landscaping the site; new plantings must be compatible with the soil and climate. Evergreens are good buffer trees because of their dense, full-length foliage and compact growth. Sprawling, branched trees may not be a good choice if located where they can interfere with sailboat masts. Shrubs that bear fruit or berries attract birds and other animal life and can stain roofs, walkways, and paved areas.

Inclusion of an earthen berm is another effective buffering technique, often making it possible to use low-growing and low-maintenance plantings. It is recommended to have a buffer plan designed by a landscape architect or horticulturalist.

Very large, busy sites or sites located in areas having adjacent cottages, year-round residences, or businesses should be fenced. Stockade fencing may be necessary for visual screening at sites too small to be amenable to landscape buffering.

Fish-Cleaning Stations

Fish-cleaning stations may be requested wherever there is extensive use at a fishing facility or a launch site. Cleaning stations require fresh water, a table constructed of materials that meet health standards, and a disposal system. Commercially available units can be readily installed for these uses. A concrete floor and a screened enclosure also are desirable.

Waste from a cleaning station must be properly disposed of. Ideally, it is ground up and emptied into a local sewage disposal system upon local approval. Alternatives include an onsite treatment system or a holding tank, but the latter requires frequent pumping and a suitable dump site and can be expensive to construct and maintain, especially if a commercial pumping contractor is not available. Providing trash barrels for the waste is not recommended because of the odor and operational issues.

Photo 3-19 Sample of a commercially available fish cleaning table

Chapter 4

Designing and Constructing Waterside Components

Boat Launching Ramps

Launching ramps facilitate the launching and retrieving of boats. A launching ramp must be wide enough and long enough to provide adequate depth at the lowest anticipated water level. To safely and conveniently accommodate a vehicle and trailer, the ramp surface must provide traction to the towing vehicle and be sloped at an angle that allows a boat to be easily launched and retrieved at the lowest anticipated water elevation.

Ramp Placement and Orientation

Photo 4-1 Aerial view of a boat launching site, Kowliga Ramp, Lake Martin, AL

Launching ramps should be situated in areas where the disruptive action of waves and currents generated by both natural conditions and passing vessels is at a minimum. Breakwaters may be required to provide adequate protection. Where waves are caused by watercraft, the problem may be avoided by adopting regulations limiting boats to a no-wake speed. A **design wave** of approximately six inches is best. As wave height increases, the ease and safety of launch and retrieval diminish. Waves of one foot or higher make launch and retrieval difficult and may injure people and damage equipment, and in this case, the launching ramp area may need added protection.

Currents may adversely affect launch or retrieval of a boat because of their force against the craft. A generally accepted practice at sites subject to side currents is to orient a ramp at an angle slightly downstream to the predominant current. Debris deposited at a site by passing currents may be deflected with a debris boom constructed of logs, foam-filled pipes, or other floating materials. The boom can be held in place with piles or with wire rope or cable attached to submerged concrete anchors and/or shore anchors.

At sites located on oceans, the Great Lakes, or other large inland lakes where currents are responsible for **littoral transport**, ramp design should account for the potential impacts to the littoral processes at these locations. Since **siltation** and/or scouring are natural occurrences where land and water meet, these events can occur at launching sites. Sediment can be carried by river currents draining into water bodies off land, be driven into the water by the wind, or result from waves stirring up bottom material. It can move

about because of wave action, littoral drift, or currents. Measures to minimize sedimentation and erosion at launching areas should be included in the design.

Launching ramps should be placed well away from the entrance to the site to avoid traffic backing up onto the roadway. They also should not be located in direct alignment with the access road so that drivers will not mistake the purpose of the road and unintentionally drive onto and perhaps off the launching ramp.

Several steps may be taken to ensure that launch and retrieval occur as efficiently as possible: (1) provide a maneuvering area ample enough to allow vehicle-trailers to line up with the launching ramp; (2) allow for one-way ingress and egress to and from the launching area to even out traffic flow; and (3) situate parking areas close to the launching ramp to reduce the time a boat sits on the ramp while the vehicle-trailer is being parked or retrieved. At high-use sites, a make-ready area will accelerate launching even more and a tie-down area will expedite retrieval.

Launching ramps should be placed as far as possible from swimming areas, and swimming areas should be clearly marked off with buoys.

Constructing a launching ramp usually involves either cutting or filling the shoreline. In either case, to prevent erosion it may be necessary to protect the slopes adjacent to the launching ramp. When building a cast-in-place concrete launching ramp, this may be accomplished with steel sheet piling or concrete cutoff walls (short retaining structures). Even with cutoff walls, the banks at the sides of a launching ramp should be further protected with riprap that is installed flush with the ramp surface—at least 3 to 5 feet wide and 12 to 18 inches (compacted) deep.

Excavating an inlet to construct a launching ramp should be avoided because this can create a sediment trap, making facility maintenance very costly. In cases where the site has long shallow stretches of water, it may be necessary to build a causeway to reach water deep enough for boat launching and retrieval.

Soil conditions also must be taken into account. Sometimes the soil at a site is so unsuitable that the launching ramp must be built on pilings. When this is the case, the design must incorporate a structural frame upon which the ramp can be placed.

Ramp Design

Launching ramps should have a 12 to 15 percent slope. Generally, a slope steeper than 15 percent may make retrieving a boat and trailer difficult. A lesser slope will also cause a problem: the flatter the slope, the farther the vehicle must back into the water to enable the boat to float free of the trailer.

The accessible route at a site ends at the top of the boat launching ramp. Although a launching ramp cannot be designed so its slope will meet accessibility standards, boaters with disabilities should find coping briefly with the steeper slope of a conventional launching ramp far less troublesome than having to launch or retrieve a boat from a ramp with a lesser grade.

Generally, the top of the launching ramp should be 2 feet above high water level (based on the site water datum) and the toe (bottom) of the launching ramp should be a minimum of 3 feet below the lowest expected water level (design low water level). At a site subject to water buildup from onshore winds, water elevations sometimes exceed normal highs, and this condition should be considered in the ramp design.

Conversely, offshore winds blowing over a site reduce water elevations, and other design adjustments must be made, such as dredging a channel from the launching ramp to navigable water or constructing a ramp long enough to accommodate the low water.

Launching ramps intended for multiple simultaneous launchings should be divided into lanes generally 12 to 20 feet wide and free of obstructions. Boarding docks, surface markings, signs, and/or curbing may be used to delineate the ramps. For planning purposes, one lane will accommodate up to 50 launchings and 50 retrievals a day, but capacity may be increased if make-ready and/or tie-down areas are available. Generally, at high-turnover sites, one lane for every 20 to 30 parking spaces is ideal. At low-turnover sites, one lane for every 30 to 50 parking spaces will suffice.

Since large hydraulic trailers are increasingly used at commercial marinas, it is possible to transport vessels much larger than those ordinarily launched by recreational boaters. If these trailers will be used to launch or retrieve large watercraft, design of the facilities should include appropriate wheel loads and ramp profiles.

The transition from the shore to the slope of the launching ramp should be made with a vertical curve *(see Figure 4-1).* This allows smooth passage onto the ramp of the vehicle-trailer unit (preventing the hitch's dragging on the abrupt change of grade that will exist absent a vertical curve) and improves the driver's visibility. A vertical curve from 20 to 30 feet long is recommended.

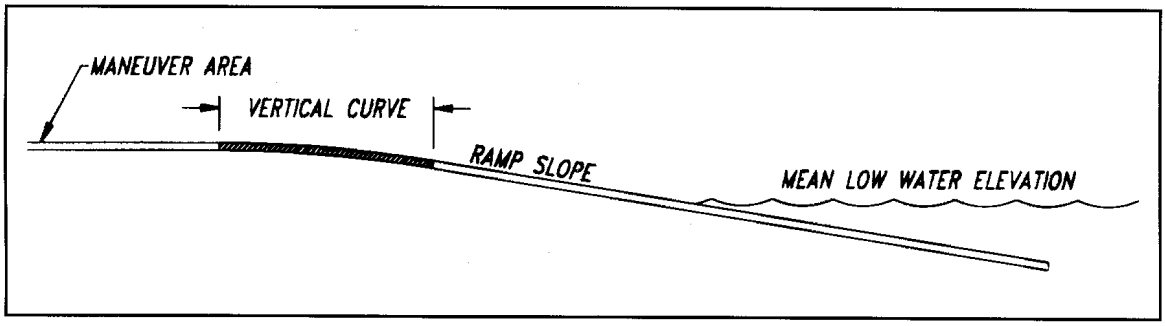


Figure 4-1 Example of a transition accomplished through employing a vertical curve between the maneuvering area and the slope of a launching ramp

Where seasonal water elevation fluctuations are at least several hundred feet, special design is required. Features such as self-adjusting boarding docks provide easy access at all water levels, and, in these instances, it is common to provide multiple parking areas that become usable as the water level recedes. Multi-stage parking areas help keep the parking areas closer to the launch area as compared to parking lots located above the

high-water elevation. To facilitate launching where multi-stage parking occurs, turnarounds at least 60 feet in diameter should be provided at intervals of about 200 feet.

In the past, boaters pulled or winched their craft onto the trailer. A common practice today is to motor, or power load, the boat onto the trailer, and the turbulence from propellers over the end of the launching ramp can create a hole at the toe of the ramp. The material displaced from the hole may accumulate and form a barrier that impedes boat movement. If the wheels of a trailer drop into a washed-away area, damage to the trailer and/or the tow vehicle may occur. In addition to these problems, the turbulence can undermine the ramp by displacing the material under the end of the ramp, potentially causing collapse.

This practice of **power loading** a boat onto a trailer can be expected to continue, and launching ramps should be designed with this in mind. Design measures to address this practice include extending the ramp beyond the length needed to meet the low-water design condition. If this is not practical, adding scour protection, such as riprap or other revetment materials, will help minimize this problem. Some states use curbs at the end of the ramps. When curbs are used, users need to be warned to avoid potential damage to the boat, trailer, or tow vehicle.

Photo 4-2 Effect of power loading at a launching ramp

Surface Materials and Construction Processes

A launching ramp should have a stable surface that provides traction sufficient to permit the towing vehicle to pull a loaded trailer up the ramp. The surface may be asphalt concrete, Portland Cement Concrete (PCC), or compacted gravel. Ramps constructed of PCC are generally preferred and may be cast in place or constructed of precast panels or push-in slabs. In the discussion that follows, examples from several states are presented. SOBA offers an instructional video that illustrates various types of ramp construction practices and procedures. The video can be ordered from the SOBA website at www.sobaus.org.

Cast-in-Place Concrete

Cast-in-place launching ramps typically are constructed of concrete slabs 6 to 8 inches thick, and are reinforced with rebar, welded wire fabric, and/or fiberglass strands to meet temperature and structural requirements. Each ramp site must be assessed and the launching ramp designed to meet site conditions. To permit placing (pouring) and finishing of the concrete for any underwater portion of the launching ramp, the area usually must be dewatered with a **cofferdam**.

Photo 4-3 Example of a coffer dam for cast-in-place construction, Newport, DE

CALIFORNIA—The following are the guidelines adopted by the California Department of Boating and Waterways for constructing a typical cast-in-place concrete launching ramp:

- six-inch-thick concrete in fresh water, eight-inch-thick in saltwater
- ¼-inch-thick (maximum) crushed aggregate
- Type 11 (low-alkali) cement
- 4,000 psi minimum compressive strength concrete, with 5 percent **air entrainment**
- **Slump** of 3 to 4 inches
- V-grove finish, at 60 degrees from ramp centerline
- No. 4 rebar, at 12 inches on center each way

A ramp should be built one lane at a time, with lane widths of 15 feet for multiple lane ramps and 16 to 20 feet for single lane ramps. Placing wet concrete and properly finishing it in greater widths than these is not recommended. Starting at one corner of the lower end of the formed ramp area, the wet concrete should be placed in the forms, vibrated, and screeded (leveled) in an uphill direction. The surface should be floated immediately, and any aggregate that is at the surface or causing problems should be pushed down. At the appropriate time, begin the finish work.

The rate of placement of wet concrete into the forms should be based on the following considerations:

- Time of year
- Climate
- Temperature
- Wind
- Altitude
- Crew size
- Haul distance to the site from the concrete batch plant
- Design of the concrete mix

The following are suggested guidelines for constructing launching ramps:

- Use a concrete crew of no fewer than five people.
- Have all tools, equipment, and materials on site before beginning.
- Place no more than 8 to 10 cubic yards of concrete per hour.
- Finish the concrete placed in each form before beginning the next placement.
- Start from a bottom corner and work uphill.
- Start early in the day.
- Build one lane at a time.

Over the years, the preferred finish for launching ramps has proven to be the V-groove design, in which 1 x 1-inch V-grooves are formed into the wet concrete at a 60-degree angle to the centerline. This finish provides excellent traction for vehicles, wears well over a long period, has an attractive appearance and, to some extent, is self-cleaning because waves tend to move sand and debris down the grooves and off the ramp. However, because they are difficult for people with disabilities to negotiate, V-grooves should not be formed into portions of the ramp used to access boarding docks.

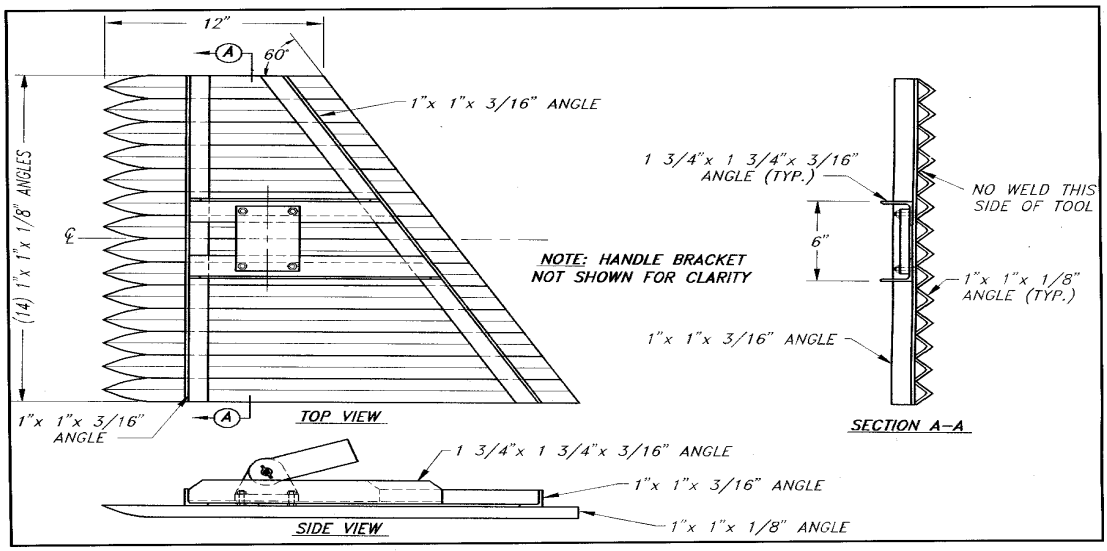


Figure 4-2 A drawing of a tool used to impart V-grooves to wet concrete

V-grooves are imparted to wet concrete by a finishing tool specially fabricated for the purpose. Although steel, aluminum, and wood tools all have been used successfully, aluminum appears to be the best choice because, compared to tools of other materials, aluminum tools are lighter, larger, and can be used with more ease and speed. Experience shows that a tool of approximately 22 to 25 pounds is ideal, with a maximum length of 24 to 30 inches. If a 1 x 1 x 1/8-inch steel angle iron is used, the maximum width of the tool can be only 8 to 10 inches, but an aluminum tool of the same size stock can be up to 24 inches wide and still weigh only about 25 pounds. This means the aluminum tool will finish a wider surface and be about 2½ times more productive than a steel tool of the same weight. An aluminum tool of the dimensions described above can be easily used to finish 30 to 35 linear feet of a 15-foot-wide lane an hour, or an area 450 to 525 square feet *(see Figures 4-2 and 4-3).*

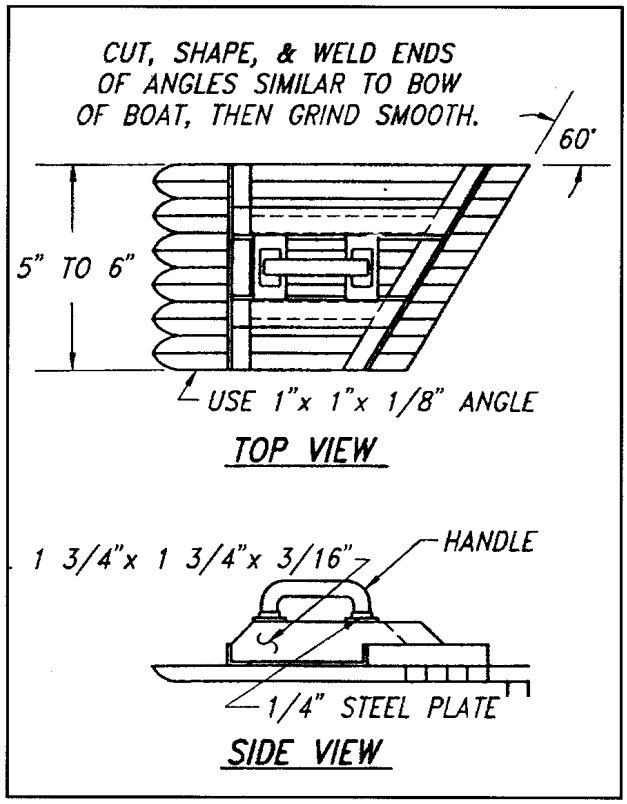


Figure 4-3 A drawing of a tool used to complete the edges of V-grooves in wet concrete

Photo 4-4 Photo of a V-groove tool in use

Precast concrete panels and/or planks (the latter are narrower and do not abut each other) are recommended for construction underwater because their installation does not necessitate dewatering the site. Coffer dams are expensive, sometimes dangerous to construct, and not always environmentally acceptable, and occasionally they cannot be used because of poor soil conditions.

California concrete panels are usually of the following dimensions and weight:

- 36 to 42 feet long
- 4 to 5 feet wide
- 6 inches thick in fresh water
- 8 inches thick in salt water
- 7 to 10 tons

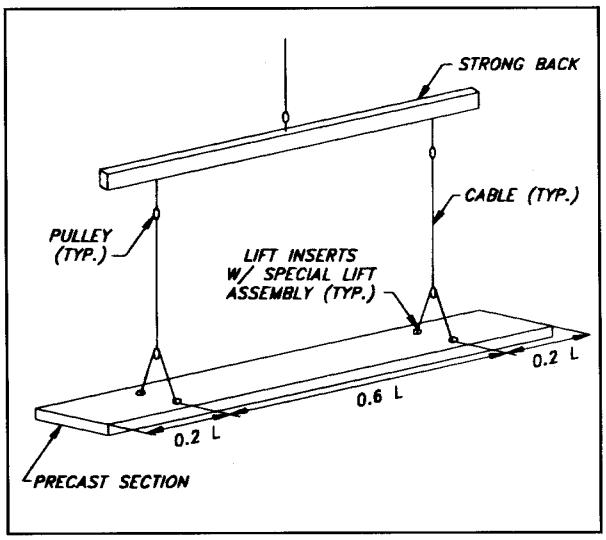


Figure 4-4 The recommended four-point method of lifting concrete panels

California connects panels not with rebar loops (as described below), but by tongue-and-groove key joints that run the length of the panel edges, enabling each panel to both give and receive support from adjacent panels. This design is very effective in transferring the **live load** of vehicles and trailers from one panel to another and also in guarding against a panel's collapse due to soil problems. In the event of localized erosion or undercutting of the supporting base rock and soil, panels keyed together will bridge these problem areas and maintain the integrity of the launching ramp until repairs can be made.

When large panels are used, it is absolutely critical that they be designed specifically to withstand, to the extent possible, the stress of being lifted during manufacture, shipping, and placement at the site. Additionally, to avoid cracking the panels, proper rigging and lifting procedures must be used *(see Figures 4-4 and 4-5).*

Information about rigging procedures is available from concrete accessory supply houses throughout the country.

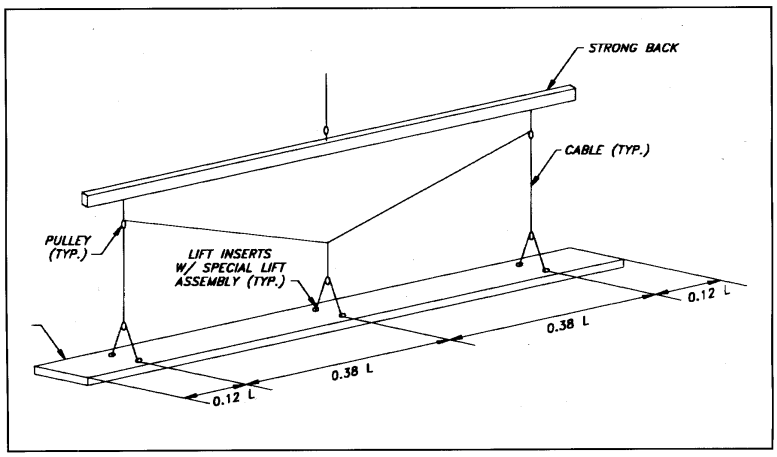


Figure 4-5 The recommended six-point method of lifting large concrete panels

CONNECTICUT— The Connecticut Department of Environmental Protection uses both planks and panels in constructing launching ramps. In saltwater environments, precast concrete panels with a V-groove surface are used, which provide good traction, especially where algae grow. Metal fasteners are not used in this application because of their susceptibility to corrosion. Connecticut precast concrete panels for saltwater use are:

- 10 feet long and 4 feet wide
- 8 inches thick
- Approximately 4,000 pounds
- V-grooved

At freshwater locations, precast concrete planks are utilized for the underwater portion of launching ramps. The planks are bolted together with overlapping flat connecting bars. Connecticut precast concrete planks for freshwater use are:

- 10 feet long
- 6 inches thick
- 14 inches wide
- Approximately 875 pounds
- Coarse broom finish

MICHIGAN—In constructing launching ramps, Michigan Department of Natural Resources typically uses concrete panels that have been cast in forms either at a plant or at the job site and often incorporate steel rebar loops that extend from one or both sides for connecting to adjacent panels.

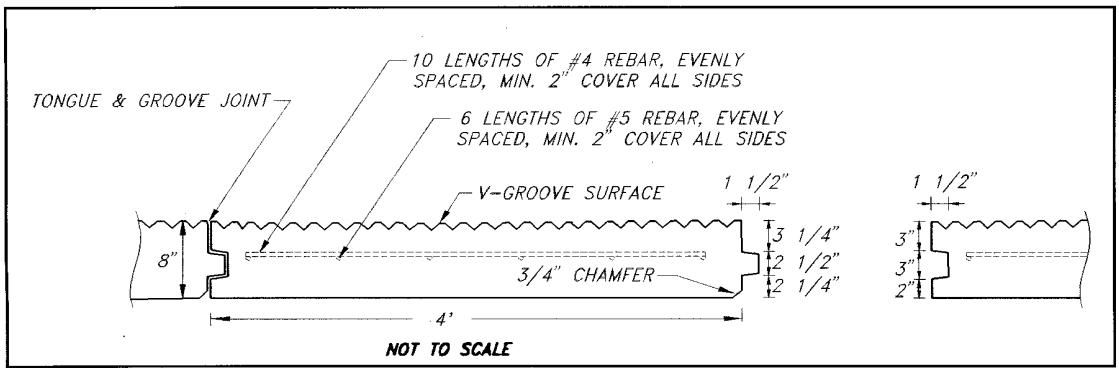


Figure 4-6 A typical precast tongue-in-groove concrete panel

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The Michigan panels are:

- 18 feet long
- 4 feet wide
- 5 inches thick
- 4,600 pounds

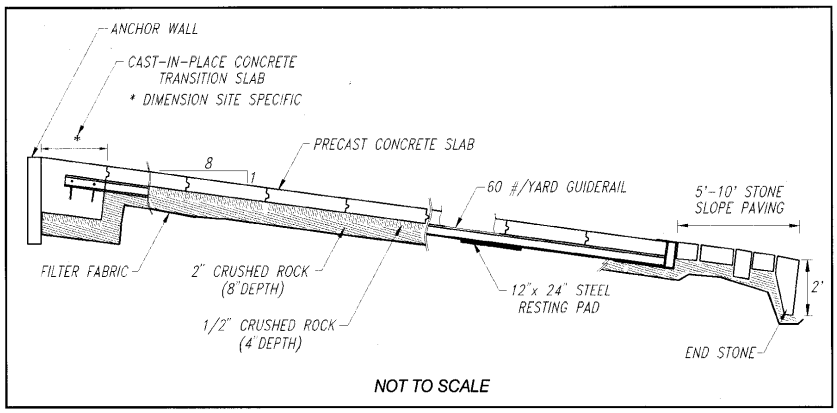


Figure 4-7 A profile of a concrete panel system, illustrating how the continuous surface is attained

Many states use concrete panels instead of planks at and below the water line because ice can form in the gaps between planks and move or damage them. Properly designed and placed tongue-and-groove panels provide an unbroken surface where ice impacts, eliminating gaps in which water can freeze and expand *(see Figures 4-6 and 4-7*).

Using concrete panels requires properly laying a suitable base and carefully installing the panels. Michigan has developed a successful procedure to accomplish this, which is described in the following paragraphs.

Personnel and equipment consist of three equipment operators, a worker in a wet suit, a tracked excavator with a 1 to 2-cubic-yard bucket and a 30-foot boom, a low-boy trailer and tractor, a wheeled front-end loader with a 3-cubic-yard bucket, two tandem 10-cubic-yard dump trucks, an I-beam or grade bar, and two four-inch-in-diameter steel grade pipes 35 to 42 feet long (used well casing works satisfactorily). The grade bar is adjustable and consists of a double welded I-beam, 21 feet long and 2 feet wide, to accommodate panels 18 feet long. The photo shows such a tool being used to grade loose rock, as described below.

Photo 4-5 Leveling windrowed stone with a drag towed by an excavator

Beginning at the baseline established in the engineering plans, the ramp location is measured off. Line rods or fence posts are set 2 feet off each corner of the ramp and at 10-foot intervals along each side. A line rod is set that marks the location of the bottom of the ramp.

A sub-base approximately 12 inches thick is preferred and is constructed by dropping two-inch crushed rock into the water in 20- to 22- foot windrows (heaped rows) parallel with the shore. (The windrows will extend a few feet more than the conventional 18 feet of the precast concrete panels.) The windrows are placed every 10 feet from the toe to the top of the ramp, at a height sufficient to achieve the desired 12-inch thickness after the material is graded.

Steel pipes are temporarily laid on top of the windrows, perpendicular to the shore, 2 feet toward the center from the planned sides of the ramp. They are pushed into the windrows to a depth of 4 inches below the planned grade or to the thickness of the concrete panels to be used at the site. With the pipes set to proper grade, an I-beam or grade bar is lifted with chains to the toe of the ramp, set on the pipes, and mechanically pulled up the pipes, leveling the rock for a smooth grade.

Photo 4-6 The temporary placement of pipes on top of windrows

When the rock is graded to the level of the pipes, a concrete panel is set on the pipes and pushed toward the water until its lower edge is just under the surface of the water. A second panel is put in place above the water, and both panels are adjusted and bolted together. When the lower edge of the second panel is barely in the water, a third panel is bolted to it, and the process continues until the first panel is down to the design depth of the ramp. As the panels are carefully pushed down the pipes, their alignment is checked and adjusted. When all of the panels are in place, the pipes are pulled out and the gaps between the panels filled with rock, which completes a row of panels for the ramp. If additional rows are to be placed, the same procedure is followed.

Photo 4-7 Panels being pushed over pipes, into place

WISCONSIN—The Wisconsin Department of Natural Resources has constructed several boat launching ramps using precast "waffle" panels, such as those commonly used on precast building projects.

The panels typically are of the following dimensions and weight:

- 12 feet long
- 8 feet wide
- 3 inches thick (10 inches overall)
- 7,200 pounds

The surface of each waffle panel is V-grooved at a 60-degree angle. A steel channel goes around the entire perimeter, four lifting anchors are precast into the panel, and panels are joined by hook-and-eye connections. A small vent (weep hole) in each waffle section allows trapped air to escape, preventing the panel from "floating" out of position. At the top of the ramp, panels are connected to a 10-foot-wide, poured-in-place concrete slab at the vertical curve, keyed to the sub-base by a 12-inch-wide x 18-inch-deep concrete key at its midpoint and extending across the entire width of the ramp. At the bottom of the ramp, panels are tied together with steel cable and eyes. *Figure 4-8* illustrates the Wisconsin precast concrete waffle panel design.

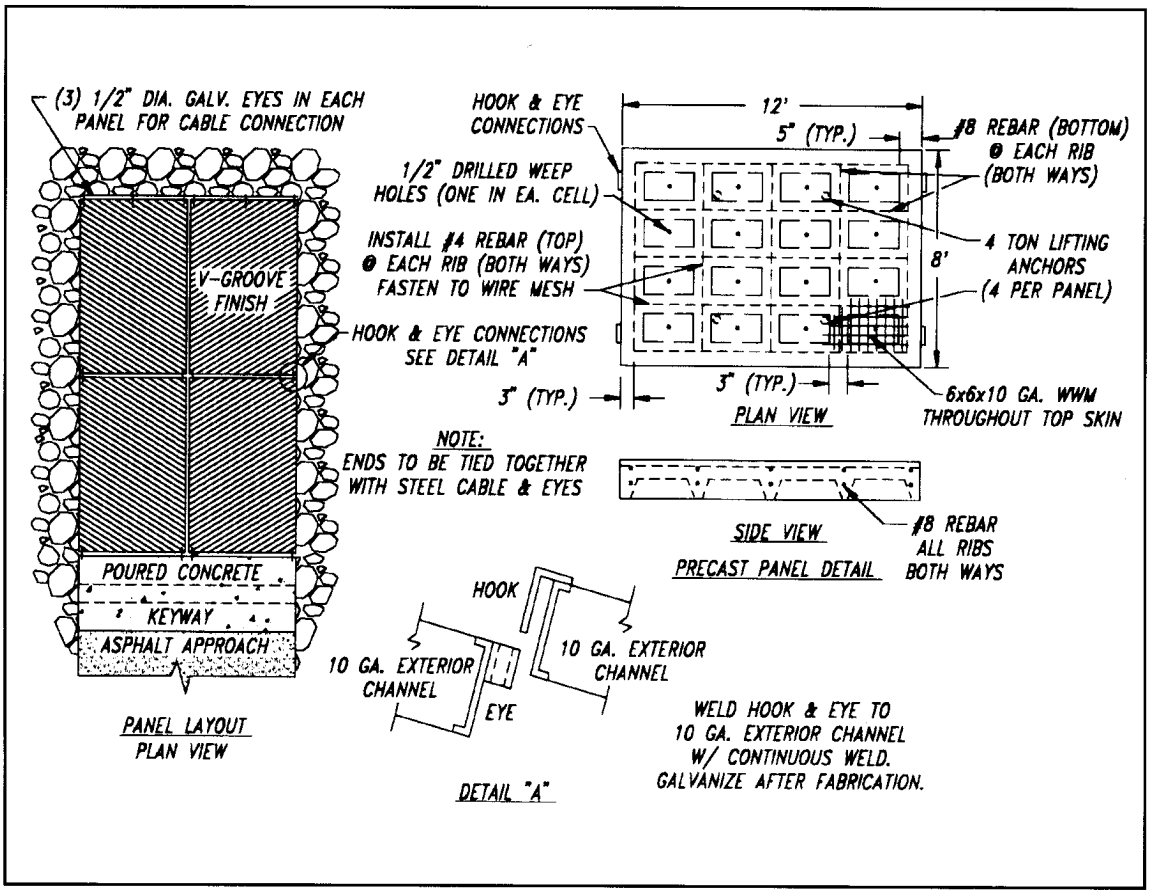


Figure 4-8 Dimensions of a Wisconsin-designed waffle panel

Precast Slabs: Push Method

SOUTH CAROLINA—The South Carolina Department of Natural Resources, among others, has obtained excellent results by constructing the underwater portion of boat launching ramps from a precast reinforced concrete slab pushed into place with a bulldozer. Using a slab prevents a problem commonly incurred with planks: separation due to the rusting of shackles and/or rebar, followed by power loading holes into which a trailer wheel may inadvertently drop.

Photo 4-8 A slab being cast on a polyethylene sheet over which rebar has been placed

A slab is cast on the ground as near as possible to where it is to be installed, which keeps to a minimum the distance it must be moved. The slab should be formed on approximately the same grade as that of the finished sub-base, which may require constructing a temporary earth ramp for a portion of the first section to be placed. The form is set on a polyethylene sheet on the prepared grade, rebar is placed, and the concrete is cast. The bottom edge of the slab that faces the water may be beveled to ease its being pushed into place, and to assist in final alignment, eyes or hooks may be cast into the sides. The rebar should be set so that at least 3 feet of its length extends from the landside end of the slab to provide a continuous steel tie between the precast slab and the remainder of the ramp. To assure that the rebar is properly placed in the center of the slab, constant supervision is necessary. Using devices to suspend or support rebar (hangers and chairs, respectively) is not encouraged because they may be pushed down into the base, making it difficult to move the slab and possibly affecting the slab's structural integrity.

A process similar to that for a cast-in-place ramp prepares the underwater portion of the sub-base, except that the grading is performed underwater and requires constant monitoring to assure that the proper grade is achieved. To provide a stable base, riprap should be used on fill sections and small stone used as a leveling course. After the concrete is cured, but before the slab is moved, test cylinders should be drilled out of the concrete and evaluated to ensure that the concrete meets strength

Photo 4-9 A slab being pushed into place for a single-lane launching ramp

specifications. To move the slab into place, its landside end needs to be lifted slightly and the slab pushed down the grade with a bulldozer until it is in place underwater. A slab 50 feet x 14 feet x 6 inches, which forms a single lane of a ramp, can be moved and, to some extent, steered into place by a bulldozer. A double-lane slab, 50 feet x 28 feet x 6 inches, may necessitate the use of two bulldozers.

Photo 4-10 A slab being pushed into place for a double-lane launching ramp

The precast/push method may also be used to extend existing concrete ramps. The sub-grade is prepared in the same manner as when constructing a new facility, and a one-inch layer of sand and a form lined with polyethylene are placed on top of the existing ramp. Rebar is set to extend 3 feet from the end of the slab facing the land, and the concrete is cast. The new section is then pushed into place with the appropriate size bulldozer, care being taken not to damage the existing slab. The new slab should be pushed at least 5 feet beyond the existing ramp and a suitably sized concrete transition section cast to join the two sections smoothly. The transition section should also be reinforced with rebar, which is connected to the rebar extending from the new slab. To allow the transition section to be cast in place above the waterline, it may be necessary to cut a small portion off the lower end of the existing ramp.

Precast Plank Method

MINNESOTA— The Minnesota Department of Natural Resources has developed an economical and efficient way to construct small- to mid-sized concrete plank ramps that require minimal personnel and equipment. The precast planks are constructed of reinforced concrete in three sizes, as follows:

"Standard" Plank

- 12 feet long
- 1 foot wide
- 5 inches thick
- 780 pounds
- Broom Surface Finish

"Mid-size" Plank

- 12 feet long
- 5 feet wide
- 6 inches thick
- 3900 pounds
- Broom Surface Finish

"Large" Plank

- 15 feet long
- 6 feet wide
- 7 inches thick
- 8000 pounds
- V-groove Surface Finish

Photo 4-11 A plank ramp in use, Green Lake, MN

The equipment required for a typical installation of a "standard 12-foot by one-foot plank ramp includes the following:

- a tractor/backhoe/front-end loader
- a 2½-ton single-axle dump truck
- a trailer suitable to transport the backhoe and planks
- shovels, wrenches, rock bars, and a wet suit

Personnel requirements include a trained and certified equipment operator and two to three laborers. Additional staff and equipment may be required to safely and effectively install the larger planks.

The standard Minnesota small plank launching ramp is 50 feet long, 20 feet of which are in the water and 30 feet out, and made of 37 to 40 planks. A fulcrum point is established either at the water's edge or at the ordinary high or low water point. The slope of the launching ramp is established by filling or excavating (1) water ward from the fulcrum

point so that, at a point 20 feet from the shore, the water is a minimum of 2½ feet deep and (2) inland from the fulcrum point so that, at a point 30 feet back from the shore, the top of the grade is 2½ feet above the water. This will provide a 13 percent slope. The slope for the bottom three planks should be increased, however, to help minimize the effects of power loading. An additional method for addressing the effects of power loading and prop-wash is to replace the bottom 8 "standard" one-foot planks with 2 "mid-size" five-foot planks.

Photo 4-12 A plank ramp being pulled from the water

The sub-base grade elevation is established at a minimum of 12 inches lower than the desired finished surface of the ramp, and a six-inch base of two-inch crushed rock is installed as the bed for the planks. Geotextile fabric can be used under the crushed rock if unstable soil is present, e.g., clay, peat, or other soft organic material. Plank installation begins at the top and progresses downward. For the out-of-water portion of the ramp, up to three planks may be bolted together at one time with U-bolts and put in place with the backhoe. When they are in place, the gaps are backfilled with two-inch crushed rock and the backhoe can move on top of them and proceed with laying subsequent planks.

When installation of the ramp reaches the water's edge, a wetsuit may be required to perform the underwater bolt work.

After the launching ramp is fully installed, the side slopes are shaped to a 3:1 grade. Storm water from the parking lot and turnaround area should be directed away from the water body and erosion control measures employed. If drainage ditching is required along the side(s) of the launching ramp, it is shaped and graded to a slope similar to the side slopes. Depending upon the slope of the ditch and the anticipated drainage pattern, the ditch bottom may be sodded, seeded and mulched, or lined with crushed rock.

Although some special conditions may be encountered when using the above method to install a launching ramp, they can be dealt with relatively simply.

- If the base material is unstable and too deep to be excavated or there is groundwater seepage, a geotextile fabric may be used to improve stability.

- If there is more than a 5 percent slope in the back-down lane at the top of the ramp, 1½-inch crushed rock may be mixed into road grade limestone, then wetted and compacted with the heavy equipment. When the mixture dries, it is nearly as hard as asphalt. The proportion of rock to limestone in the mixture is determined through experience and depends, in part, on the quality of the limestone.

- On slopes greater than 13 percent, traction should be enhanced by the installation of additional planks or by using asphalt concrete shoreward up the slope.

- Where the natural water depth is less than 2½ feet at the end of the boat launching ramp, additional excavation may be necessary to dredge either a launch pool or a small channel leading to the point at which the water is naturally 2½ feet deep.

Asphalt Concrete

Asphalt concrete provides a firm, flexible surface and has been extensively used in Maine with good success. Maine places asphalt concrete in two-inch layers over a suitable base material. To prevent algae from growing when using asphalt concrete in tidal waters, the material is placed only in the upper third of the tidal range (the lower two-thirds of the tidal range are constructed of grooved precast concrete planks). Maine has constructed inland water launching ramps entirely of asphalt concrete and has found that this material provides a satisfactory surface.

Asphalt has limitations, however, in locations subject to marine growth. In saltwater environments, marine growth can make the ramp surface slick, which diminishes traction, and good traction is critical in launching and retrieving boats. This problem is compounded on asphalt ramps, which are naturally smooth. Under certain conditions, the use of asphalt may not be advisable at all. In California, for example, asphalt paving on roadways and parking areas immediately adjacent to the top of a launching ramp becomes seriously deteriorated within three to six years of construction due to salt water dripping from boats and trailers. The problem consistently appears in a fan-shaped zone extending up to 125 feet from the top of the ramps. In Alabama, bilge drainage also contributes to asphalt deterioration.

Gravel

As a general rule, if it is worthwhile to install a launching ramp, a hard surface for the ramp is recommended, but gravel and similar materials (e.g., shells, slag, volcanic cinders) may be used in remote or low-use areas. It may be necessary to remove existing materials so that the gravel can be placed to the required depth of 12 inches, and in poor soils, geotextile fabrics and/or slope stabilizers should be incorporated into the design. Gravel launching ramps are most easily maintained in protected areas, but they always are vulnerable to ice movement, tend to erode, and require a considerable maintenance.

Carry-Down Sites

A carry-down site consists of a lane leading from a road or parking lot on which a boater can safely carry a car-top boat or canoe to the water for launching. To facilitate moving their craft from the vehicle to the water at carry-down sites, boaters sometimes use wheeled devices upon which the boat rests. The National Park Service, through the Rivers, Trails & Conservation Assistance Program has published *Logical Lasting Launches: Design Guidance for Canoe and Kayak Launches,* Spring 2004, which provides guidelines for the development of these facilities. For more information, see www.nps.gov/ncrc/programs/rtca/helpfultools/ht_launch_guide.html.

Boarding Docks

Boarding docks may be provided to expedite the launching and retrieval process and for the convenience of the boaters. Docks most often are floating but may be non-floating (fixed or movable), and they often serve to separate launching lanes.

If a boarding dock is not provided at a facility, boaters enter and exit their craft either directly from the launching ramp or from the adjacent area. All that is required is a firm surface for footing, which is usually the launching ramp itself.

Boarding docks may be constructed of wood, concrete, metal, composites, or a combination of these materials. Decking may be wood, concrete, metal, or composites. Whatever the material, the surface should be nonskid, especially when wet, but easy to clean and maintain. If wood is used, planking is preferred to plywood. If planking is used, gaps between planks should not exceed ½ inch after shrinkage. All exposed lumber surfaces should be even and un-warped. Corrosion-resistant fasteners should be flush to the surface or slightly below the surface so they do not impede or create hazards to people using the structure. Screws and/or bolts are preferred over nails because of their superior holding power and because they can more easily be removed for maintenance purposes. Fastener materials should be compatible with the chemicals in the treated timbers and water environment.

Water elevations at a boat launching facility fluctuate, sometimes daily with tides, sometimes periodically with power dam releases, and almost always seasonally. To accommodate daily, operational, or seasonal water-level fluctuations, boarding docks are designed either to float so they can "self-adjust" or to be manually moved along the launching ramp as the water elevation changes. The former will float on the surface of the water so that, regardless of water level, they are in the same relative position with respect to the towing vehicle, boat, and trailer. **Skid pier**s, which may be manually moved, most often are used where the fluctuation is minimal or seasonal.

Floating Boarding Docks

Where daily fluctuations render movable piers impractical, if boarding docks are provided, they are usually constructed to float. Floating boarding docks are normally connected to shore by a hinged attachment and designed to adjust to water elevation

fluctuations. For stability, floating docks should be no less than six feet wide and designed to carry the dead load of the dock as well as the live loads listed below, applied concurrently. The following represent minimum loading conditions for light use applications. These values should be adjusted upwards to account for site-specific applications.

- Uniform live load – 20 pounds per square foot
- Lateral wind load – 15 pounds per square foot
- Vertical live point load – 450 pounds

The 20-pound uniform live load criterion is nationally recognized as proper for launching-ramp boarding docks and should be considered over the entire surface of the boarding dock. On a 6-foot x 20-foot boarding dock, 15 people averaging 160 pounds each equate to a live load of 20 pounds per square foot.

The 15-pound lateral wind load criterion is to be applied to the side(s) of the dock exposed to the wind, taking into account the estimated profile (height above the water) of boats likely to be tied to the dock and being blown against it. Assuming that the **freeboard** is 12 to 20 inches, the wind load per linear foot of dock will be 15 to 25 pounds. Also assuming that the average profile of boats tied to the dock is 1½ to 3 feet, the design wind load per linear foot of dock increases to 22½ to 45 pounds. Information about local wind conditions and the type of boats likely to use the boarding dock is necessary to accurately calculate the proper wind-loading criterion to be applied.

In calculating cross slope and floatation requirements, the 450-pound **vertical live point load** criterion is applied to all points on the boarding dock deck 12 inches or more from any edge. It is based on a 250-pound adult in a 200-pound electric wheelchair; typically, the wheelbase of the wheelchair is about 24 inches wide and 24 to 30 inches long. For design purposes, it is assumed that the combined center of gravity of the person and the chair will always be 12 or more inches back from the edge of the dock.

Photo 4-13 A gangway to a boarding float, Joe Wheeler State Park, AL

Typically, on the shore end there is a fixed pier or abutment, to which is attached a gangway that rests on a structure floating in the water. Occasionally, floating boarding docks are attached directly to the abutment, and at low water, they rest on the ramp. As the water rises, the dock sections float off the ramp. This design is referred to as a "groundout" system.

Photo 4-14 Groundout boarding float system

Where daily tides carry marsh grass or other debris that can pile up against a solid structure in the water, a fixed pier is often used instead of an abutment, and the boarding dock is usually placed at a right angle, rather than parallel, to the launching ramp.

Floating boarding docks are generally placed adjacent to or between a ramp's launching lanes, and at low water they rest on the ramp. As the water and the floating dock rises, the dock's slope may be reduced to nearly horizontal. This can occur whether a gangway is used or the floating dock is directly connected to the shore.

Boarding Dock Specifications

If boarding docks are provided, at least one should be barrier-free, having a minimum width of 60 inches and a clear travel path of 36 inches. There should be no railings and no projections over the side. Railings prevent access to boats during launching and retrieval, and overhangs can be struck causing boat damage.

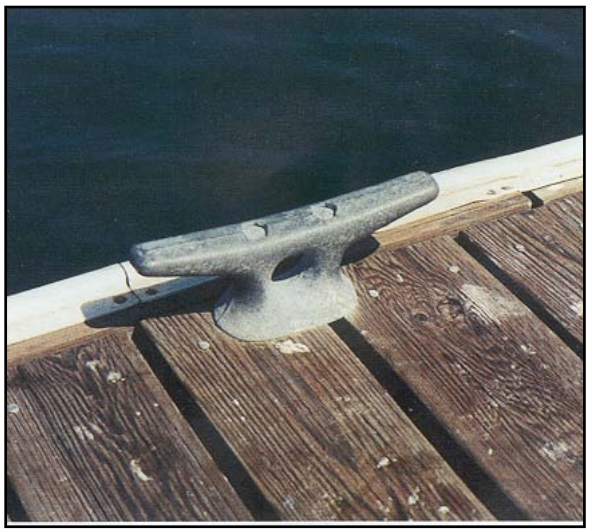


Photo 4-15 A typical cleat on a boarding float which lines may be attached to moor a boat

Since floating and non-floating boarding docks serve common purposes, they have some requirements in common. For example, both should have deck cleats or tie rails to which boaters can attach lines (ropes). Generally, cleats are cast metal or high-strength plastic and at least 8 inches long to withstand the pull of lines. They should be bolted, not screwed, to the structure.

Tie or bull rails, which are continuous wooden or metal rails fastened to the outside edge of the deck, should have a three-inch minimum clearance above the deck and be bolted down at intervals of 3 to 4 feet. To be barrier-free, there should be breaks in the rails at suitable intervals to permit boaters' unimpeded ingress and egress to their craft.

Photo 4-16 A typical bull rail which lines may be attached to moor a boat

Floating docks are best constructed in 16- to 20-foot sections. Smaller segments are usually overly responsive to live loads and tend to rise up and down under foot traffic. When people walk on an improperly designed dock they can lose their balance, due to the rhythmic rise and fall of the structure. The key factors that contribute to a safe and stable floating structure are hinging, buoyancy, width, length, and method by which it is attached to shore and/or pilings.

Pontoons support floating docks and provide a uniform freeboard. The pontoons should consist of foam floatation with protective containers (metal, plastic, concrete, or timber).

Floating docks must be able to ride up and down in response to fluctuating water levels. Systems consisting of rope, piling, rails, chain, cable, or **elastomeric** moorings are used to guide the vertical movement and maintain the horizontal alignment of the dock. Guide piles may be made of wood, steel, or concrete. Where docking occurs on both sides of the structure, guide piles should be placed within, rather than outside, the dock structure. In salt water, concrete piles are normally used. If wood piling is used, it is generally pressure-treated with a preservative to prolong its life. In lakes having large water fluctuations, steel rail guidance systems work well, but they are expensive.

If a dock must be attached to piling, a pile guide is used. This is a device that is affixed to the dock and surrounds the piling. The face of the guide rubs against the piling and usually is protected with rub strips or rollers. Such protection prolongs the service life of both piles and guides and, when it is windy, can greatly reduce the noise of the piles striking the guides.

There are a number of commercially available floating docks that can be delivered, ready for installation, to a site. For information on proprietary systems, contact the National Marine Manufacturers Association, 200 E. Randolph Drive, Suite 5100, Chicago, IL, 60601, or go to www.nmma.org.

Gangways

If a floating boarding dock is located adjacent to but off of the launching ramp, a means of bridging the distance between the shore and the dock must be provided. The gangway is usually hinged to a shore structure, such as an abutment or a pier, at one end, and the other end rests on the dock but is unattached, enabling it to adjust to changing water levels. A **transition plate** must be provided at the dock end of the gangway to facilitate barrier-free access. The gangway surface should be nonskid, without steps, and have a clear width of at least 36 inches. The maximum slope should not exceed that of the launching ramp.

Photo 4-17 Accessible gangway with transition plate, Oxnard, CA

Abutments

An abutment is a wedge-shaped structure commonly installed at the top of a launching ramp to anchor the shore side end of a floating boarding dock. On the shoreward end, it merges into a walkway or roadway to provide smooth, obstruction-free pedestrian access from the shore to the boarding dock. Its lower, or waterside, end is attached to the boarding dock or the gangway leading to it. Abutment design considerations include length, width, height, surface treatment, position on the ramp, and hardware.

Photo 4-18 Boarding float abutment under construction

The slope of the launching ramp and the dimensions of the boarding dock(s) determine the length, width, and height of an abutment. For ramps ranging in slope from 12 to 15 percent, abutments will typically be 13 to 25 feet long. To avoid protruding edges that can damage vehicles and trailers, abutment width should conform precisely to that of the boarding dock, including fenders. Abutment height typically ranges from 20 to 30 inches, depending on the dead weight of the dock, the design live load, and the desired freeboard. These factors all influence the size and depth of the dock's flotation units and the

dimensions of the dock frame, which, in turn, determine the overall height of the dock and the abutment.

From the standpoint of user convenience and safety, the height of an abutment should not exceed 30 inches. Boaters commonly step onto and off abutments, and a step in excess of 30 inches is too large for comfort and is hazardous. If the abutment has to be higher than 30 inches, **safety rail**s must be provided. Safety rails are a poor design option because they get in the way of vehicle doors and mirrors and boat lines, and they greatly restrict the movement of people launching or retrieving boats.

The face, or water-ward side, of an abutment should not be truly vertical but rather angled forward so that it is perpendicular to the sloped surface of the launching ramp. This permits proper fitting of the floating boarding dock to the abutment and leaves some room between it and the abutment to guard against damage from driftwood and other debris that may be floating into the area.

Where possible, an abutment should be positioned at the top of a launching ramp, approximately two feet above the high water level. The upper end of the abutment should merge into walkways, roadways, or other paved areas at the top of a ramp. Curbs, **bollard**s**,** or other suitable traffic control measures may be incorporated to prevent trailer or vehicle wheels from passing over the abutment and onto the deck of the boarding dock. Such traffic control measures are an important feature if they do not constitute a barrier to people with disabilities.

Attaching a boarding dock or gangway to the abutment usually is accomplished with a hinge assembly. On concrete abutments, the hinge assembly is best anchored by casting the concrete with the hardware in place, thus providing a permanent attachment that cannot work loose. The use of a continuous hinge, attached flush with the top of the abutment, will eliminate all gaps between abutment and the dock or gangway.

Abutments are usually constructed of reinforced concrete and cast as a single piece with the upper portion of a cast-in-place concrete launching ramp. The top surface should slope water-ward at a grade not exceeding 2 percent, to provide drainage. To provide good traction, a rough broom finish should be applied. The edges should be cambered (beveled) one inch to minimize injury should a user slip off or scrape against the abutment and to maximize resistance to chipping and breakage from the impact of vehicles and boat trailers.

Although concrete abutments are sturdy and long lasting, abutments may also be constructed of masonry, stonework, rock cribs, and/or timber. Whatever material is selected, care must be taken to provide a secure attachment for the floating boarding dock or gangway and a safe surface for pedestrians, including people with disabilities.

Non-floating Boarding Docks

Non-floating boarding docks can be movable skid piers, fixed piers, bulkheads, or even rock cribs. Except for movable piers, non-floating units are effective only when water elevation fluctuations are minimal, because the deck height is permanently fixed. Non-floating boarding docks are usually 4 to 6 feet wide. Refer to Chapter **7** for accessibility requirements relating to these structures.

Vertical rub rails (fenders), which permit boats to ride against them instead of rubbing against or overriding the surface of the deck, are found more commonly on fixed rather than floating docks. On floating docks, the action of the boat against rails attached to the dock can cause the dock to be racked out of alignment and can strain the mechanism connecting the dock to the shore. The fenders usually consist of 4 x 4-inch or 6 x 6-inch timbers, are located at four-foot intervals and extend up to 42 inches above and 12 inches below the deck. Because they wear out more quickly than rot, wooden fenders often are not pressure-treated with a preservative, especially in freshwater environments. Pilings can be installed as fenders to protect watercraft from hitting them. Fender pilings are typically driven at intervals of 5 to 8 feet and extend 3 feet above the ordinary high-water elevation. The practice of providing fenders varies around the country, and boaters appear to be satisfied with whichever approach is taken—fenders or no fenders.

Movable boarding docks such as skid piers can be moved up and down a launching ramp. They are most often used when a site's water level fluctuations are seasonal, rather than more frequent. They are typically built of steel and timber and designed so the deck stays level while the structure is moved up or down a ramp with a 12- to 15-percent slope. Two designs are common:

(1) The first has two sets of supporting legs to which are attached metal skids 6 inches wide and 10 inches long and bent slightly upward at the sliding edges to prevent their being caught between concrete joints. The deck should be a minimum of 5 feet and may have timber fenders every 4 feet, which extend 3 to 4 ½ feet above and one foot below the deck *(see Figure 4-9)*.

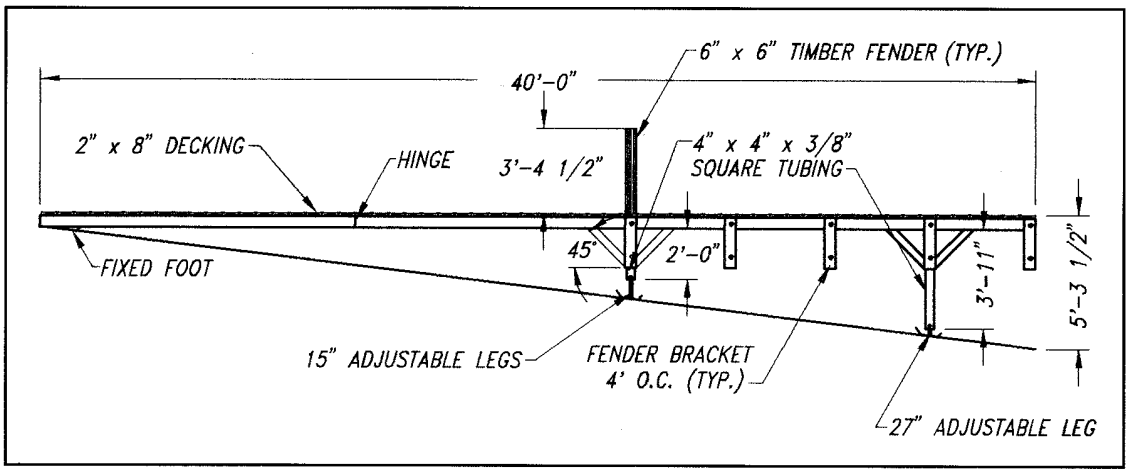


Figure 4-9 The design and dimensions of a typical skid pier used in Michigan

(2) The second style consists of a single dock section supported by wheels on one end. The wheels (which may be removed) are part of a superstructure that can be adjusted to compensate for differences in launch ramp slope or in the lake bottom adjacent to the ramp. The dock is rolled into place either on the ramp or immediately adjacent to it. A transition plate should be included to provide easy access from the ramp to the boarding dock. Eye bolts or other anchoring devices may be installed in a poured ramp so that the dock may be anchored to the ramp with cables or chains. If the dock is placed beside the ramp, a modest depression in the lakebed may be all that is necessary to secure the dock in place. The shoreward end of the dock is often fitted with a trailer hitch for transporting it to a new location.

If either type of movable pier is used on other than a hard-surfaced launching ramp, it should be possible for adjustments to be made to the pier to maintain a level surface and acceptable cross slope.

Photo 4-19 A roll in boarding dock being moved

Photo 4-20 A roll in boarding dock in place

It should be kept in mind that a skid pier stays in place only by virtue of its dead weight and the friction between it and the launching ramp surface and, therefore, certain design details are important. The total dead weight should be sufficiently high (1,000 to 7,000 pounds, depending on the site requirements) to keep the pier stationary even when impacted by vehicles, boats, wind, and waves. If uplift can occur from wind and/or waves surging under and up against the bottom of the decking, it may be necessary to use perforated decking for relief from the uplift pressure.

Channels to Navigable Water

Although every effort may be made to acquire property with sufficient depth offshore to immediately accommodate launched boats, in some cases dredging will be necessary to provide a channel from the launching ramp to navigable water. The channel should be at least as deep as the water at the end of the ramp, the minimum depth being 3 feet. If the facility will be used to launch larger vessels, a greater depth may be necessary.

The design depth for the channel must be based on low-water conditions. Over-dredging one to two additional feet may be practical to leave extra room for siltation, which can reduce the frequency of maintenance dredging.

Channel widths vary. As a minimum, the channel should be wide enough to accommodate two design vessels passing safely at no-wake speed. In Oregon, the specified minimum is 40 feet *(see Figure 4-10)*; in California, 75 feet; and in Ohio, 100 feet.

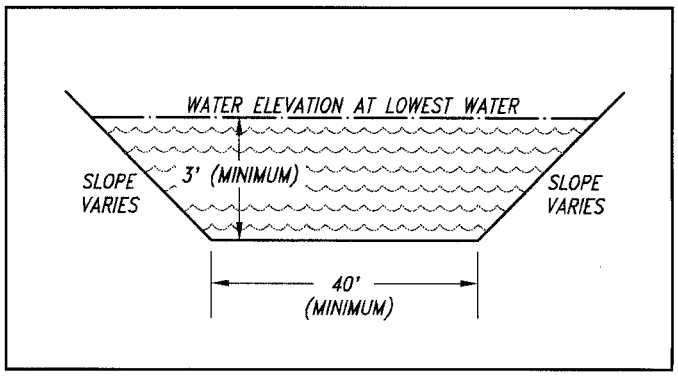


Figure 4-10 The 40-foot minimum channel bottom width required in Oregon

Dredging

Channels can be dredged with a variety of equipment. The facility designer must be knowledgeable about the type of material to be dredged to be able to specify the type of equipment to be used. There are various types of dredging operations that are useful for specific applications based on material handling and regulatory requirements.

Hydraulic dredges may be the most economical in moving large amounts of material (50,000 cubic yards or more). These are floating pumps, with cutter heads that extend to the bottom and churn up the material so that both the material and the water necessary to transport it can be pumped from the dredged location through pipes to a suitable disposal area. The disposal area is the key to a successful hydraulic dredging operation. It must be within the pumping capability of the hydraulic dredge, be suitably diked to contain the materials, and have a sediment trap so that the water flowing out of the diked area is allowed to clarify. However, since most channels constructed to serve boat launching facilities involve moving only small amounts of materials, hydraulic dredging rarely is used.

Photo 4-21 Hydraulic dredge

A **crane** operation may be used in small and large projects alike, depending upon soil conditions and disposal requirements. A crane can work from shore or be barge-mounted based on site access requirements. The crane operation can utilize a clamshell or **dragline** as the excavation method.

An excavator, which works similarly to a dragline or clamshell, may also be appropriate for low-volume projects, but their range is more limited because their buckets are attached to rigid arms. "Excavator" is a general term for equipment such as rubber-tired and track, backhoes, grade-alls, and even front-end loaders. Standard earth-moving equipment, such as bulldozers and bottom scrapers, may be used when a channel can be excavated in the dry (i.e., it has been coffer dammed or the water level is sufficiently low).

When a channel must extend some distance, floating barges may be necessary for the crane or excavator operation. In this case, the materials excavated must be barged or rafted to shore.

Dredging Permits

Dredging a channel normally requires a permit from a federal and/or state agency. The regulating agency will require information about the design of the channel and the nature, quality, quantity, handling, and disposal of the material to be excavated. Excavating is often less of a problem than disposing of the dredged material, and the extent to which contaminants are found in the materials will dictate the type of disposal required. Disposal of highly contaminated materials requires removal to an approved facility and may cost several hundred dollars per cubic yard.

Navigation Aids

Channels should be marked to identify their location, width, and length. If a channel is located in waters under the jurisdiction of the federal government, a permit to place navigation markers will be required from the U.S. Coast Guard. The permit will prescribe the number, color, and location of the markers, and may also require that some be lighted to mark the channel at night. If a channel is dredged in waters under only state or local jurisdiction, a state or local permit to place navigation markers may be required.

The markers prescribed by the Uniform State Waterway Marking System, which is recognized by the U.S. Coast Guard, usually are suitable for waters not connected to U.S. navigable waters. The U.S. Coast Guard can provide information about required or suitable navigation markers for a specific channel in either federal or nonfederal waters.

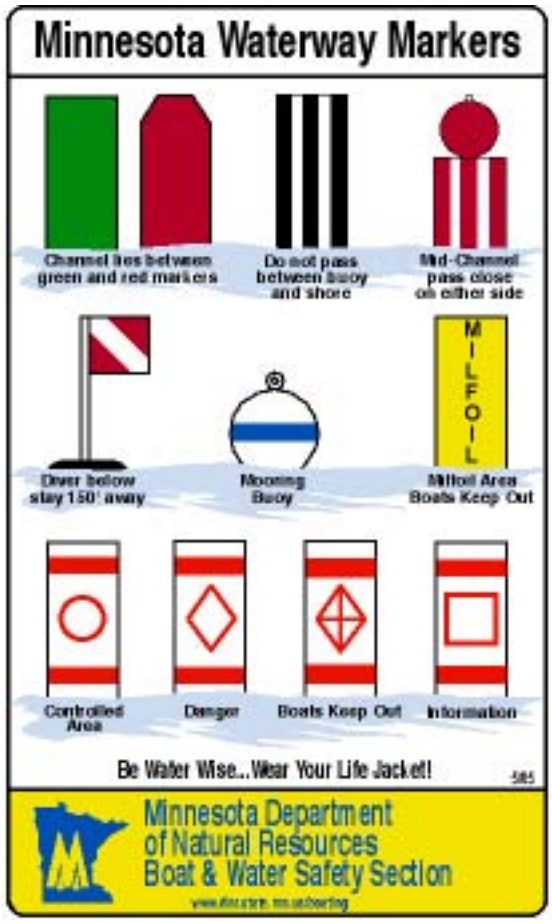


Figure 4-11 Navigational marker sign used in Minnesota

Chapter 5

Docking and Fishing Facilities

Site Conditions

Water level fluctuations, water depth, seasonal environmental conditions, and the need for protection from wind and waves all affect the design of and material selection for docking and fishing facilities.

Photo 5-1 Transient dock system, Joe Wheeler State Park, AL

Water Level Fluctuations

Nearly all water bodies fluctuate to some degree as a result of tidal influences, operational requirements (such as hydroelectric discharges, irrigation diversions, domestic water supplies), and seasonal fluctuations. Where water levels fluctuate less than two feet, the docking system may be fixed or floating, and the slopes and distances necessary to travel from the shore to the docking facility minimal. However, where fluctuations regularly exceed two feet, it is almost always necessary to construct floating dock systems in which the docks can rise and fall with the changing water levels and maintain constant freeboard, which is important for boater safety and convenience. As the main pier rises and falls with the water level, it affects the slope of the gangway and the other connections with the shore.

Docking facilities are often located on lakes and reservoirs subject to water level fluctuations of 10 to 50 feet, but sometimes as much as 300 feet. All such water bodies have shores that slope to some degree, requiring that the entire docking system and its anchorage system be periodically repositioned horizontally to the shore to accommodate the changing water level. Under such variable conditions, a docking system may need to be moved up or down a boat launching ramp, roadway, or other shore path appropriate to pedestrian and vehicle access. How often the docking system must be moved depends on the length of the gangway, the shore's slope, and the rate of water level change. A relatively long gangway reduces the frequency of repositioning a docking system.

In tidal waters, fluctuations will occur on a daily basis and will vary over the course of the year. Tidal variations also vary from location to location. For example, in Maine and Alaska, the variations can exceed 30 feet vertically. In locations closer to the equator, the variations are much smaller, in the range of two to five feet.

Water Depth and Soil Conditions

The design water depth at the site may dictate the type of structure to use, the method for anchoring, and other layout issues. In shallow water, guide piles are typically used where bottom conditions are favorable. Where bottom conditions are not suitable for piles, other anchoring methods are required.

In deeper water, bottom conditions increasingly influence the design of the anchoring system. Dredging and other operations also impact the choice of anchoring systems. For example, where maintenance dredging will be required, a guide pile system is generally preferred over a cable-stayed anchoring system.

Seasonal Variations

The design of the structures must also accommodate environmental conditions such as drought, evaporation, flooding, ice, and seiche. Such environmental factors can represent significant load conditions or cause increases in the water level fluctuations that influence the design of the structure.

Specific site evaluations may be required to define and quantify these environmental conditions at a specific location. Since these conditions can be significant, the benefit of a thorough site evaluation can be particularly cost-effective. For example, the seiche effect in a large lake can affect the water level by several feet in a short period of time.

Wind and Wave Loads

Wind and wave loads directly affect waterside structures, and wind loads selected for design conditions should account for operational as well as extreme conditions. Local records can be useful in determining the wind speeds at a particular location. The primary design condition or operational condition will be determined by local codes, and therefore local building officials should be consulted to identify any specific local requirements. Design storm events can be based on historic weather data and local history as recorded by local authorities.

Photo 5-2 A wave's impact on a pier

The design vessel and its surface area that is exposed to the wind determine the wind load on the vessel and the berthing structure. The designer must account for the vessels berthed at the facility as well as the wind load on the structure itself.

Where multiple vessels are berthed together, a shadowing effect can occur where the windward vessel is fully exposed to the wind load and only a portion of the full wind load affects leeward vessels. Sound engineering judgment is required when determining the factoring in this case, and variations in wind direction and speed for any given condition must also be taken into account. Local codes, conditions, and records are important guides to use in this calculation.

Wave loads are a function of the height and length (period) of the wave. Wind-generated waves can be relatively high and short as compared to a wake-generated wave. The lateral force of the wave climate typically represents the significant portion of the environmental loads on waterside structures. The design wave should represent the maximum wave that can be expected to occur within a marina basin caused by the highest significant wave impinging on the protected works of the marina basin or by the maximum wind wave that can naturally set up within the marina basin perimeter, whichever is greater.

The dynamic loads caused by currents, if applicable, also represent significant lateral loads and should be addressed as they can significantly increase if accompanied by even a moderate debris load.

Offshore Wave Protection

Breakwaters are offshore structures constructed to provide protected waters for boating facilities or for navigational purposes. Their location in water deeper than normally accessed from the shore makes them desirable for fishing. The decision to incorporate fishing components in a breakwater must be based on the effect the modifications will have on navigation compared to the benefit to anglers.

Fixed breakwaters, which can be constructed as a rubble mound structure, a rock crib, caissons, or vertical sheet piles, are positioned offshore to create perimeter protection for the marina basin. This type of breakwater can be the most effective means of protecting marine structures from waves. A fixed breakwater can virtually eliminate wind-generated waves from the basin, depending upon site geometry.

Photo 5-3 Overview of a rubble mound breakwater, St. Innace, MI

Rubble mound construction is a pyramid-shaped gravity structure. Rocks are carefully placed to create a sloping, irregular surface down to the waves, which allows waves to roll up on the breakwater and dissipate their energy in the process. The alternative is a vertical wall construction usually higher than rubble mound breakwaters. It must be stronger because waves hit it with full force and the wave action is not dissipated on the way up the structure as it is with rubble mound installations. Rubble mound structures have a larger footprint than vertical structures, and, consequently, they create more force at the bottom of the water body. Rubble mound structures can also provide more underwater habitat area compared to vertical structures.

A floating breakwater, often referred as a Floating Wave Attenuators (FWA), can be a cost-effective alternative to the fixed structure, depending upon the wave environment. FWAs are generally effective for sites where waves are less than four feet high with a wave period of approximately 3½ to 4 seconds. Waves exceeding these parameters are difficult to attenuate with a floating structure largely due to the geometry of the relatively large wave and relatively small structure.

An FWA system involves several design considerations: (1) flotation materials to keep the structure on the surface; (2) a frame network to keep all of the components together; (3) a wave-deflection surface; (4) mass, width, and depth for the design wave; and (5) an anchoring system that can withstand the design wave and combined wind loads. Materials usually consist of a combination of concrete, metals, and/or timber. FWA systems can be effective, but maintaining them can be costly.

The use of an FWA is a good solution where sensitive habitat or environmental conditions exist on the bottom of the water body.

Photo 5-4 Floating wave attenuator

Berthing Structures

This section provides design guidance for structures associated with long-term and temporary berthing of vessels.

The following structures provide berthing facilities:

> *Marina* – a dock or basin providing secure berthing for pleasure boats and often offering supply, repair, and other facilities
> *Boarding Dock (courtesy dock)* – a fixed, floating, or adjustable structure typically parallel to a launching ramp, designed to permit mooring for launching and retrieving operations
> *Transient Dock* – a temporary berthing area provided for a specified, limited duration as determined by the facility manager

The design of berthing facilities depends upon site restrictions, cost considerations, and the desired level of efficiency. Numerous variations exist, and most involve in-water components consisting of (1) a main pier—a structure extending more or less perpendicularly from the shore that serves as the main access way for the facility, and (2) finger piers—auxiliary structures that extend from a main pier at right angles, from which boaters board and exit their craft. Finger pier widths vary, based on the length of the structure. *(See Figure 5-1)* The water space between finger piers in which a boat is moored is referred to as a slip.

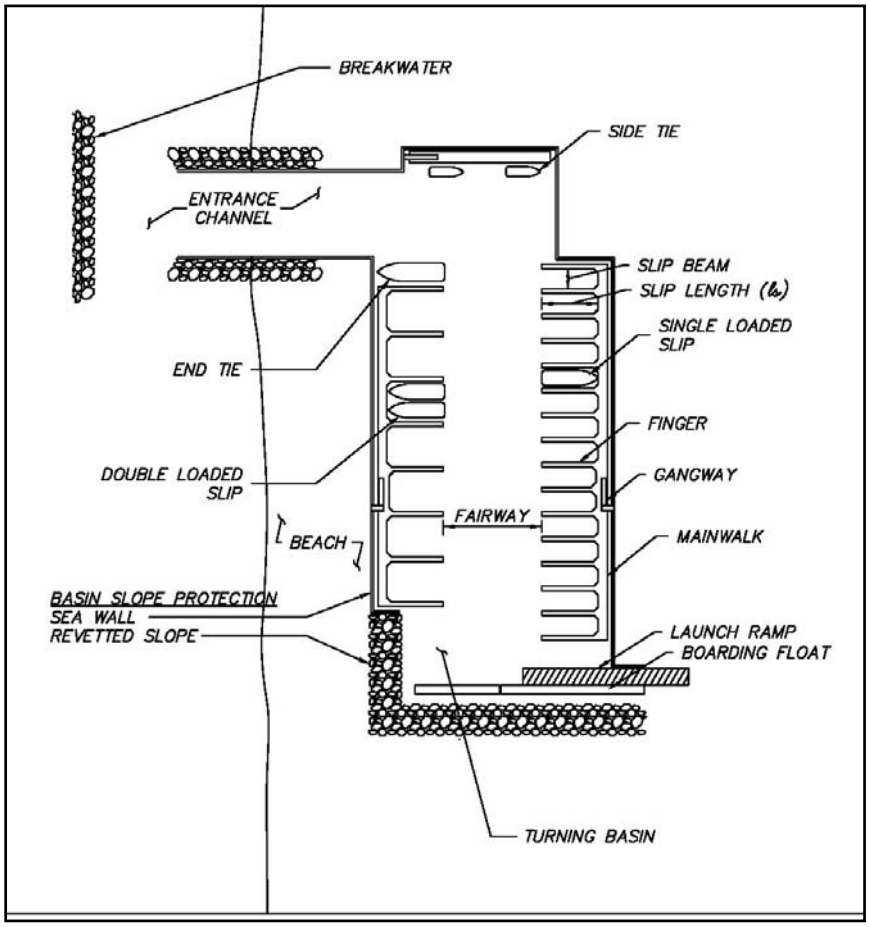


Figure 5-1 Typical marina basin nomenclature

Design Criteria

Live Load – A Uniform Live Load (ULL) of 20 pounds per square foot minimum should be applied to account for both the load to which the structure is subjected and the load of the structure's own weight (usually consisting of the weight of people and/or objects on the structure). Increased usage and vessel size may require a higher load value. Live load analysis for *fixed structures* should also include a 450-pound point load applied anywhere on the surface of the structure. For *floating structures,* the live load analysis should include a minimum 400-pound point load applied 12 inches from the edge of the structure. The point load and ULL need not be considered simultaneously.

Photo 5-5 Example of what can happen when the live load is exceeded

Impact Load – The kinetic energy of a vessel striking the structure either fixed or floating. This is a function of the weight of the vessel, the assumed vessel speed, and the angle of attack. A speed of approximately 2 knots and an angle of 10 degrees should be considered as minimums. These values should be adjusted in accordance with local usage or adopted guidelines.

Dead Load – The total weight of the structure, all hardware, and permanently attached equipment. Dead Load should also include the weight of material stored in the storage boxes and fluids in all pipelines.

Fixed Dock (or Fixed Pier) – A fixed structure constituting a pile-supported walkway above the high-water level (based on local datum and conditions). Fixed piers, which provide vessel mooring and water access, are usually constructed on water bodies with minimal fluctuations. The size of the structure can vary based on planned use, but generally berthing space is provided for two vessels, one on each side.

Materials

Fixed piers are typically constructed of metals, timber, concrete, composites, or a combination of these materials. Local conditions, cost, and availability influence the choice of materials, and life-cycle maintenance considerations should also be a part of the material selection process.

Photo 5-6 Example of a fixed pier marina system, Elberta, MI

Floating Docks – Structures supported with floatation devices are designed to rise and fall with the water level fluctuations. Floating docks are usually constructed on water bodies with fluctuations that exceed 2 feet. Floating docks can be individual structures or can be combined to comprise an entire marina complex. In either case, the design parameters are consistent.

Materials – Unlike fixed structures, materials utilized in the design and construction of floating structures can be used in significantly different ways. The primary components of a floating structure include the structural elements, flotation, walking surface, and anchoring connections.

Concrete docks can be manufactured in a number of ways, and one is the pontoon system utilizing modular pontoons or float units. In this system, the modular floats are structurally held together with timber walers. The concrete-encased foam flotation units serve as the float unit as well as the deck. The modular units are assembled to create the fingers and main piers.

Photo 5-7 A concrete pontoon dock system, Dana Point, CA

Another concrete system is a structural concrete system that is similar to the pontoon system only in that the flotation is concrete-encased and the deck is an integral part of the casting. In this system, the float units are larger and cast with structural reinforcing steel and high-strength concrete. The concrete casting is the structural element, so the loads are transferred through the structural steel and concrete, not the timber walers.

Photo 5-8 A structural concrete dock system, Bristol Harbor, RI

Metal frame docks are manufactured using a structural metal frame—typically a truss frame supported with encased foam flotation with one of a variety of decking materials. The most common systems are made of galvanized steel or aluminum. They are designed as truss systems or standard structural members consisting of welded or bolted connections.

Photo 5-9 Metal frame dock

Photo 5-10 Timber dock system, Saginaw, MI

Timber docks are constructed using timber members as the structural elements. Timber structures also are supported with encased foam flotation and a variety of decking materials. Typical designs utilize dimensional lumber or glue-laminated (glu lam) members. It is recommended that the timbers be pressure-treated with preservatives to protect them against the marine environment and insect infestation. Timber docks are typically the easiest to repair and provide a long-lasting service life when properly maintained.

Composite docks can be modular units that are readily assembled in a pontoon manner—where the structure is actually created by the floatation units. Various composite materials are also used for decking and rub rail elements.

Moorings

Moorings that are constructed of ground tackle and mooring lines can provide both temporary and permanent berthing. The mooring system includes an anchor with a chain or lines that are floated on the surface to which vessels may be tied. Mooring areas should be relatively protected from environmental conditions and close to landing facilities for tender access to the moored vessels.

Single Point moorings provide a single anchor connection, which allows the vessel to rotate with the changing wind and current directions. A single point mooring system can accommodate a wide range of environmental conditions, but requires more space per vessel.

Photo 5-11 Example of a single point mooring system, Tahoe Vista, CA

Double Point mooring configurations provide an anchor and connections for both bow and stern. This system is very useful when the wind and current conditions are stable and where space is at a premium.

Anchoring Systems

Anchoring systems are specifically designed to the site conditions. The system design should account for both the system load and the transfer of loads from the structure to the ground.

Guide piles are vertical structural members used to restrain the structure from horizontal movement. They are typically used in relatively shallow water not exceeding 20 feet in depth, where suitable soil conditions exist and where water levels fluctuate only 2 to 10 feet. Steel (pipe or other column shapes), concrete columns (pre-stressed precast), and treated timber poles are all used for guide piles. Jetting, drilling, or hammers (drop or vibratory) are commonly used for installation; the actual method used depends upon soil type and conditions, regulatory restrictions, and availability of equipment.

Photo 5-12 Example of a guide pile anchoring system, USCG, San Diego, CA

Cable-stayed anchoring systems consist of a bottom anchor with a cable system that connects to the floating structure and holds it in place. Cable-stayed systems are useful in deep water and/or where water levels fluctuate greatly. Depending upon the water-level fluctuations, winches may be included in the system to facilitate adjustments for the changing water elevations, to keep the cables evenly adjusted, and to maintain structure alignment.

A cable system, which can be made of any combination of chain, cable, rope, or other device, should be specifically designed to best accommodate the site conditions, structure size and strength, and bottom conditions. Cable and chain systems utilize the inherent **catenary** effect to absorb and transfer loads evenly.

Alternative systems are being used that include elastomeric devices. These are basically high-strength and very durable elastic cords designed to maintain a constant tension on the structure. As the system experiences load increases, it absorbs the increased loads through controlled and predictable elongations. The elastic units are specifically designed to accommodate the anticipated water level fluctuations and anchor loads on the structure.

Photo 5-14 An elastomeric anchoring system, Lake Las Vegas, NV

Anchors

Gravity anchors are large weights placed on the bottom of the water body to which anchor cables are attached. The anchors must be sized appropriately to account for both the buoyant forces as well as sliding friction, and large anchors may be needed where both of these conditions exist. Anchor designs can incorporate steel protrusions or shapes to help hold the anchors in place. Gravity anchors are typically cast concrete, but other materials, such as steel, can be used.

Photo 5-15 Example of concrete anchors, Joe Wheeler State Park, AL

Mechanical soil anchors, devices that are physically installed at a precise location, have predetermined holding capacities. The holding capacities of the anchors are determined

by soil conditions and the construction methods used for their installation. Such anchors include soil augers and locking anchor devices (toggle bolt effect) that are screwed or driven into the soil. Mechanical anchors have the benefit of minimizing disturbance to the bottom and will not slide as gravity anchors do.

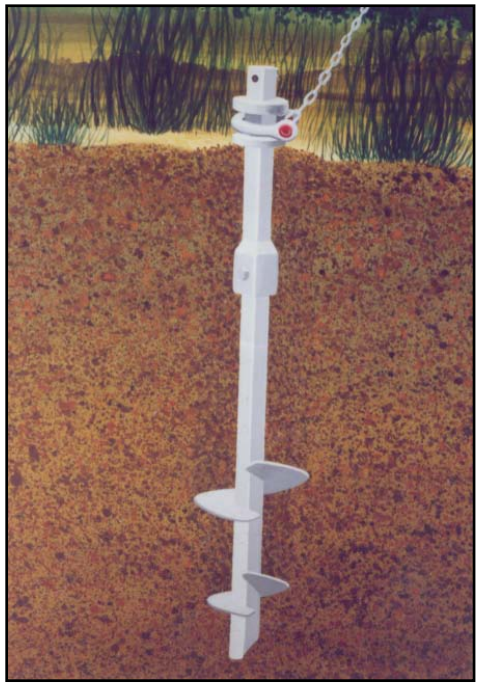


Figure 5-2 A helix anchoring system

Fueling

Fueling stations provide waterside fuel capabilities. The fueling area should provide a safe mooring area for vessels and a platform for fueling equipment. Due to the hazardous nature of these facilities, there are numerous codes and regulations that must be incorporated. Safety equipment is required for fire safety, spill response, and spill containment.

The fuel dock should be a stable structure constructed of fire-resistant material such as concrete. The dock should incorporate piping and utility systems in protected conduits with easy access for monitoring, inspections, and maintenance. In many cases, small structures are provided on the dock for point-of-sale operations.

Photo 5-16 A fuel dock complex, Lake Powell, UT

Fuel storage can be provided in underground, above ground, or floating tanks. In all cases, there are specific regulations that address access, leak detection, fire suppression, and spill containment.

Pump Out Stations

Clean Vessel Act (CVA) Pumpout Program

The U.S. Fish and Wildlife Service offers grants to appropriate state agencies to provide pump out and dump stations where boaters can dispose of human waste in an environmentally safe manner. Pump out stations are used to pump waste out of recreational boat holding tanks. Dump stations are used to empty portable toilets. For more information, go to http://federalasst.fws.gov/cva/cva.html.

Pump out stations provide waterside sewage disposal capabilities. The pump out area should provide a safe mooring area for vessels and a platform for the sewage collection equipment. Due to the potential for water quality impacts, there are numerous codes and regulations that must be incorporated. Safety equipment is required for user safety, spill response, and spill containment.

The type of boating activities at a marina can determine the best pump out system to install. For large-scale marinas a high-capacity pump out station is required. For remote marinas where smaller vessels are used, a small dump station may be adequate. There are various systems to consider, including fixed and portable and various types of mechanical operations.

Fixed, or on-dock, systems provide services for boaters from a permanent pump out installation. This type of system can be at a designated mooring area or be a manifold system that services the vessels at individual slips. The fixed systems include a pump out station that delivers the effluent to a holding tank or to a direct sewer connection.

A portable system is typically a cart-mounted pump that either pumps into a holding tank or a sewage transfer system installed on the dock. Another type of portable system to be considered includes a transportable system whereby the vessel is serviced at its slip or mooring by a tender boat equipped with a **sewage pump out** and holding tank.

The pump out dock should be a stable structure constructed of long-lasting and easily maintained materials. It should incorporate piping and utility systems in protected conduits with easy access for monitoring, inspections, and maintenance. In many cases, the pump out station might be located next to the fuel dock or other high-use areas to facilitate public access.

There are three principal types of mechanisms for pump out equipment: peristaltic, diaphragm, and vacuum. The type chosen depends on the length of the system, the expected usage rates, and the disposal methods. For information regarding testing of pump out equipment, contact SOBA at www.sobaus.org.

Utilities

Utility services such as water, fire suppression, electrical, lighting, telephone, Internet access, and cable television are often provided at berthing facilities. The systems are installed along the main pier with service connections at the slip areas. The dock should incorporate piping and utility systems in protected conduits with easy access for construction, monitoring, inspections, and maintenance. When utilities are provided at boat slips, power lines and hoses should not cross finger piers or access ways.

Utility requirements for modern facilities allow for more electrical capacity and access to new technologies. Multiple receptacles may be necessary to meet the electrical demands of modern vessels. Typically, a combination of outlets is utilized to provide flexibility of service to a wider range of vessels. For example, a slip for a 50-foot vessel could be fit with either two 50-amp receptacles or a combination of one 30-amp outlet and one 50-amp outlet. Electrical outlets, water service, cable television, and telephone connections should be 15 to 48 inches above the dock surface.

Local fire authorities should be contacted early in the design process to identify any local agency requirements in addition to the national code requirements.

Fishing Facilities

Fishing facilities can take a variety of forms—from landside access such as banks, bulkhead, and jetties to structures that provide access out over the water. Pier structures can be parallel or perpendicular to the shoreline and can be either fixed or floating.

Photo 5-17 A floating fishing dock

Banks

Natural shorelines provide an ideal setting for bank fishing, often with only the modest investment necessary to establish fishing sites along the shore and to provide access to the site. Sites need to be large enough to facilitate fishing with appropriate clearance(s) for the type of fishing anticipated.

Care should be taken to prevent anglers from inadvertently fishing where they could be caught in rapidly rising water. Fishing facilities constructed on banks immediately downstream from hydroelectric or other impounding structures should be well above the ordinary high-water mark. If an auditory signal is used to indicate an imminent discharge of water, ADA rules specify that a visual warning, such as a flashing light, also be present for the benefit of people with hearing impairments. Signs warning that sudden

water fluctuations will occur and giving information on their frequency, extent, and the type of warning signal used should be located at the facility's entry points.

Photo 5-18 A group of people bank fishing

Bulkheads

A bulkhead, which is a vertical wall separating land and water, can provide access to shore fishing. Where fishing takes place and where there is general pedestrian traffic in the land area just behind the bulkhead, the area should have a hard or packed surface.

Where conditions warrant it, a railing should be installed. If the primary use of the area behind the bulkhead is for seated fishing, the railing can be a maximum of 34 inches high; otherwise, a safety rail 42 inches high is recommended. Where a railing is not required, a warning should be placed at the water's edge to alert anglers of possible safety hazards.

Fishing Docks (Floating)

Floating fishing docks, which are structures supported by floatation devices designed to rise and fall with water level fluctuations, are placed for fishing access in locations where there is adequate water depth and a viable habitat for fishing. The docks may be modified with special features such as railings, fishing wells, rod holders, and spaces to accommodate fish landing.

Because floating fishing docks and boarding docks are fundamentally the same structures, similar design criteria apply to both, with exceptions for the Uniform Live Load (ULL). For public-use fishing docks, a minimum ULL of 40 pounds per square foot is recommended. All other design criteria shall be as for a floating dock.

Piers and Platforms

Platforms are typically smaller fixed structures attached at the landside and extending over the water with fishing allowed from three sides. Fishing piers are typically longer structures that provide access out over the water body. Both platforms and piers generally are pile-supported with a deck height determined by local conditions. Critical design elements include the railing configuration, decking, and shore connection.

Platforms can be constructed of metals, concrete, timber, and composites. The surface should be skid-resistant, especially when wet, and easily cleaned and maintained. Material selection should be compatible with local site conditions, expected usage, and long-term maintenance considerations. If wood is used, planking is preferred to plywood. If planking is used, gaps between planks should not exceed ½ inch after shrinkage. All planking should be even and not warped. All fasteners should be flush or slightly below the surface, so as not to impede or create hazards to users. Screws may be preferred to nails.

The design criteria for the structure shall include the appropriate environmental loads and a ULL of 100 pounds per square foot minimum. The live load condition should also include the 450-pound point load anywhere on the structure's surface.

Dead load shall include all structural members, hardware, decking, and railings as well as any utilities—including the weights of any fluids in the pipes.

Anglers may stand or sit to fish. The railing, which should consist of either pipe or slanted board to encourage unsafe practices such as sitting or standing on it, can provide a convenient rest for fishing rods. One acceptable design calls for a 2- x 10-inch board, slanted so its outer edge is at a 32-inch height and its inner edge is 29 inches high. If desired, 1½-inch holes angled out at 30 degrees to the horizontal may be drilled in the rail to hold rod handles. Because many anglers fish with more than one rod, such holes are best provided every 2 feet. For ease in landing a fish, a retrieval opening in the railing up to 9 inches wide may be provided at a maximum of 8-foot intervals.

Photo 5-19 An example of a timber fishing pier, Massey Landing, DE

Ladders on fishing piers facilitate recovery if someone falls from the pier, but their presence may encourage people to swim from the pier and encourage boaters to drop off or pick up passengers there. Regulations prohibiting swimming and prohibiting boats from stopping at piers should be adopted, and signs stating the prohibitions should be posted.

Life rings and rescue poles may be provided, but experienced program administrators report they are subject to theft and often not available when needed.

Photo 5-20 A fishing pier, Woodland Beach, DE

Chapter 6

Operating and Maintaining Facilities

Facility operation and maintenance is an important aspect of boating and fishing access programs that must be considered during the design phase of a facility renovation or construction project.

Facility operation refers to the control exercised by the administering agency over the activities permitted at a recreational boating or fishing facility. Maintenance refers to the actions required to keep a facility in a desirable condition. Although each is considered separately in this chapter, specific legal and public responsibilities apply to both.

This chapter provides a brief overview of facility operation and maintenance. More detailed information about the operation and maintenance of facilities can be found in the 1999 SOBA publication *Operations and Maintenance Guidelines for Recreational Boating Facilities*. This publication, which can be ordered from SOBA's web site www.sobaus.org, should be reviewed before initiating a boating facility operation and maintenance program.

Legal Responsibilities

United States law is rendered in two ways: (1) imposed by Congress, state legislatures, and local government agencies, and (2) imposed by the courts. A law enacted by Congress becomes public law; by a state legislature, a statute; by a lesser government agency, an ordinance. Government agencies impose a legal responsibility by promulgating a rule or regulation that must be specifically authorized by a public law, a statute, or ordinance. If a court establishes a law, it is by judicial decision; collectively, judicial decisions are known as the common law.

With regard to liability under state law, most states provide for governmental immunity. Any activity pursued by a state agency may be classified as either a governmental or a **proprietary activity**. If governmental, the government body is immune from liability for acts of "ordinary negligence" (in most states, the operation of a recreation facility is so classified). If proprietary, however, the government body is not immune. Acts beyond ordinary negligence, normally classified as "gross negligence," are not immune from a lawsuit, regardless of classification.

Legal advice should be sought when a recreational boating or fishing program is being established or expanded because legal liabilities are incurred in the administering of a recreation facility. The legal responsibilities of the administrator must be clearly understood, and the advice of legal counsel should be sought to ensure that all liability requirements are being met and to determine if there is a need for liability insurance.

Public Responsibilities

If the property in question is public, it is desirable to permit all possible recreational uses. However, if the facility is a boat launching site or a fishing pier, additional uses may not be desired. Boat launching and fishing facilities are developed to meet specific recreation needs. Competing uses may impair this objective, and therefore the best approach is to permit uses that are compatible with the primary function of the facility. Some activities desired by the public may or may not be appropriate depending on site conditions and location. The goal should be to allow all recreational uses of a site that do not adversely affect its primary function, cause unreasonable disturbances in the neighborhood, or invite abuse of laws.

Operations

Categories of Use

Most boating programs include launching facilities of varying sizes, located on many types of water bodies in various areas of a state. For this discussion, the facilities are categorized as low-, medium-, or high-use facilities. Generally, low-use facilities are located in more remote areas, medium-use facilities are nearer population centers, and high-use facilities are in metropolitan or destination recreation areas.

A low-use facility is generally small and provides the fewest amenities. Its parking area is small and may not have delineated parking spaces. If a launching ramp is provided, it may be a single lane without a boarding dock. Restrooms are generally not located at such sites.

Medium-use facilities are, by definition, sites that offer amenities ranging between those provided at low-use sites and high-use sites. Medium-use launching sites generally have larger ramps (usually with boarding docks) and a larger and more defined parking area than low-use sites have. Restrooms may be present. Because medium-use sites generally receive more multiple-use than do low-use sites, regulations are necessary to balance conflicting uses.

High-use facilities are typically the largest in a program and frequently offer a full range of amenities. At these launching sites, user fees are sometimes levied and attendants may be present.

User Fees

User fees can be of value in administering a recreational facility, but generally are regarded negatively by site users. This is especially true if the site is supported entirely or in part by revenue from other fees or taxes levied upon the people who use these sites.

User fees serve two purposes. In addition to producing revenue, they help control facility activities. Collecting fees at the entry and allowing only the number of vehicles or vehicle-trailers for which parking is provided assures that a facility will not be used

beyond its capacity. Imposing user fees at sites other than large, high-use facilities is impractical. Although such fees generate revenue, collection costs are high.

If the sole purpose of charging a fee is revenue, an honor system with periodic enforcement can be instituted. The primary challenge in such an arrangement is to devise both a way to collect the fees and to keep them from being stolen. The collection receptacle has to be reasonably safe from theft. Even if these objectives are met, it is desirable to remove collections frequently and regularly from the site.

Winter Use

Wherever water bodies freeze, there will be demand for access in the winter for such uses as ice fishing, ice skating, ice boating, and snowmobiling. Facilitating winter access at a site may involve maintenance that cannot be justified. Although declining to operate a site during winter will not eliminate use completely, the site's unplowed condition will deter or at least inconvenience some users. In some instances, members of local sports clubs or people interested in winter use may maintain access to a water body through their organization.

Facility Rules

To ensure violators are subject to penalties, rules or regulations must be based in law. Therefore, legal authority is necessary both for adopting rules and prescribing penalties for violators.

Typical Rules

The items listed below represent some common issues and activities that need to be addressed through regulation at boating access facilities. They are listed from broadest to most specific. Their application is cumulative. Only the most basic of these items need be addressed at a low-use facility, but all of them need to be considered at a high-use facility:

- Property damage and theft
- Illegal personal activities (disorderly conduct)
- Onsite boat storage
- Ice shanty storage and abandonment
- Posting of advertising signage
- Fire and fireworks
- Pets
- Firearms
- Commercial use
- Camping
- Picnicking
- Swimming
- Undesignated parking
- Alcohol and drug use

Rule Language

The wording of a rule has great legal significance. Rules should be written only by persons with rule-making expertise and reviewed by legal counsel before promulgation.

Promulgation/Notice

The procedure by which rules are promulgated usually is established by the legislation authorizing the rules. This procedure must be followed if the rules are to survive a legal challenge.

Even the best-written and most complete rule may fail to be upheld in court if notice of its existence is inadequately provided to facility users. A user cannot conform to a regulation if he/she does not know about it. In addition to prominently posted signs regarding such activities as parking, a bulletin board should be installed at the facility to post rules, warning notices, or other information. Publishing applicable site rules on access site maps and other publications also helps inform the public.

Penalties for Violation

If penalties cannot be imposed on violators, there is no way rules can be enforced. If they cannot be enforced they should not be adopted. Rules are only as good as their enforcement.

Legislation granting rule-making authority to a government agency normally provides that violating an adopted rule is a misdemeanor or other offense punishable by fine and/or confinement. If such a provision is not included, an administrator should make every effort to have the authorizing legislation amended before attempting to promulgate rules.

Emergency or Temporary Rules

In adopting and publishing rules that govern a boat launching or fishing program, provision should be made for emergency and/or temporary rules to meet unforeseen circumstances. Most states have an established procedure, including proper notice and posting, for instituting such rules. If it is desirable to continue an emergency or temporary rule indefinitely, an amendment to the standard rules of the agency may be prepared in accordance with the normal promulgation process.

Permitting Special Use of a Facility

Many requests will be made for special use of a boat launching or fishing facility. Since some will be compatible with program purposes and produce revenue, a procedure should be established whereby permission for special use may be formally granted. One means is through issuing a permit that specifically identifies the activity; names the sponsoring person, group, or business; establishes the hours or duration; and outlines the financial and legal responsibilities of the sponsor.

A word of caution—liability may be incurred by the administering agency. Appropriate legal authorities should review the permit procedure and the potential to determine potential liability and to plan alternatives to limit or avoid it. One alternative is to require permittees to carry liability insurance sufficient to **indemnify** the agency and to designate the agency as a named insured. Another is to require the permittee to hold the agency harmless, that is, free from liability resulting from the activities authorized by the permit. To constitute a valid agreement, the enforcement of which can be upheld in court, all permits must be signed by the sponsor.

Every allowed special use competes with the primary use of a facility, and issuing a permit implies that the special use may take precedence over primary use. Compatibility with normal facility use is a very important criterion by which the desirability of a request for special use should be measured. Frequently requested special uses include the following:

- Charter and cruise boat operations
- Boat races/regattas
- Fishing tournaments
- Scuba diving groups
- Civic picnics or family reunions
- Vendors and other commercial uses

It is also not unusual to receive requests from adjacent property owners for permission to use a portion of the site for a driveway, to cross the site with utilities, or to extend a building onto the site. Since the duration of such permission undoubtedly will be long-term, it should be in the form of an easement or other appropriate legal conveyance, if granted.

Other agencies, such as a local government agency, might request permission to use a site for a specific period and for a specific purpose. Such requests should be subject to the same liability review as any other, and appropriate hold harmless and/or liability insurance provisions required.

Evaluating Facilities

Boating and fishing sites are acquired and facilities are designed and constructed on assumptions or studies of user need. From time to time it is desirable to re-evaluate user needs to determine if they are still being met by the facilities. An evaluation should determine whether (1) existing facilities and amenities should continue to exist, (2) they meet user needs and expectations, (3) they are properly designed and (4) they are of adequate size. Such questions can usually be answered by surveying facility users.

Suitability/Quality

The assumed needs of future users are taken into account when a facility is designed and constructed. Although the assumptions may once have been correct, the passage of time brings change, including innovations in boat and/or trailer design that eventually render existing boating facilities less than completely satisfactory. Surveys need to be conducted periodically to ensure that user needs are being met.

Just as the suitability of facilities and/or amenities may change with time, so may the desirability of amenities. Survey questions about amenities should be written in such a way that respondents understand clearly that the costs or other aspects of a program may change if additional amenities are provided. Even so, users tend to indicate a desire for more, rather than fewer, amenities and services than are currently being provided. An administrator must balance user desire for additional amenities with other claims on available funds and determine the program's overall best interests.

Maintenance

Maintenance involves all activities required to keep a boat launching or fishing facility in a condition that will permit functional, convenient, and safe use. Maintenance needs to be an integral part of the facility program and its components specifically spelled out, particularly if other agencies are involved in facility construction or operation. There are many excellent reasons for good facility maintenance.

Importance of Proper Maintenance

The following are important reasons for keeping a site properly maintained:

Preserving Intended Use – One of the best reasons for maintenance is to assure that a facility fulfills its intended use. No matter what facilities are initially provided, if improperly maintained they will not fulfill their function, and the initial investment will be lost. For example, shoaling at the end of a launching ramp is commonplace, and if it is not remedied, the ramp becomes difficult, if not impossible, to use. So long as such a condition prevails, the investment in the facility is of no value to boaters because the facility cannot be used as intended.

Safety – By providing facilities, program administrators are inviting use and incurring a duty to users to keep the facilities safe for the intended use. Failure to carry out that duty

not only exposes users to potential injury, but also may expose the agency to monetary damages. Maintenance personnel should be informed of the responsibilities of the agency to users and be held accountable for the condition of the site and facilities.

Complying with Laws – The jurisdiction in which a facility is located may have laws or ordinances requiring that certain minimum maintenance standards be met.

Preventing Vandalism – Vandalism is always a potential problem at public facilities. Since much of it results not from a single act, but from an accumulation of acts, a responsive maintenance program can help keep vandalism in check by correcting early acts. Unintentional damage, such as broken guardrails, may appear to others as vandalism and, if not repaired, encourage similar acts.

Extending Facility Life – Maintenance extends the life of facilities. For example, potholes expand quickly if not repaired, skid piers pushed off a launching ramp may be damaged by the elements if not quickly put back in place, and a boat ramp may collapse if eroded or washed-out areas are not quickly repaired.

Promoting Goodwill – Well-maintained facilities promote a good image of the program among the site neighbors. Neighbors maintain their property to personal standards and may resent others who do not. One of the charges to maintenance personnel should be to assure that a facility is maintained to the standards of the neighborhood, since such a policy will engender considerable goodwill. For example, if portions of the site are to be mowed, the mowing should occur regularly.

Reducing Litigation – If facilities are regularly inspected and maintained, the chances of accidents occurring and liability being incurred are reduced. Not only must maintenance personnel be concerned with physical facilities, they also must be trained to observe site conditions. For example, trees or limbs that have fallen or, worse, are likely to fall, are potential causes of personal injury.

Maintenance Categories

There are three basic categories of site maintenance: routine, cyclic, and reconstruction. Maintenance work in all three categories can differ enough to require different equipment and special training of personnel. Whether maintenance is performed frequently or only periodically is dictated by facility use and other factors.

Routine Maintenance

Routine tasks include picking up litter, replacing notices on bulletin boards, sawing and/or removing fallen tree limbs, clearing the ramp of debris, removing accumulated sand or silt from a ramp, and replacing signs. Maintenance performed more often than once or twice a week generally occurs only at large, high-use facilities and, in addition to the routine tasks mentioned above, includes emptying trash containers and cleaning and restocking restrooms.

Cyclic Maintenance

Weekly or less frequent maintenance is most appropriate for low-use facilities. The trash load is less at small sites (some may not have trash containers at all), so maintenance crews have time to perform more tasks in one visit at these facilities than they do at larger, higher-use sites.

Mowing is an example of a cyclic task, but it should be scheduled routinely. Most sites also require occasional replacement of such items as bulletin boards, guardrails, posts, skid-pier fenders, deck boards, and signs. This may be done routinely through scheduled visits or in response to reports from maintenance personnel. Usually a facility is scheduled for routine and cyclic visits by a crew equipped and trained to remedy frequently experienced problems. A facility may be slated for special visits when unscheduled maintenance activity is necessary.

Reconstruction Maintenance

Reconstruction maintenance includes special, major, or deferred maintenance and usually involves work of a significant nature. Examples are repairing a ramp eroded by propeller wash from crafts being powered onto trailers, repairing a road washout, and rebuilding or replacing a facility. These tasks require a wide variety of equipment and specially trained maintenance personnel, such as a construction crew.

Scheduling Maintenance

The number of visits and the time required for each visit should be based upon what is required to perform the tasks necessary to meet established maintenance standards. Every effort should be made to perform maintenance during the time of day when facility use is lightest.

Maintenance is scheduled on the basis of facility activity and use, facility size, the tasks to be performed, and the available resources. The supervisor/scheduler must be familiar with the daily use patterns at facilities. Some facilities are used heavily on weekends and holidays but little during the week; others are used fairly consistently every day. Use patterns may change, however, because of reports that fishing is good, because a nearby campground is hosting a large, organized event, or for no discernible reason. Such variances severely test the flexibility of an administrator and a maintenance program.

In addition to the extent and effect of the use made of facilities, an administrator must keep in mind the number of sites to be maintained by a given labor force. A program must necessarily operate within the resources available to it, and if the maintenance goals exceed the capabilities of assigned maintenance personnel, equipment, or funds, the only variable is the degree of maintenance to be provided.

The maintenance scheduled at a given facility must reflect its daily use and particular characteristics. This involves consideration of the following:

- Amount of trash accumulated

- Level of activity and its effect on facility amenities (e.g., restrooms, roads, ramps, parking areas)
- Need for mowing, painting, landscape upkeep, ramp cleaning, or other regular maintenance

Routinely scheduled tasks will vary according to facility use. On high-use days, maintenance personnel may only remove trash, clean restrooms, and restock paper supplies. On medium-use days, they may also replace broken fenders, repost paper signs, and clean the ramp. On low-use days, routine maintenance may include removing silt from the ramp, replacing site signs and bulletin boards, and servicing landscape plantings. For best results, maintenance personnel must be allowed some discretion and flexibility, but supervisors need to inspect the sites on a regular basis to ensure that program standards are being met.

Trash disposal at most access sites is the key maintenance activity. Where trash receptacles are provided, collection may become a daily requirement based on the volume of use at the site. Trash receptacles at remote sites can also result in people using the site for disposal of household refuse. Where trash receptacles are not provided, site regulations for users to remove their trash are recommended (pack-in/pack-out policy). All sites should be policed regularly to control littering and keep the area free of debris.

Maintenance Plan

For each site, a maintenance plan outlining the types and frequency of the tasks to be accomplished needs to be established. The plan may be set up for an entire year or for a shorter period and should include a site drawing, to reasonable scale, that shows the items needing attention.

It may be helpful to develop a matrix that lists on one axis the tasks to be performed and on the other the frequencies at which they should be performed. A supervisor may want to combine the matrices of several sites to develop an area or regional maintenance plan. This technique will often help in determining the size and number of crews necessary to administer a number of sites.

Personnel

Agency Employees

Boat launching and fishing facilities are most heavily used during warm weather, and in areas where cold weather occurs part of the year, year-round full-time maintenance is unnecessary. In such instances, it is cost-efficient to use temporary or part-time maintenance workers. High school and college students are a good source of temporary labor and usually are available throughout late spring, summer, and early fall.

The core of the maintenance force, however, must be full-time personnel who can train and supervise seasonal help and perform off-season maintenance. Also, because special and major maintenance and facility safety inspections require specific skills and/or training, it is desirable to use full-time personnel for these tasks.

A typical routine maintenance crew consists of two people (for safety reasons) who travel to a site in a single vehicle. Although both may be seasonal employees, until they are sufficiently trained to perform without direct supervision, it is customary to pair one full-time employee with one seasonal employee.

Seasonal employees without safety training and supervision should not be assigned tasks requiring the use of such specialized machinery as chain saws, compressors, or large, mechanized equipment. Even their use of lawn mowers and weed cutters should be prohibited until they have been properly trained and equipped with appropriate safety clothing and gear.

Maintenance personnel should receive special training, conducted by qualified individuals, to sensitize them to the needs of people with disabilities so that routine maintenance of barrier-free facilities is performed with these needs in mind. One particularly effective technique is to conduct a training session at a barrier-free site wherein the maintenance personnel use wheel chairs and crutches to traverse the parking lot and access ways and while using restrooms and other site components. This special training enables maintenance personnel to appreciate why particular aspects of routine maintenance take on new significance when considering persons with disabilities.

Contract Employees

It is not essential that agency employees perform maintenance. Private firms may be engaged or facility neighbors can be employed to perform routine maintenance, especially when the site in question receives relatively light use.

Local government entities, including villages, cities, townships, counties, road commissions, schools, or school districts, also may be contracted to maintain facilities. Sports clubs or organizations are potential contractors, as are civic groups or, in rare instances, garden clubs. Although outside people, groups, government agencies, and companies may be used in some cases, they rarely are available in sufficient number to relieve the administering agency of the necessity of having its own maintenance force.

Volunteers

On occasion, volunteers offer to assist in maintaining a facility, especially when they believe more is required than the agency can provide. Utilizing volunteers has both advantages and disadvantages. Volunteers can save money and can provide additional maintenance at a site, but the agency has virtually no control over volunteers and no assurance that their assigned tasks are actually being carried out. Although volunteers invariably are well intentioned, they should be considered a temporary resource and used, if at all, only until properly trained and fully supervised personnel are available to perform the job.

Equipment

The number and type of sites to be maintained largely determines the equipment needed. However, since the maintenance workload varies from day to day, daily equipment requirements also vary. An extensive list of commonly used equipment and tools for maintaining access facilities is listed in the 1999 *Operations and Maintenance Program Guidelines for Recreational Boating Facilities* from SOBA at www.sobaus.org.

Safety Program

Safety programs have proven effective in reducing accidents. Aside from human suffering, accidents are expensive both in terms of productivity and money. In addition, with the enactment by Congress in 1970 of the Occupational Safety and Health Act (OSHA), and similar legislation by many states, a safety program has become absolutely essential.

Organization

In most states, the recreational boating and fishing programs are part of a larger department that have established employee safety programs to which the boating and fishing programs must conform. However organized, there is one goal: All employees in the program, from top to bottom, must understand and carry out their responsibilities regarding safety.

Responsibility

Overall responsibility for the safety of the public and the employees involved in the program is vested in the boating program manager, who is responsible for seeing that an occupational safety and health program covering all employees, property, and facilities is established, implemented, and monitored. Day-to-day administration usually is delegated to a staff person designated as the safety coordinator. Components of the safety and health program include hazard awareness and control, inspections, preventive maintenance, job training and enforcement, incentives, and record keeping.

The key people in a safety program are the employee supervisors. They must be informed, trained, and motivated.

Their responsibilities include the following:

- Assuring that the workplace complies with safety and health standards
- Assuring that employees are properly trained
- Assuring that employees are provided with and are properly using required personal protective equipment
- Receiving, reviewing, and following through on accident reports, so as to abate the causes
- Locating and acting to remedy unsafe conditions or procedures
- Ensuring availability of first-aid treatment and medical services
- Conducting safety briefings and motivational talks
- Maintaining required safety records and inspection and evaluation reports

All employees must accept safety as a personal responsibility for themselves, their co-workers, and the public. Their responsibilities include the following:

- Reporting hazards as well as unsafe conditions or procedures to their immediate supervisor
- Reporting all incidents and injuries in a timely manner
- Forwarding safety recommendations to the appropriate supervisor, safety officer, or official
- Consulting with their supervisor before starting or continuing tasks if they are uncertain about how to proceed safely

Training

Safety training for employees must be continuous, beginning at the start of each workday. The primary responsibility for employee training must be vested in the supervisors. They must thoroughly instruct new employees in job procedures and equipment use before allowing them to work without direct supervision. They also must retrain employees whenever their job assignments or equipment change.

Many states have enacted “right-to-know” laws requiring that information and training be provided to employees who are (1) exposed to hazardous chemicals in the normal course of employment or (2) likely to be exposed to hazardous chemicals in an emergency. These acts are specific in their coverage and requirements and must be strictly complied with to avoid liability on the part of the agency. Special employee training may be required.

Special training of any nature should be noted in an employee's personnel record. This helps prove both that appropriate training is being provided and that it has been provided for the particular employee. This is important in the event of accidental injury, when it may be necessary to establish fault or responsibility.

Accident Reporting

The heart of a safety program is an accident-reporting system that provides for analysis and subsequent corrective measures necessary to try to prevent reoccurrence. An accident report form should be designed and a procedure adopted outlining when reports are required, to whom they must be submitted, and how all appropriate personnel shall be notified of corrective action. Accidents or incidents involving the public or non-agency personnel (e.g., contract maintenance providers) also must be reported; such reports can be invaluable in the case of a lawsuit.

Safety Council

Some departments have a safety council made up of top-level administrators. If such a council exists in a department of which a recreational boat launching or fishing program is a part, the program administrator should be a member of the council. Because boat launching and fishing programs involve many employees and a great number of public users, safety is clearly a concern. The functions of a safety council include the following:

- Reviewing implementation of safety and health standards, procedures, laws, codes, etc.
- Reviewing accident reports to evaluate the implementation and adequacy of recommended corrective actions
- Sharing information from public incident reports, citations for violation of occupational hazards legislation, and inspection reports
- Considering ideas for accident prevention or hazard abatement
- Analyzing adequacy of job training and preventive maintenance
- Keeping records on safety performance to identify units or individuals needing additional training or motivation

Safety Inspections

A formal program of regular safety inspections of boat launching and fishing facilities is an essential component of any safety program.

Work Sites

Supervisory personnel who follow an established procedure should formally inspect work sites annually. During the check, another employee should accompany the inspecting supervisor so that, if necessary, the inspection can be confirmed in court.

A standardized checklist should be followed to assure that no items are overlooked. A formal inspection report should be filed with the inspector's immediate supervisor and forwarded up the command ladder to the program administrator. The report should list unsafe conditions and note whether they are being corrected and, if not, why they are not. Copies of inspection reports should be retained for a period equal to the statute of limitations on lawsuits as defined in the state statutes, to recover damages for personal injuries (normally, three years).

Operating Facilities

A procedure similar to that used to inspect work sites must be established for inspecting operating facilities. Again, the responsibility must be specific: a checklist followed, the inspection completed in the company of another employee, a report filed for each inspection, and copies retained. Items that should be considered include noxious plants, drinking-water wells, overhead electric lines, buoys, and warning signs on piers and boarding docks.

Grant Facilities

Grant-funded facilities are those that have been built and/or are being administered and operated by a local government agency with a grant from a state program. Grant-funded facilities should be inspected annually and the inspection reports submitted to the administering local government agency with a copy to the state program administrator. A follow-up procedure must be in place to assure that safety deficiencies are corrected.

Equipment Preventive Maintenance

Preventive maintenance assures safe and dependable operation of equipment and prolongs its life. Equipment should be serviced in accordance with the manufacturers' recommendations. For equipment other than hand and small power tools (e.g., tractors, pumps, and generators), all use and maintenance should be entered in a logbook. Quarterly equipment inspections are an important element of a safety program. The equipment operator’s immediate supervisor is the key person in an equipment maintenance/inspection program.

Forms for reporting equipment inspections should be developed and area supervisors charged with using them for the regular inspections. Supervisors should also occasionally conduct unscheduled spot checks to ensure equipment is being maintained between inspections.

Chapter 7

Accessibility Requirements

Introduction

This chapter presents an overview of the guidelines for meeting current accessibility needs. It is recommended that the designer refer to the Americans with Disabilities Act (ADA) - Architectural Barriers Act (ABA) information provided on the United States Access Board (the Access Board) website www.access-board.gov.

As a point of background, in 2002, the Access Board published guidelines for recreational facilities in the Americans with Disabilities Act Accessibility Guideline (ADAAG) 15. The recreational boating facilities guidelines were published in ADAAG 15.2.

In 2004, the Access Board coordinated its update of the ADA and ABA guidelines into a single rule. The final rule contains updated scoping provisions, which specify what has to be accessible, and technical requirements which spell out how access is achieved. It consists of three parts: a scoping document for ADA facilities (Part I), a scoping document for ABA facilities (Part II), and a common set of technical criteria referenced by both scoping documents (Part III). The new document is commonly referred to as the ADA-ABA.

The Access Board approves and publishes only guidelines, not rules or requirements, and these guidelines are submitted to the Department of Justice (DOJ) for review and approval. Once approved, after the guidelines become federal rules enforced by DOJ. At the time this handbook was prepared, the guidelines were being processed for approval by DOJ.

The following sections highlight principal issues pertaining to the design of boating access recreational facilities. The ADA-ABA guidelines apply to renovation of existing facilities as well as to new construction projects. For practical purposes, a general rule of thumb is "If you touch it, you make it compliant." The applicable limitations to renovation projects can be found in ADA-ABA Chapter 2.

The Access Board brochure for *Accessible Boating Facilities,* is provided as Appendix 4.

Landside

Landside facilities include the public access road into the site, the parking area, and routes from the parking area to the facilities as well as the improvements at the site (e.g. restrooms, picnic shelters, and fish cleaning stations). The facility may be a simple parking lot and launch ramp or a major recreational complex. The following sections highlight the principal ADA-ABA guidelines and provide descriptions of each.

Parking areas – The project is to provide the proper number, type, and sizes of parking spaces in the appropriate location with the required signage.

To determine the number of parking spaces, refer to ADA-ABA Chapter 2, Section 208, which numbers are listed in Table 208.2.

Total Number of Parking Spaces Provided in Parking Facility	Minimum Number of Required Accessible Parking Spaces
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	2 percent of total
1001 and over	20, plus 1 for each 100, or fraction thereof, over 1000

Figure 7-1 (ADA/ABA Figure 502.2) Required number of accessible vehicle parking spaces

ADA-ABA Chapter 2, Section 208.3 provides information regarding the required location of the accessible parking spaces. The accessible parking spaces are to be located as close to the principal facility amenities as possible.

Dimensions of Spaces

ADA-ABA Chapter 5, Section 502.2 provides requirements for the width of the spaces and Section 502.3 addresses the access aisle requirements.

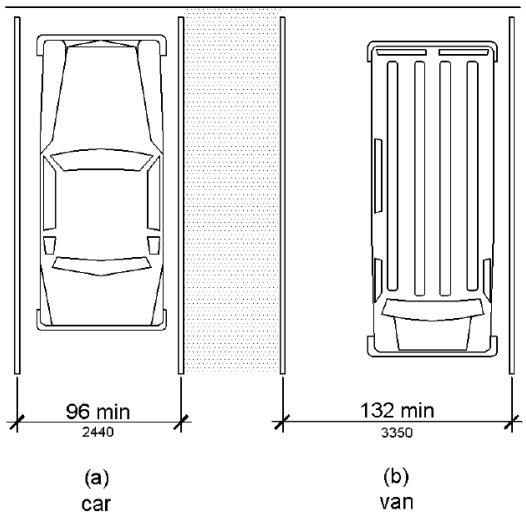


Figure 7-2 (ADA/ABA Figure 502.2) Vehicle parking space

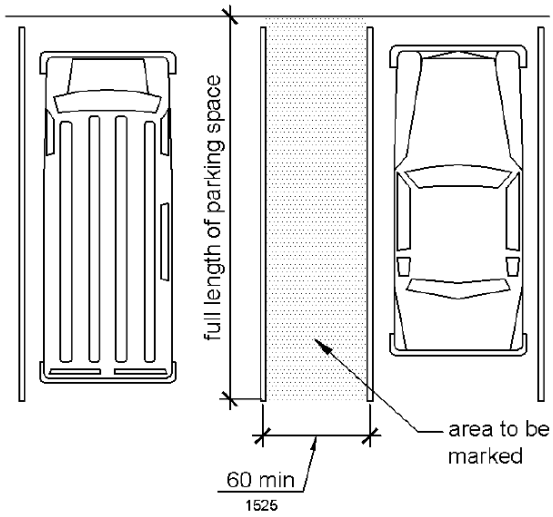


Figure 7-3 (ADA/ABA Figure 502.3) Parking space access aisle

Parking spaces that have been designed as accessible spaces for vehicle/trailer combinations should be a minimum of ten feet wide and 40 feet long. For the aisle width to meet accessibility guidelines, its width should remain constant over the entire length and should extend the full length of the vehicle/trailer space. The ground slope for these parking spaces and access aisles should not exceed 1:48.

Figure 7-4 provides an illustration of accessible parking space recommendations for vehicle/trailer and van/trailer accessible users.

Of the required accessibility-compliant parking stalls provided at any facility, one of every eight required accessible spaces shall be designed and designated as van accessible. If only one space is required, it should be marked as a van-accessible space.

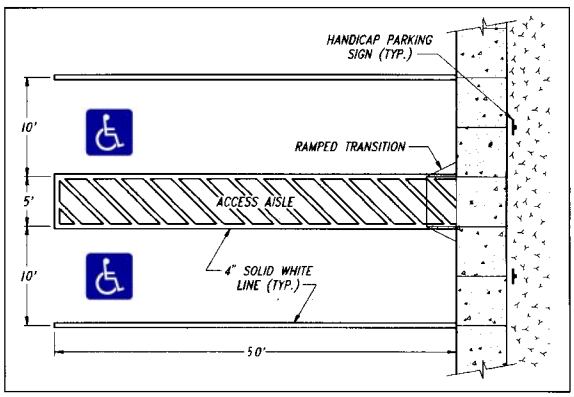


Figure 7-4 The dimensions of accessible parking spaces for vehicle-trailer combinations

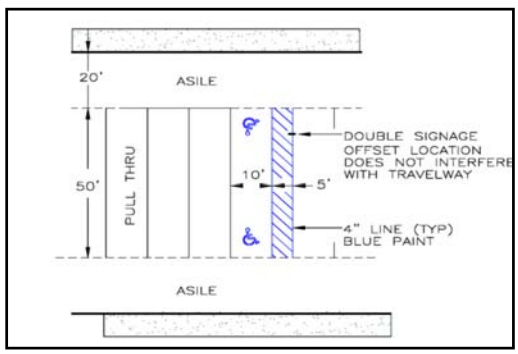


Figure 7-5 The location and color of the symbol for accessible pull-through parking spaces

Accessible Routes

Accessible routes consist of one or more of the following components: walking surfaces, doorways, ramps, curb ramps, elevators, and platform lifts. For recreational boating facilities, the accessible routes are the pathways that lead from the parking areas to the launch ramp area and other site amenities.

The designer is referred to ADA-ABA Chapter 4 for the requirements related to accessible routes.

Paths – Paths and walkways that are part of an accessible route shall not have a running slope steeper than 1:20 with a cross slope not to exceed 1:48 (see ADA Chapter 4, Section 403.3). Other components of accessible routes, such as ramps (Section 405) and curb ramps (Section 406), are permitted to be more steeply sloped. Clear widths on paths shall be a minimum of 36 inches with allowances for minor restrictions; refer to ADA Chapter 4, Section 403.5 for additional guidance. Requirements for overhead clearances and turning spaces are also addressed in ADA Chapter 4.

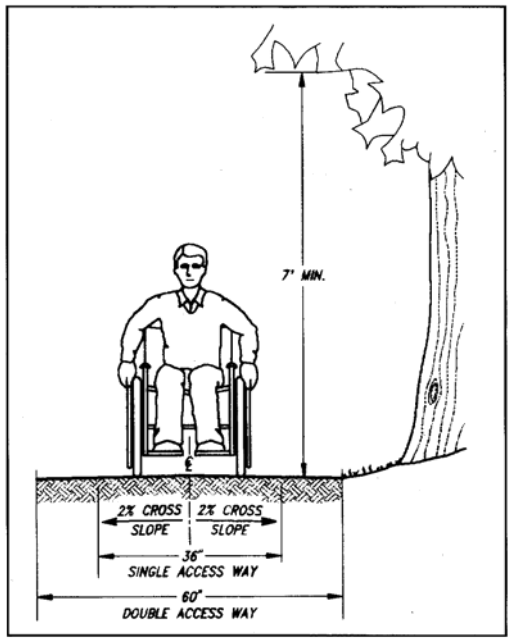


Figure 7-16 An illustration of the requirements for accessible routes, showing cross slopes, single and double access ways, and the overhead clearance

Surfaces – Accessible routes shall be stable, firm, and slip-resistant (refer to ADA Chapter 3, Section 302). Requirements for changes in levels and openings in the walk surface are fully defined in ADA Chapter 3.

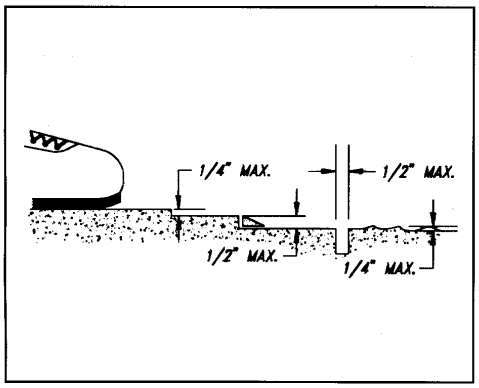


Figure 7-7 Requirements relative to pedestrian pathway surface projections, height changes, and gap widths

Ramps – A ramp is defined as a sloped portion of the accessible route steeper than 1:20 that shall not exceed a 1:12 slope maximum (see ADA Chapter 405). The clear width of the ramp shall be considered the same as that of accessible pathways. The important issue relative to the ramp design is limiting the maximum rise of any portion of the ramp to 30 inches (see ADA Section 405.6). ADA Section 405.7 provides guidance relative to the number and size of landings required between ramp segments. ADA Section 405.8 indicates that handrails are

required where the rise of a ramp is greater than 6 inches. The remainder of ADA Chapter 4 provides additional requirements relative to ramp design.

A ramp is a fixed portion of the accessible route and is not to be confused with gangways and boat launch ramps, which are special cases within the accessible route.

Photo 7-1 Example of a curb ramp, Martinez, CA

Curb Ramps – If curbs are provided, curb ramps shall be included in accordance with ADA-ABA Chapter 4, Section 406.

Handrails – Handrails are required on a walkway or ramp where the slope is steeper than 1:20 and the rise is 6 inches or greater on all stairways (see ADA –ABA Chapter 5, Section 505.1). The remainder of Section 505 provides requirements relative to handrail design.

Safety rails, or guardrails, are not addressed as a part of the accessibility requirements per se, but they may be required by other building or safety code conditions. Refer to other applicable building codes for further guidance. Guardrails are required to protect drop-offs and safety rails might be required based on the proposed use and location.

Photo 7-2 Safety rail system, Joe Wheeler State Park, AL

Restrooms

Restroom facilities, if provided, shall meet all applicable federal, state, and local requirements, including ADA-ABA requirements. If restroom facilities are to be provided they should be located in close proximity to the launching ramp or marina access and connected by accessible routes. Refer to ADA-ABA Chapter 6 for the principal accessibility requirements for restroom facilities.

Fishing Piers and Platforms

In the design of fishing piers and platforms, the principal considerations include the accessible route, railings, and dispersion of lowered railings for ease-of-access by seated users. Refer to ADA-ABA Chapter 10, Section 1005 for the accessibility requirements relative to fishing piers and platforms. Section 1005.2 provides references to other federal codes that mandate when railings need to be provided.

Photo 7-3 Fishing platform, Broad Creek, DE

Other amenities

If other amenities such as fish cleaning stations, picnic areas, pavilions, and drinking fountains are to be provided, ADA-ABA requirements must be applied in the design process. In the case where specific ADA chapters do not exist, the principal design elements must include accessible routes to the amenity and operational characteristics that meet overall ADA requirements.

Waterside

Gangways

A gangway is defined as a variable sloped pedestrian walkway that links a fixed structure or land with a floating structure.

When an existing facility is to be altered, the extent of the gangway improvements as part of the accessible route, are determined by the requirements of ADA-ABA Chapter 2, Section 202.4 (for altered facilities).

Photo 7-4 Accessible gangway with transition plate, Oxnard, CA

Photo 7-5 Accessible gangway to float, Cullman, AL

For new facilities, the design of the gangway must comply with the accessible route requirements as specified in ADA-ABA Chapter 4, with exceptions noted in Chapter 10, Section 1003.2.1. The exceptions address critical design elements such as the minimum and maximum lengths of the gangways, as well as gangway requirements based on the size of facilities, transition plates, and cross slopes.

In simple terms, accessible gangway systems, when required, can be limited to a maximum length of 80 feet with a 30-foot maximum for marinas with fewer than 25 slips. Only gangways that are part of the accessible route to accessible slips must meet these requirements. This means that if a marina has more than one gangway, only the gangway that is part of the accessible route to the accessible slips must adhere to these standards.

Boat Launch Ramp

There are no provisions that address access to launch ramps without boarding piers. The Department of Justice advises that if there are no applicable scoping requirements, i.e., how many features must be accessible, then a reasonable number—at least one—must be accessible.

In general, accessible route considerations for boat launch ramps extend to the top of the ramp only. The portion of the route to the boarding pier, if provided, along the ramp itself does not need to comply with the slope requirements of an accessible route.

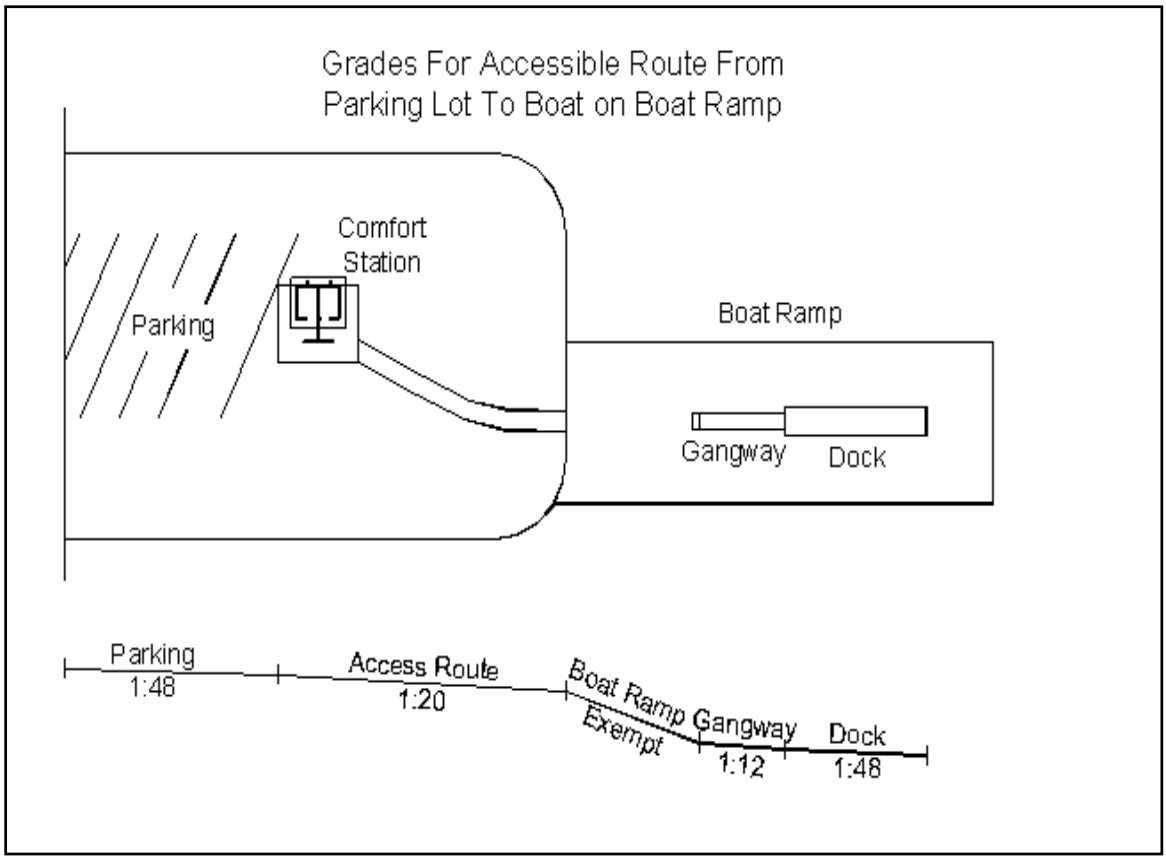


Figure 7-8 Grades for accessible route from parking lot to boat on boat ramp

If boarding piers are provided, at least one must meet the requirements of ADA-ABA Chapter 10, Section 1003.3.2 for clearances.

Photo 7-6 Boarding float, Stevenson, AL

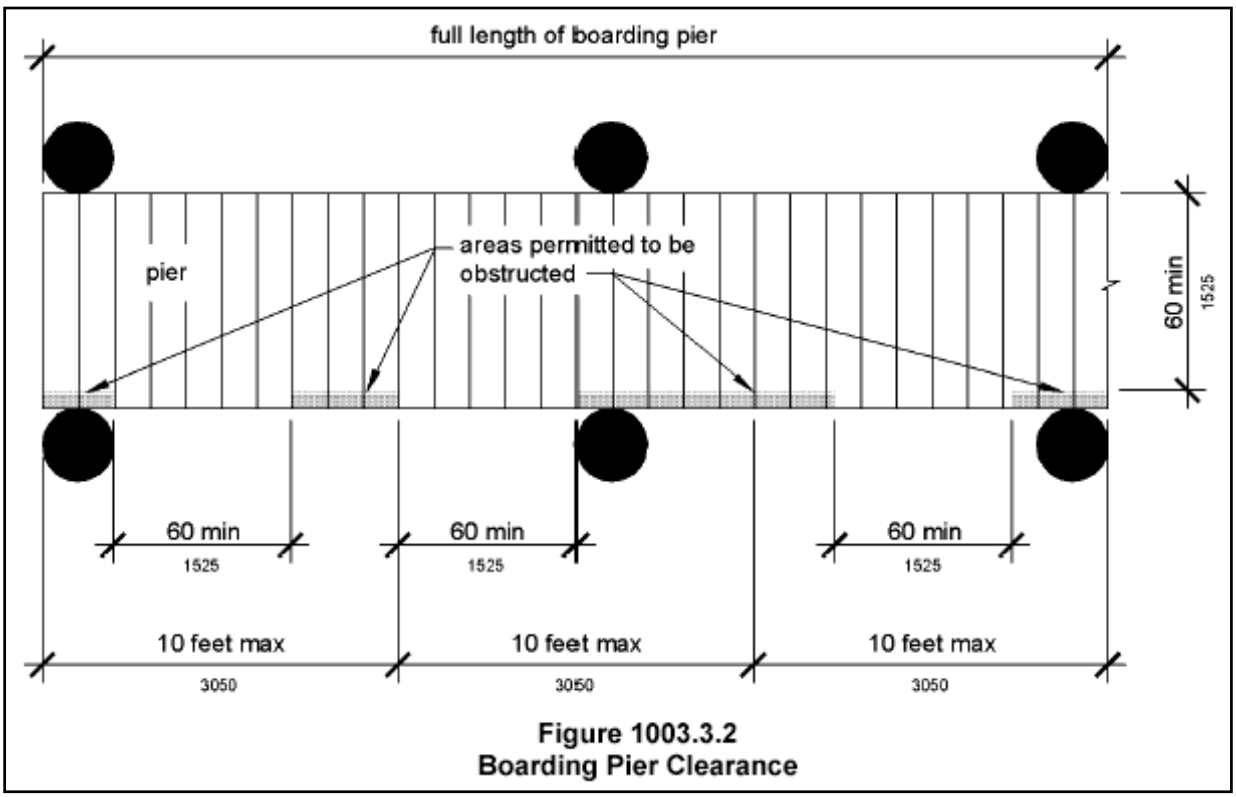


Figure 7-9 (ADA/ABA Figure 1003.3.2) Boating pier clearance

Marinas

Slips are defined as that portion of a pier, main pier, finger pier, or float where a boat is moored for the purpose of berthing, embarking, or disembarking. ADA-ABA Chapter 2, Section 235.2 provides guidance as to the number of accessible slips that are to be provided in a single facility based on the size of the facility.

Table 235.2 Boat Slips

Total Number of Boat Slips Provided in Facility	Minimum Number of Required Accessible Boat Slips
1 to 25	1
26 to 50	2
51 to 100	3
101 to 150	4
151 to 300	5
301 to 400	6
401 to 500	7
501 to 600	8
601 to 700	9
701 to 800	10
801 to 900	11
901 to 1000	12
1001 and over	12, plus 1 for every 100, or fraction thereof, over 1000

Figure 7-10 (ADA/ABA Table 235.2) Number of accessible slips to be provided in a single facility based on the size of the facility

Section 235.2.1 provides the requirement that the accessible slips are to be dispersed throughout the various types of slips provided at the facility.

ADA-ABA Section 1003.1 provides clearances and clear-space requirements for a slip to be considered as accessible. It is recommended that the exceptions and advisories included in ADA-ABA Section 1003 be reviewed prior to design.

For marinas, the portions of the **main walkway** and the **marginal walkway** that are segments of the accessible route to accessible slips must comply with the requirements for accessible routes.

Utilities need to be in the right place and conform to required reach and access dimensions. Refer to ADA-ABA Chapter 3, Section 308 for requirements regarding the reach ranges that shall be met for placement of utility services.

Forward Reach	15 inch minimum	48 inch maximum	ADA Chapter 3
Side Reach	9 inch minimum	54 inch maximum	ADA Chapter 3

Conclusion

This handbook updates boating and fishing access facility design and development information contained in earlier SOBA publications and incorporates to the extent possible the most recent accessibility requirements. Although every attempt was made to adequately cover barrier-free requirements to help insure compliance, the regulations are in some cases complex, confusing, and are subject to possible modification or change. SOBA always recommends double-checking requirements with the latest ADA published guidelines and sharing design information with those responsible for compliance determinations before initiating a project. SOBA believes the information provided in this handbook will be helpful to anyone involved in any aspect of recreational boating and fishing facility projects or programs.

SOBA recognizes that although every effort was made to cover all aspects associated with facility design and development additional questions are likely to arise. To comment, make suggestions, or obtain additional information write to SOBA, 50 Water Street, Warren, RI 02285, call (401) 247-2224, or fax (401) 247-0074 or www.sobaus.org.

Readers also may obtain information from the reference service maintained by the Fish and Wildlife Service of the U.S. Department of the Interior. Write to the Fish and Wildlife Reference Service, Suite 110, 5430 Grosvenor Lane, Bethesda, MD 20814-2158.

Glossary

A

Aggregate – a mass of small rocks or stones, page 27

Air entrainment – the introduction of microscopic air bubbles into wet concrete, during mixing; the bubbles, which are produced from a liquid chemical additive, improve the workability of the concrete and increase its resistance to stress induced by freezing and thawing, page 53

Asphalt concrete – a mixture of bituminous material, sand, and gravel, usually heated, used to form pavement, page 26

B

Bathymetric charts – charts the introduction of microscopic air bubbles into wet concrete, during mixing; the bubbles, which are produced from a liquid chemical additive, improve the workability of the concrete and increase its resistance to stress induced by freezing and thawing, page 13

Berm – a narrow raised ridge or shelf designed to provide a visual screen or absorb sound between two areas, page 39

Bioswale – a shallow depression created in the earth to accept and convey storm water runoff; a bioswale uses natural means, including vegetation and soil, to treat storm water by filtering out contaminants being conveyed in the water, page 35

Boarding dock – a fixed, floating, or adjustable structure extending parallel to a launching ramp and designed to permit mooring of a watercraft in such a way as to facilitate boarding or exiting the craft, page 4

Bollard – a thick post on a ship or wharf used for securing ropes and hawsers and also used in traffic control, page 71

Borrow pit – a location from which earth material is removed and transported for use elsewhere, page 40

Breakwater – an offshore structure erected to break the force of waves, page 11

Bridge – a structure spanning from the shore to a boarding dock at a boat launching ramp , page 22

Bulkhead – an upright wall (seawall) separating land and water, page 25

C

Carry-down area – a location provided for launching small boats and canoes that are usually transported on top of or in a vehicle, page 25

Carrying capacity – the use (both in terms of types of use and numbers of users) of a water body, beyond which the average user perceives that his/her boating, swimming, etc., experience is degraded; may be applied to a specific type of use, such as boating, in which case the term would be "boat-carrying capacity," page 10

Catch basin – a drainage structure that collects surface water and routes it to an outlet; to collect sediment, the structure normally has a sump, page 35

Catenary [effect] – the curve formed by a flexible chain or cable supported at both ends and hanging freely, acted on by no force other than gravity, page 86

Causeway – a raised roadway or walkway constructed across wet ground or water, page 39

Chip and seal – a surface made by spraying a heavy coating of emulsified asphalt oil onto a road surface and then covering the oil with rock, page 26

Cofferdam – a temporary, mostly watertight enclosure from which water is pumped to expose the bottom of a body of water to allow for construction, page 53
Crane – a power-operated machine that can raise, shift, and lower objects by means of a boom with cables; when a bucket or "clam shell" is attached to its cables, it can be used to excavate and/or move materials, page 75
Cutting side – the side, generally of a river, on which the current has an erosive effect, page 13

D

Depository side – the side, generally of a river, on which materials carried by a slow current are deposited. It is opposite the cutting side, page 13
Design low water – a selected low-water level, based on hydrologic data and other appropriate records, which is used as a safe and practical lower limit in the design and construction of a recreational boating facility, page 14
Design storm – the maximum storm force (storm water flows) for which a specific structure is designed, page 36
Design wave – the maximum wave height for which a specific structure is designed; if a higher wave could be experienced, additional protection—usually a breakwater—must be designed for the facility, page 49
Dragline – an excavating machine that tosses out a bucket that fills with material as it is dragged back toward the machine by cables, page 75

E

Eddy – current of water running contrary to the main current, page 13
Elastomeric – constructed of elastomer, a material resembling rubber and characterized by having the ability to resume its shape after being greatly deformed, page 69

F

Fee title – the complete title to a parcel of property, page 20
Fetch – open-water distance over which wind blows unimpeded, page 12
Fishing pier – any portion of a fixed or floating structure that is intended for fishing; includes but is not limited to piers, bulkheads, and breakwater fishing platforms (the latter are facilities on breakwaters that are designed to enhance angler access to the water), page 25
Fill – material used to raise the bottom level of a pit, hole, or depression, page 39
Freeboard – the distance between the waterline and the deck of a boarding platform or the top of a boat hull, page 67

G

Gabion – a framework of wire filled with stone, which forms a bin, crib, or similar structure, page 43
Geotextile fabric – a woven plastic fabric that is non-biodegradable and is resistant to most soil chemicals; can be used to (1) separate weak soils and load-distributing aggregate materials, (2) control movement of water both along and through it, and
(3) prevent soil movement, page 27
Groin – a rigid, horizontal structure built at an angle from the shore to protect the shore from erosion by currents, tides, or waves and to form a beach by trapping sand, page 39

I

Impoundment – a confined body of water, usually formed by constructing a dam, for such purposes as irrigation, flood control, or generation of power, page 5

Indemnify – to protect the administering government unit from loss, usually in the form of court- assessed damages resulting from the actions of a person who has been authorized by the administering unit to use a boat-launching or other facility for a designated purpose, page 97

L

Launching lane – the portion of a launching ramp designed to accommodate launching or retrieving a single watercraft from a trailer, page 29

Littoral transport – the movement of sand or other natural materials along a shoreline; the drift is the direction toward which the most material is moved, page 49

Live load – the load to which a structure is subjected in addition to its own weight, including the weight of people and/or objects on the structure and excluding wind load, page 56

M

Main walkway – the walkway that has the most pedestrian traffic at marinas, page 115

Make-ready area – the land area at a boat launching site where a boat may be prepared for launching, page 25

Management measures – Economically achievable measures to control the addition of pollutants to waters; the measures reflect the greatest degree of pollutant reduction achievable through applying the best available nonpoint-pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives, page 35

Marginal walkway – a pedestrian path at a marina other than the main walkway, page 115

Mean high water – a summary of all measurements of high water over a given period, to establish the level most often achieved, page 14

Mean low water – a summary of all measurements of low water over a given period, to establish the level most often achieved, page 14

P

Power loading – the practice of using the boat's engine to propel or assist in propelling the watercraft onto its trailer, page 52

Prescriptive [use] – a use made of property against the interests of the owner and without the owner's consent. If such use continues over a specified time (usually about 12 years) and is open and notorious (well-known), it may be determined by a court to be a use that cannot be stopped by the owner, page 18

Proprietary activity – in law, any activity conducted by a government unit primarily to produce a pecuniary profit for the unit; excluded are activities normally supported by taxes or fees, page 76

R

Reservoir – a place where water is collected and held for use when wanted; the collection may involve artificial structures, page 5

Reverter [clause] – a clause in a deed or conveyance providing for returning the property title to its former owner upon the occurrence of an event certain, page 21
Riparian – the owner of property located on the shore of a river or lake who has the right to use the water and/or its surface, page 8
Riprap – a layer of uniformly graded, angular stone placed on (1) an embankment— to hold it in place against such natural occurrences as rain or (2) a shoreline—to protect it from wave action, page 40
Rock crib – a frame of logs, timber, or other material that is open at the top and filled with stone, page 44

S

Safety rail – a barrier provided to protect people from falling from marine structures, page 71
Scour – the action of waves or of a current that results in the removal of sand, small stones, or similar material from an area, page 44
Seiche – an oscillation or trough on the surface of a water body caused by variations in atmospheric pressure and/or seismic disturbances, page 14
Sewage pump out – a stationary or portable device used to pump sewage from vessel tanks and discharge it into an approved disposal system, page 88
Shoal – a reduction in the depth of a water body, page 49
Siltation – the deposition or accumulation of silt and sediment, page 49
Skid pier – a structure designed to serve as a boarding dock at a boat-launching ramp. It usually is built of steel and is 3 to 4 feet wide and most often 20 feet long. Its structure consists of a steel frame with adjustable steel legs, the bottoms of which have plates attached. The plates are curved up at each end to permit skidding the structure up or down the launching ramp. The legs are adjustable so that the structure can be level over its entire length when resting on the boat-launching ramp, page 66
Slump – an indicator of the workability of wet concrete; the 12-inch-high testing device used is a portion of a steel cone, open at the top and bottom. Wet concrete is placed in the cone and compacted with a steel rod, in layers, until the cone is full. The cone then is removed, allowing the wet concrete to slump. The difference between the top of the cone and the top of the uncontained concrete-the slump-ideally will be 3 to 4 inches. If less, the concrete is too stiff; if more, it is not stiff enough, page 53
Soil strength – an engineering term describing the ability of soil to support loads; strength is determined by texture and consistency, page 27
Surf – wave activity in the area between the shoreline and the outermost limit of breaking waves, page 11
Surge – boating facility water-elevation changes caused by wind, waves, or currents that otherwise do not directly affect the area, page 11

T

Tie-down area – an area in which a vehicle-trailer may be parked to permit the boater to wash, tie down, or otherwise prepare the boat/trailer for departure from the site, page 30

Transition plate – a level or sloping plate that pedestrians access between (1) such waterside components as gangways, boarding docks, piers, and marine ramps or (2) the shore and a waterside component. A variation is a toeplate, which is used at the lower end of a gangway to ease pedestrian access between the gangway and a boarding dock, marine ramp, or pier, page 70

V

Vertical curve – the curved transition section that runs from the turnaround/maneuvering area to the boat-launching ramp, page 33
Vertical live point load – a live load measured at a specific point on a structure, page 67

W

Wave attenuator – a floating dock made of aluminum or concrete that attenuates, or dissipates, a wave's horizontal motion by displacing the wave's energy; helps control shoreline beach erosion, page 11

Appendix 1

Sample of a Public Boater Survey

SAMPLE

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
Public Access Boaters

Dear Boater,

Every few years we—the Minnesota DNR—survey boaters on recreational boating issues, such as boating opportunities and boating safety. The DNR makes many decisions that affect these issues. When making these decisions, we want to be sure we understand what you think.

Please complete this survey today, and mail it back to us in the postage-paid envelope. **THE SURVEY WILL ONLY TAKE ABOUT 15 MINUTES TO COMPLETE.** If you have any questions about the survey, please contact _____.

Thank you for your help.

PLEASE ANSWER QUESTIONS FOR THE BOATING TRIP ON THE LAKE WHERE YOU RECEIVED THIS SURVEY

1. How many years have you been boating on this lake? ____ years

2. How far is your permanent home from this lake? ____ miles

   2a. What is the zip code of your permanent home? _____

3. Do you have a home or residence on this lake? (CHECK ONE) ____ yes ____ no

4. Where did you launch your boat on this trip? (CHECK ONE)
   ____ here at this public access ____ another public access
   ____ private access or marina ____ resort/private campground
   ____ other (please specify) _____

5. Where did you park? (CHECK ONE)
   ____ in lot at this public access ____ street ____ other (please specify) _____
   ____ resort or campground ____ another lot
   ____ at my home ____ friend's home

6. a. Including you, how many adults, teens, and children were in your boat on this trip?
   ____ adults 55 or older ____ adults 18 to 54 ____ teens (12 to 17) ____ children (11 or younger)

   b. How many of these adults, teens and children wore life vests on this trip?
   ____ adults 55 or older ____ adults 18 to 54 ____ teens (12 to 17) ____ children (11 or younger)

7. What time did you leave from shore on this trip? ____ AM/PM

8. How many hours did you boat on this trip? _____ hours

9. What was your group's primary activity on the lake on this trip? (CHECK ONE)
____ fishing ____ sailing ____ boat ride ____ transportation to/from
____ swimming ____ jet skiing ____ water skiing ____ canoeing/kayaking
____ other (please specify) _____

10. Are there sufficient opportunities on the lake to: (CHECK THE APPROPRIATE RESPONSE FOR EACH QUESTION)
a. Beach your boat? ___ yes ___ no ___ don't know/not sure
b. Anchor or tie up with other boats into a raft? ___ yes ___ no ___ don't know/not sure
c. Use picnic areas or toilets at a public lakeshore wayside? ___ yes ___ no ___ don't know/not sure

11. What type of boat did you use on this trip? (CHECK ONE)
____ cruiser (has cabin or superstructure) ____ jetski ____ canoe/kayak
____ runabout (has windshield) ____ pontoon ____ sailboat
____ fishing (no windshield) ____ other (please specify) _____

12. What is the length of that boat? ____ feet

13. What type(s) of motor(s) does that boat have? (Fill in number of each motor type, and horsepower of largest gas motor)
____ gas (_____ horsepower) ____ electric ____ no motor ____ don't know

14. Which of the following do you have on your boat? (CHECK ALL THAT APPLY)
____ fire extinguisher ____ horn ____ lights
____ visual signal (flag, flare gun) ____ GPS unit ____ fishfinder
____ underwater camera ____ marine toilet ____ none of these items

15. Which of the following beverages did you have with you on the boat on this trip? (CHECK ALL THAT APPLY)
____ soft drinks ____ beer ____ no beverages
____ coffee/tea/water ____ wine ____ refuse to answer
____ other nonalcoholic ____ other alcoholic ____ don't know/not sure

16. Overall, how satisfied or dissatisfied were you with your boating experience on this trip? (CHECK ONE) ___ very satisfied ___ satisfied ___ dissatisfied ___ very dissatisfied ___ don't know/not sure

17. What was the main reason(s) you were so satisfied or dissatisfied? (please describe)
_____

18. While you were on the lake on this trip, did you see an enforcement officer? (CHECK ONE)
____ yes ____ no ____ don't know/not sure

19. Were you checked by an enforcement officer on this trip? (CHECK ONE)
____ yes ____ no

19a. (IF YES) How would you rate the officer's professional conduct during this check? (CHECK ONE)
_____ excellent _____ good _____ fair _____ poor _____ very poor _____ don't know

20. On this trip, did you travel through any parts of the lake where you thought there were too many boats? (CHECK ONE) ____ yes ____ no ____ don't know/not sure

21. How does the number of boats you encountered on this trip compare to the number of boats you have seen on other trips on this same part of the lake? (CHECK ONE)

____ substantially fewer ____ slightly fewer ____ about the same
____ slightly more ____ substantially more
____ don't know/not sure ____ haven't boated here before this trip

22. From a safety standpoint, how did you feel about the number of boats on the lake on this trip? (CHECK ONE)

___ few boats here ___ about right ___ crowded ___ far too crowded ___ don't know/not sure

23. Would you boat again if you knew there were going to be about the same number of boats as on this trip? (CHECK ONE)

____ yes ____ no ____ don't know/not sure

24. Based on your experience on this trip, how much of a problem is each of the following on this lake? (MARK ONE OF THE BOXES FOR EACH OF THE NUMBERED ITEMS)

ITEM	not a problem	slight problem	moderate problem	serious problem	very serious problem	don't know
1. careless or inconsiderate operation of boats						
2. boat operators who have been drinking too much						
3. the amount of noise from boats on the lake						
4. near miss or collision						
5. high wakes						
6. use of personal watercraft (jet skis)						
7. large boats (boats over 24 feet)						
8. boats operating too fast, too close to shore/docks						
9. boats not yielding the right-of-way						
10. number of boats on the lake						
11. excessive speed in channels and crowded areas						
12. excessive speed in open water						
13. fishing tournament activities on the water						
14. fishing tournament activities at the public access						

NOW WE HAVE SOME QUESTIONS ABOUT BOATING SAFETY

25. What special boating restrictions are there for this lake? (CHECK ALL THAT APPLY)

____ none ____ horsepower restrictions
____ boat type and size restrictions ____ speed restrictions/quiet waters
____ time restrictions ____ area of lake restrictions
____ don't know/not sure ____ other (please describe) _____

26. Overall, how do these restrictions affect your enjoyment of the lake? (CHECK ONE)

____ add to enjoyment ____ detract from enjoyment ____ neutral with respect to enjoyment

27. Overall, do think special boating restrictions on this lake are: (CHECK ONE)

____ too restrictive ____ about right ____ not restrictive enough ____ don't know

28. What special boating restrictions are needed for this lake? (CHECK ALL THAT ARE NEEDED)

____ none
____ boat type and size restrictions
____ time restrictions
____ don't know/not sure
____ special restrictions for personal watercraft (jet skis)
____ horsepower restrictions
____ speed restrictions/quiet waters
____ area of lake restrictions
____ other (please describe) _____

29. Have you taken a formal course in boating safety? (CHECK ONE)

____ yes ____ no ____ don't know/not sure

30. Should all boat operators (powered & unpowered) be required to complete a boating safety course? (CHECK ONE) ____ yes ____ no ____ don't know/not sure

31. Should all motorboat operators be required to obtain an operator's license? (CHECK ONE)

____ yes ____ no ____ don't know/not sure

NOW A FEW QUESTIONS ABOUT THIS PUBLIC BOAT ACCESS

32. Have you ever used this access before? (CHECK ONE)

____ yes ____ no ____ don't know/not sure

33. Have you ever tried to use free public access on this lake and found the access parking lot full? (CHECK ONE)

____ yes ____ no ____ don't know/not sure

33a. (IF YES) How many times did you find the lot full in the past 12 months? ____ times

33b. (IF YES) What did you do when you found the parking lot full? (CHECK ALL THAT APPLY)

____ parked on the road
____ waited for place in lot to open up
____ went to another lake
____ went to another access on this lake
____ didn't boat that day
____ other (please specify) _____

34. Do you currently have a disability that affects when or where you boat? (CHECK ONE)

____ yes (please describe disability) _____
____ no

34a. (IF YES) Was this public access facility adequate for your needs? (CHECK ONE)

____ yes
____ no (please specify inadequacy) _____

34b. (IF YES) Did you park in a designated handicapped space at this access? (CHECK ONE)

____ yes
____ no (IF NO, why not?) _____

35. How would you rate this access for launching and landing a boat? (CHECK ONE)
____ excellent ____ good ____ fair ____ poor ____ very poor ____ don't know/not sure

36. Did you have any particular problems using this access on this boating trip? (CHECK ONE)
____ yes ____ no ____ don't know

36a. (IF YES) What was the problem(s)? (CHECK ALL THAT APPLY)

____ not enough parking spaces
____ ramp blocked by parked cars, campers etc.
____ access parking lot being used by non-boaters
____ insufficient number of launch lanes/ramps
____ difficult to launch/land because of wind or waves
____ water too shallow
____ no dock
____ access site in disrepair
____ ramp slope too steep
____ ramp too short
____ inadequate directional signs to access
____ not enough maneuvering room on land near ramp for launch/landing
____ swimmers near ramp made it difficult to launch/land a boat
____ not enough maneuvering room on water near ramp for launch/landing
____ people fishing from the dock at the access made it difficult to maneuver
____ safety of entry to access area from road or highway
____ couldn't find the access from the lake after dark
____ other (please specify) _____

37. Which of the following improvements do you feel are needed at this launch site? (CHECK ALL THAT ARE NEEDED)

____ better directional signs to access
____ better informational signs at access
____ a dock to aid launching
____ better lighting of access/parking area
____ beacon light visible from lake
____ more parking spaces in lot
____ protection from wind/waves in front of launch ramp
____ other (please specify) _____
____ litter pickup
____ toilets
____ toilet maintenance (if applicable)
____ more launch lanes/ramps
____ better enforcement
____ trash containers
____ larger parking spaces in access lot

38. How large a problem to you were any effects of “power loading” at this launch site (“effects” include scouring a hole at the end of the ramp and building a ridge off the end of the ramp)? (CHECK ONE)
____ no problem ____ slight problem ____ moderate problem
____ serious problem ____ very serious problem ____ don’t know

39. When you landed your boat today, did you “power load” the boat onto your trailer? (CHECK ONE)
____ yes ____ no ____ don't know

NOW SOME GENERAL QUESTIONS

40. In the last 12 months, how many times did you use a free public access to launch a boat onto a Minnesota lake or river? ____ times (if zero, write “0”)

41. Do you know of a lake(s) within 50 miles of this lake that needs an additional (or initial) public boat access? (CHECK ONE)
____ yes (IF YES, please name lake(s): _____) ____ no ____ don't know

42. Do you think an additional (or initial) public boat access is needed on this lake? (CHECK ONE)
____ yes (IF YES, why needed? _____) ____ no ____ don't know

43. How many other lakes do you boat on within about 50 miles of this lake? ___ lakes

43a. How do you gain access to these other lakes? (CHECK ALL THAT APPLY)
____ free public access launch site
____ my home or cabin
____ road end/road right-of-way (unimproved site)
____ friend or relative's home/cabin
____ resort, marina or private launch site
____ other (please specify) _____

44. How important to you are each of the following items at a public boat access? (MARK ONE OF THE BOXES FOR EACH OF THE NUMBERED ITEMS)

ITEM	not important	slightly important	moderately important	very important	don't know
1. dock to aid launching/landing					
2. toilets					
3. map of the lake showing depth, hazards					
4. map of lake showing boating restrictions					
5. emergency information					
6. paved parking lot (as opposed to a gravel lot)					

JUST A FEW FINAL QUESTIONS

45. What type of radio station do you primarily listen to? (CHECK ONE)
____ classical ____ country ____ rock & roll ____ public radio
____ easy listening/lite ____ jazz ____ talk ____ religious radio
____ sports ____ other (please specify) _____

46. Have you ever obtained boating-related information from the Minnesota DNR web page (www.dnr.state.mn.us)? (CHECK ONE) ____ yes ____ no ____ don't know/not sure

47. Which category best describes your total household income before taxes last year? (CHECK ONE)

____ less than $20,000 ____ $40,000-$49,999 ____ $100,000 or more
____ $20,000-$29,999 ____ $50,000-$74,999 ____ refuse to answer
____ $30,000-$39,999 ____ $75,000-$99,999 ____ don't know/not sure

THAT'S THE END OF THE QUESTIONS. THANK YOU VERY MUCH.

Survey # _____ (This survey number is only used to keep track of who has completed the survey and who has not. We will send replacement surveys to those who don't respond in three weeks. Your answers are strictly confidential and will never be associated with your name.)

Appendix 2

Sample Forms for Preliminary Evaluation of Boating Sites

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
PUBLIC WATER ACCESS
PROJECT PROPOSAL

SAMPLE

PARCEL NO. _____
REGION _____

NAME OF LAKE _____ COUNTY _____

NAME OF SITE OWNER _____ ADDRESS _____

PROPOSED ACTION:

- ☐ Land Acquisition
- ☐ Lease
- ☐ Transfer to Custodial Control (Must be accompanied by Fact Sheet)
- ☐ Gift
- ☐ Easement
- ☐ Agreement with other Governmental unit for access purposes

LAKE INFORMATION:

Lake size _____ (acres) Is lake meandered? Yes ____ No ____

Number of public access sites on lake at present _____

Number of car/trailer parking spaces provided at present _____

SITE INFORMATION:

Legal Description: _____ ¼ ¼ or ½ Sec _____ ¼ Sec _____ Sec _____ Twp _____ Range
Site Location: Upland____% Lowland %
Describe: (physical landscape of the site)

Lake bottom type at proposed launching site: Sand____ Gravel____ Rock____ Muck____

Depth of water at 20 feet from shoreline? _____ at 50 feet?_____

Distance of launching site from nearest public road. Describe:

Describe road access and any potential conflicts/concerns anticipated:

Number of vehicles anticipated on an average weekend day _____

Indicate other possible uses of this site:

Adjacent land developed?___Yes ___No Residential ___ Commercial ___ Other ___
Describe:

Distance from nearest post office(in_miles)_____ Direction:_____

Describe support and/or opposition:

Other information you feel is important:

Prepared by: _____ Title: _____ Date: _____

REGIONAL INFORMATION

Regional Priority Level of Lake ___ 1st ___ 2nd ___ 3rd ___ 4th
(If third or fourth priority, state justification for establishing this access now)

Priority Rating Number from Regional priority list _____

Shore land Management Classifications: ___ General Develop ___ Recreational Develop
___ Natural Environment

Permits Needed - Corps of Engineers: ___ General ___ Special ___ Application
DNRs: ___ Yes ___ No

Archeological survey needed: ___ Yes ___ No

REGIONAL CHECK LIST:

Regional Land Specialist has initialed fact sheet, Regional Engineer has seen site.

___ Engineers development cost estimate

___ Engineering site plan and cost estimate attached

___ Site map and location map attached.

___ Signed landowner Bill of Rights Acknowledgement letter attached.

___ Photograph of proposed launching site attached.

REVIEWED/APPROVED BY:

Area Supervisor/Trails and Waterways Unit _____ Date _____
Print- _____

Regional Manager/Trails and Waterways Unit _____ Date _____
Print- _____

Water Recreation Operations Manager _____ Date _____
Trails and Waterways Unit
Print- _____

Water Recreation Program Manager _____ Date _____
Trails and Waterways Unit
Print- _____

SAMPLE

Rev. 4/21/99

INITIAL SITE ASSESSMENT CHECKLIST

Project	Parcel	County
Owner Name		Telephone No. (including area code)
Description		

CHECKLIST TO ASSESS CONTAMINATION POTENTIAL

1. LAND USE HISTORY & DEVELOPMENT:

Setting: Rural _____ Urban _____ (check one)

Current Land Uses (check applicable)

___Residential ___Commercial ___Industrial
___Agricultural ___Dump/Landfill ___Wetland
___Gravel/Mining ___Woods ___Other_____

Previous Land Uses (check applicable)

___Residential ___Commercial ___Industrial
___Agricultural ___Dump/Landfill ___Wetland
___Gravel/Mining ___Woods ___Other _____

Adjacent Land Uses (check applicable)

___Residential ___Commercial ___Industrial
___Agricultural ___Dump/Landfill ___Wetland
___Gravel/Mining ___Woods ___Other _____

2. VISUAL INSPECTION:

STORAGE STRUCTURES (check applicable)

___Wells ___Transformers ___Ponds
___Septic ___Sumps ___Basins
___Underground Tanks ___Drums ___Other _____
___Landfills ___Surface tanks
Comments:_____
_____

CONTAMINATION (check applicable)

___Surface Staining ___Oil Sheen ___Odors
___Vegetation Damage ___Other Comments:_____
_____

POTENTIAL ASBESTOS-CONTAINING MATERIALS (check applicable)

___Sprayed textured ceilings ___Building materials ___Sprayed-on fireproofing
___Floor tile ___Pipe wrap ___Acoustical tile ceilings
Comments:_____
_____

3. OPTIONAL REVIEW OF OUTSIDE RECORDS WHICH MAY INDICATE PAST LAND USES: (To be completed when checklist numbers 1 and 2 indicate a potential for contamination).

_____

_____

_____
(Land Titles, Business Licenses, Insurance Records, Fire Hazard Maps, Tank Permits, etc.)

4. OPTIONAL REVIEW OF REGULATORY AGENCY RECORD: (To be completed when checklist numbers 1 and 2 indicate a potential for contamination).

_____

_____
(Contact MPCA Site Assessment Unit, Program Development Section for this information. They will check their files to determine if there has been a release of a contaminant at or near the project location).

CERTIFICATION

The undersigned, after conducting a field inspection and/or record search for the subject property believes to the best of my knowledge that:

____there is no apparent contamination potential: the project is considered cleared.

____contamination potential exists, additional investigation is needed.

Signed: _____ Dated: _____

_____
Title

SAMPLE

Water Access Site Project Plan

I PROJECT DESCRIPTION

1. **Requisition Number** _____
2. **Lake Project Name/Lake I.D.#** _____
3. **County/Sec/Twp/Range** _____
4. **Initial Cost Estimate** _____
5. **Congressional Districts (Federal)** _____
6. **Legislative Districts (State)** _____
7. **Project Originator** _____
8. **Type of development:**
   - ___ **Crew**
   - ___ **BOE/Contractor**
   - ___ **Cooperative Agreement**

II BUREAU OF ENGINEERING (BOE) SERVICES REQUESTED:

1. ___ **BOE Concept Plan**
2. ___ **BOE Feasibility Report**
3. ___ **BOE Preliminary and Final Plan - T & W concept sketch**
4. ___ **BOE Artistically designed materials for presentation**
5. ___ **BOE Technical Assistance**
6. ___ **Topographic Survey**
7. ___ **Boundary Survey**
8. ___ **Other** _____

III PROJECT DESIGN DETAILS:

1. **Parking Lot and Roadway:**

A. # of Parking Spaces Desired: ___ Car Trailer ___ Car Only ___ Overflow
B. Type of Parking Spaces: ___ Pull Thru ___ Head In ___ Angle
C. Parking Lot Surface: ___ Aggregate ___ Bituminous ___ Grass
D. Landscaping: ___ Crew Project Contract ___ Coop ___ None
E. Road Surface: ___ Aggregate ___ Bituminous
F. Traffic Control: ___ Poured Curb ___ W.Post ___ Boulder ___ None
___ Tie Down Lane ___ Precast Curb
G. Traffic Islands: ___ Typical ___ Modified: Dimensions (LxWxH) _____
H. Road Access Name: (i.e. CSAH 12) _____
I. Road Access Sight Lines: ___ Adequate ___ Inadequate

2. Site Drainage:

Estimate
drainage requirements _____
_____
_____

3. Launch ramp:

Type: ___Gravel ___ Poured Concrete
___Precast plank ___ Standard size:
___Other___x___(i.e., 6'x12')
Water Depth at 20': ___ Existing: ___ Required:
Ramp features desired: ___ Striping ___ V-grooves ___ Broken-back
___Other
Ramp Design Considerations: _____
_____
_____

i.e., erosion, rock rip-rap, site use, ice action, boulders, stumps, dockage, debris, soil types, emergent vegetation, bed rock, sand drift, floating bog, river current, water fluctuations, flood dikes, neighbors, traction/spin outs, spawning beds, barge traffic, muck, drainage/skimming ponds, overhead wires, etc.

4. Dredging: *As measured between the toe of dredge slopes.

Boat Launching Pool: Depth _____ Pool Dimensions _____
Dredged Channel: Depth _____ Channel Dimensions _____
Describe emergent vegetation: _____
_____

5. Unique Site Issues: _____

_____

_____

i.e., filter fabric, safety light shield, navigation safety, powerlines, vandalism, nongame species, easements and R.O.W.'s, WSCD's, dikes and levees, hazardous wastes, trees, septic systems, fuel tanks, any visible utilities, power lines, dredge spoil waste, sensitve emergent vegetation, log jams, sand bars, river current, muskrats/beaver activity, litter, safety, roads to be closed, seasonal peak use periods, etc.

6. Unique Site Use Issues: _____

_____

_____

i.e., winter access, swimming, bank fishing, night fishing, disabled visitors, canoeing, wind sailing, jet skis, scuba divers, duck hunting, boat in cabins, special events, enforcement, minnow dealers, portages, etc.

7. Site Ammenities Desired:

Fencing: Type _____ Dock: Quanity _____
Location _____ Type _____
_____

Toilet: Quanity _____ Safety Lights: Quanity _____
Type _____ Location _____
_____

Other _____

IV REVIEWS NEEDED

1. Internal plan review: Date Completed:

A. Archeology _____
B. DOW _____
C. Endangered species _____
D. Non-game _____
E. Forestry _____
F. Parks _____
G. Fish and Wildlife _____

Cultural Resources Known: _____
Comments-_____

EAW - Is an Environmental Assessment Worksheet
required for this project: ___ Y ___ N

Enhancement of Surplus Acreage for Fish and Wildlife Habitat:
Potential Improvements Include: ___ Rock Spg.Beds ___Nesting Beds___Pond/s
___ Nesting Islands ___Other

Review Log:
On Site Reviews/Date:_____ attendees: _____
Comments/Activity: _____
_____
_____
On Site Reviews/Date:_____ attendees: _____
Comments/Activity: _____
_____
_____

2. External plan review:

___ DOT ___ Co. Board/ZA ___ Twp. ___ City
___ Lk. Assoc. ___ Watershed Dist. ___ Fed. Agencies ___ Ind. Reservation
___ Adj. Neighbors/Interest Groups ___ MN County Biological Survey
___ Mgmt Boards ___ Utility Co's. ___ other

Review Log: _____

_____
_____
_____
_____
_____
_____

V PERMITS REQUIRED:

1. DNR Dow Permit: NA___ General___ Protected Waters___
Date Applied For: _____
Comments _____
_____
_____

2. USCE Permit: NA___ General___ Individual___ Flood dike easement___
Date Applied for: _____

A. Wetlands Above OHW/Acreage: Type 1___ 2___ 6___ 7___ 8___
Type Impacted___ Acreage Impacted___
* These areas generally are waters of the National Wetland Inventory (NWI) and involve regulations of the USCE. Marshes as small as .10 acre need to be confirmed.

B. Wetlands Impacted Below OHW: Type 3___ 4___ 5___
Type Impacted___ Acreage Impacted___
* These areas generally are waters of the Public Water Inventory (PWI) and involve regulations of the D.O.W.

C. Wetland Mitigation On Site Alternatives are Available: _____

D. Wetland Mitigation on Public Lands are Available: _____

E. Wetland Analysis Resources: ___Map: Watershed Districts in Minnesota
___Map: Public Water Inventory (PWI)
___Circular 39, National Wetland Inventory (Fed. F & W,USCE).

3. Roadway Entry Permit: ___DOT ___Co. Hwy. ___Township Input

VI LAND INTEREST: Cooperative Agreements, Leases, Permits, Licenses

1. Trails & Waterways Interest: ___Fee__Lease Coop Agreement ___Other:_____

* Send a draft agreement (to St. Paul) Central Office for review.. Cite the resources committed by coop. agency:% of project cost, etc...

2. Cooperative Agreement:

A. Agencies Involved:_____
_____

B. Land Ownership:___City ___DNR ___Other_____
_____

C. Current Status:_____

D. Effective Date: _____

E. T&W Resources: __funds __landscaping __maintenance
__equipment __signingsodding__gravel fill
__Engineering __dockage __side walksramps
__land __archaeology __other

F. LUG Resources: __funds __landscaping __maintenance
__equipment __signingsodding__gravel fill
__Engineering __dockage __side walks
__archaeology __other

VII FIELD NOTES

Site Visit Log Attendees Date

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Notes:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

PROJECT WORK PLAN
SKETCH

Appendix 3

Sample of a Field (on-site) Evaluation Checklist

SAMPLE

WATER BODY

Name _____ Water body ID code _____

Location: County _____ Tn, Rg, Sec _____

Area: _____acres

Fishery _____

Existing access _____

Distance to nearest population center(s) _____

_____

SITE

Known historic/archaeologic features _____

Orientation, location in relation to long axis _____

Maximum fetch affecting site _____

Soil suitability: Landside _____ Waterside _____

Vegetative cover _____

Gradients: Parking _____ Ramp _____

On-site improvements _____

_____

Proportion of total value in improvements _____

Access to unique features _____

_____

Restrictive title covenants _____

Land survey needed _____

Disposal of excess land _____

Zoning _____

Local opposition _____

Buffering to nearest developments _____

Adjacent land use _____

PROPOSED DEVELOPMENT

Access type: Walk in _____ Car top _____ Car/trailer _____

Amenities _____

Parking units _____ Parking lot dimensions _____

Estimated development cost $ _____

Road suitability _____

Need for additional land _____

Disabled angler access considered _____ Possible? _____

Anticipated date of development _____

MANAGEMENT

Maintenance agreement possible _____

_____

Local input _____

_____

FUNDING _____

RECOMMENDATION Approve _____ Disapprove _____

COMMENTS _____

_____

_____

_____

_____

Reviewer _____

Date _____

Appendix 4

ADA Brochure for Boating Access

UNITED STATES ACCESS BOARD

amusement rides boating facilities fishing piers & platforms golf courses miniature golf sports facilities swimming pools & spa

accessible boating facilities

a summary of accessibility guidelines

for recreation facilities

JUNE 2003

A FEDERAL AGENCY COMMITTED TO **ACCESSIBLE DESIGN**

Contents

This information has been developed and reviewed in accordance with the Access Board's information quality guidelines (www.access-board.gov/infoquality.htm).

Accessibility Guidelines for Recreation Facilities

Introduction

The Americans with Disabilities Act (ADA) is a comprehensive civil rights law that prohibits discrimination on the basis of disability. The ADA requires that newly constructed and altered state and local government facilities, places of public accommodation, and commercial facilities be readily accessible to, and usable by, individuals with disabilities. The ADA Accessibility Guidelines (ADAAG) is the standard applied to buildings and facilities. Recreational facilities, including boating facilities, are among the facilities required to comply with the ADA.

The Access Board issued accessibility guidelines for newly constructed and altered recreation facilities in 2002. The recreation facility guidelines are a supplement to ADAAG. As a supplement, they must be used in conjunction with ADAAG. References to ADAAG are mentioned throughout this summary. Copies of ADAAG and the recreation facility accessibility guidelines can be obtained through the Board's website at www.access-board.gov or by calling 1-800-872-2253 or 1-800-993-2822 (TTY). Once these guidelines are adopted by the Department of Justice (DOJ), all newly designed, constructed and altered recreation facilities covered by the ADA will be required to comply.

The recreation facility guidelines cover the following facilities and elements:

- Amusement rides
- Boating facilities
- Fishing piers and platforms
- Miniature golf courses
- Golf courses
- Exercise equipment
- Bowling lanes
- Shooting facilities
- Swimming pools, wading pools, and spas

This guide is intended to help designers and operators in using the accessibility guidelines for boating facilities. These guidelines establish minimum accessibility requirements for newly designed or newly constructed and altered boating facilities. This guide is not a collection of boating facility designs. Rather, it provides specifications for elements within a boating facility to create a general level of usability for individuals with disabilities. Emphasis is placed on ensuring that individuals with disabilities are generally able to access the boating facility and use a variety of elements. Designers and operators are encouraged to exceed the guidelines where possible to provide increased accessibility and opportunities. Incorporating accessibility into the design of a boating facility should begin early in the planning process with careful consideration to accessible routes.

USDA FOREST SERVICE

The recreation facility guidelines were developed with significant public participation. In 1993, the Access Board established an advisory committee of 27 members to recommend accessibility guidelines for recreation facilities. The Recreation Access Advisory Committee represented the following groups and associations:

- American Ski Federation
- American Society for Testing and Materials (Public Playground Safety Committee)
- American Society of Landscape Architects
- Beneficial Designs
- City and County of San Francisco, California, Department of Public Works
- Disabled American Veterans
- Environmental Access
- Golf Course Superintendents Association of America
- Hawaii Disability and Communication Access Board
- International Association of Amusement Parks and Attractions
- Katherine McGuinness and Associates
- Lehman, Smith, and Wiseman Associates
- Michigan Department of Natural Resources
- National Council on Independent Living
- National Park Service
- National Recreation and Park Association
- New Jersey Department of Community Affairs
- Outdoor Amusement Business Association
- Paralyzed Veterans of America
- Professional Golfer's Association
- Self Help for Hard of Hearing People

BAY AREA ASSOCIATION OF DISABLED SAILORS

- States Organization for Boating Access
- Universal Studios
- U.S. Army Corps of Engineers
- U.S. Forest Service
- Y.M.C.A. of the U.S.A.
- Walt Disney Imagineering

The public was given an opportunity to comment on the recommended accessibility guidelines, and the Access Board made changes to the recommended guidelines based on the public comments. A notice of proposed rulemaking (NPRM) was published in the Federal Register in July 1999, followed by a five-month public comment period. Further input from the public was sought in July 2000 when the Access Board published a draft final rule soliciting comment. A final rule was published in September 2002.

"Whenever a door is closed to anyone because of a disability, we must work to open it…. Whenever any barrier stands between you and the full rights and dignity of citizenship, we must work to remove it, in the name of simple decency and justice. The promise of the ADA…has enabled people with disabilities to enjoy much greater access to a wide range of affordable travel, recreational opportunities and life-enriching services."

President George W. Bush, New Freedom Initiative, February 1, 2001

Boating Facilities

The recreation facility guidelines described in this guide focus on newly designed or newly constructed and altered boating facilities. Other provisions contained in ADAAG address elements commonly found at a boating facility, such as accessible vehicle parking spaces, exterior accessible routes, and toilet and bathing facilities. ADAAG addresses only the built environment (structures and grounds). The guidelines do not address operational issues of a facility. Questions regarding operational issues should be directed to the Department of Justice, 1-800-514-0301 or 1-800-514-0383 (TTY).

Recreational boating facilities can include fixed and floating facilities. Facilities can vary in size from one boat slip (for example, at a small campground facility) to several thousand slips, and can handle boats ranging in size from small canoes to large sailboats and powerboats. Facilities may be located in the same waterfront area or even in the same site (such as a State park with a large lake) and include marinas, launching facilities, piers, and docks that are designed for recreational use.

These guidelines do not cover the design of passenger vessels or ferry docks, and do not address access on and off passenger vessels. These issues will be addressed in future rulemaking for passenger vessels.

Accessible Routes

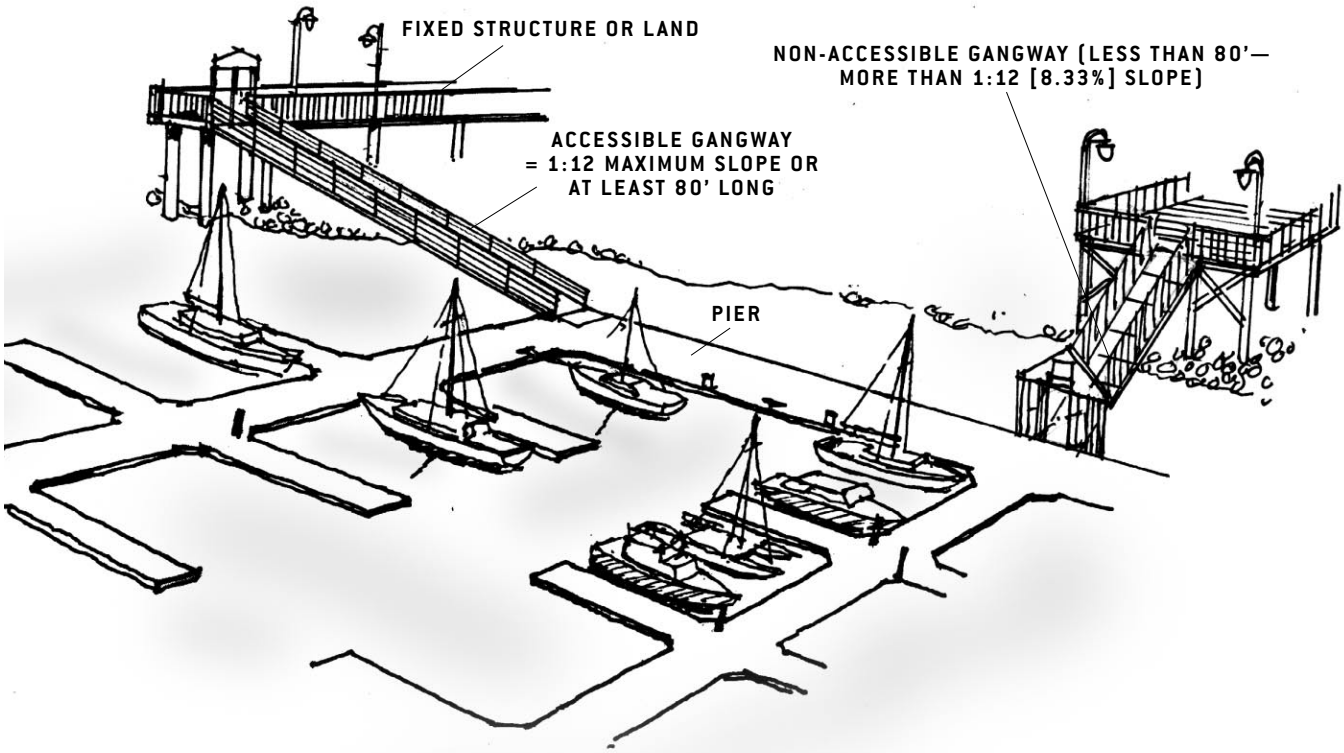
ADAAG requires that at least one accessible route connect accessible buildings, facilities, elements, and spaces on a site. Accessible boat slips, accessible boarding piers at boat launch ramps, and other accessible spaces and elements within a boating facility must also be connected by an accessible route. The accessible route must comply with ADAAG provisions for the location, width (minimum of 36 inches), passing space, head room, surface, slope (maximum of 1:12 or 8.33%), changes in level, doors, egress, and areas of rescue assistance, unless otherwise modified by specific provisions outlined in this guide.

Gangways

A gangway is a variable-sloped pedestrian walkway linking a fixed structure or land with a floating structure. Where gangways are provided as part of accessible routes to connect accessible boat slips on floating piers, the following exceptions to the ADAAG accessible route provisions have been included in the guidelines to deal with the varying water level changes and other factors in this dynamic environment. Designers and operators should note that there are no exceptions to the accessible route requirements where the accessible route connects fixed piers to land or other fixed structures.

Gangway Slope and Rise Exceptions

Gangways designed for the least possible slope will provide more independent access for persons with disabilities. As a minimum however, gangways must be designed to provide for a maximum 1:12 (8.33%) slope but are not required to be longer than 80 feet in length. For example, if the vertical distance between where the gangway departs the landside connection and the elevation of the pier surface at the lowest water level is 10 feet, the gangway would have to be at least 80 feet long. As water levels rise and fall, gangway slopes also rise and fall. At times, this gangway slope may be less than 1:20 (5%) and at other times it may be more than 1:12 (8.33%). In smaller facilities with less than 25 boat

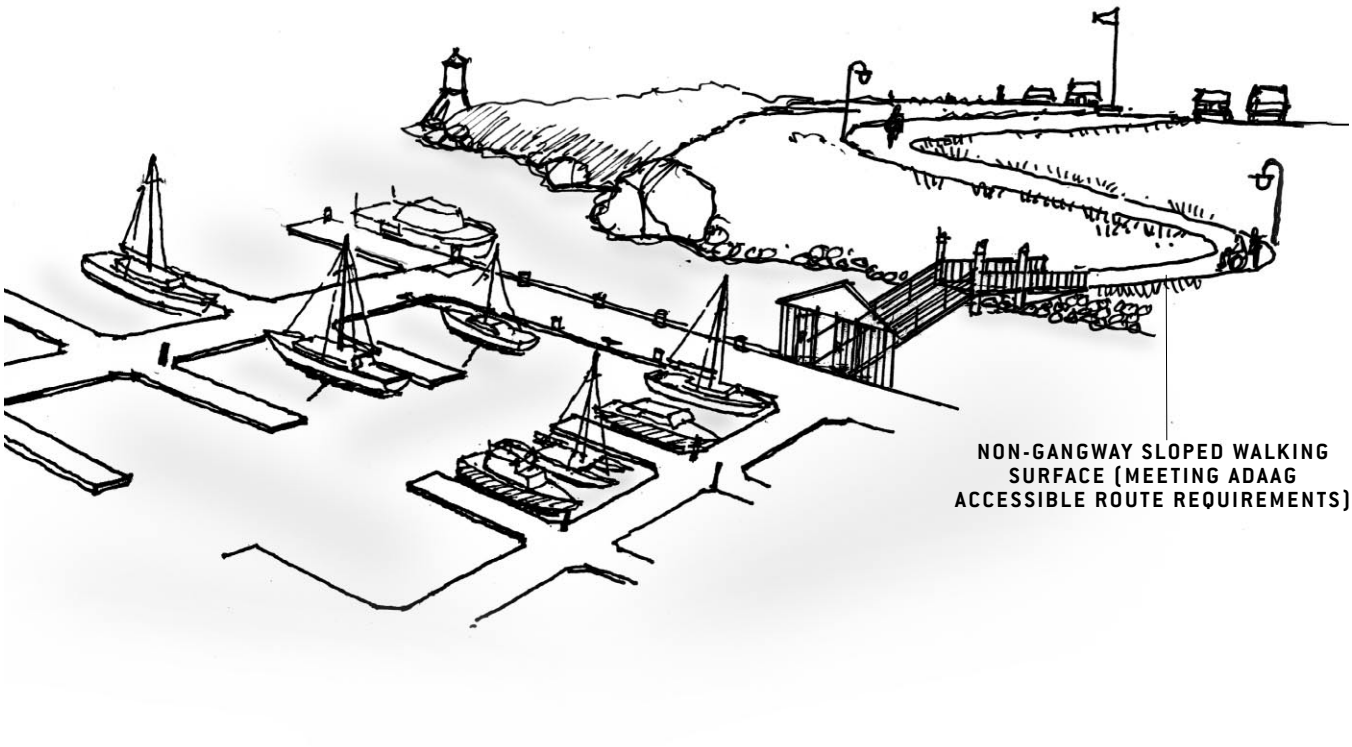


ACCESSIBLE GANGWAY SERVING ACCESSIBLE BOAT SLIPS IN A LARGE FACILITY

slips, the slope of the gangway may exceed 1:12 (8.33%), if the gangway is at least 30 feet long.

The maximum rise requirements in ADAAG do not apply to gangways. As a result, no intermediate landings on the gangways are required and gangways may be any length.

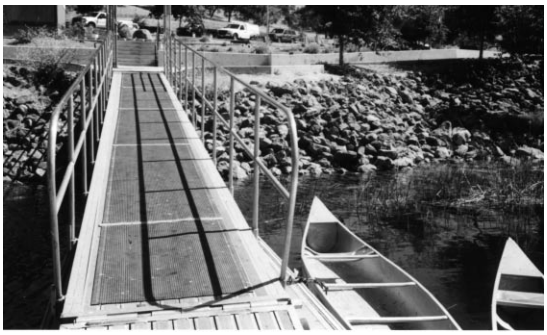
The gangway slope and rise exceptions do not apply to other sloped walking surfaces that may be part of the accessible route. For example, where a non-gangway sloped walking surface greater than 1:20 (5%) is provided as part of an accessible route connecting accessible spaces of a boating facility, it must comply with ADAAG slope and rise



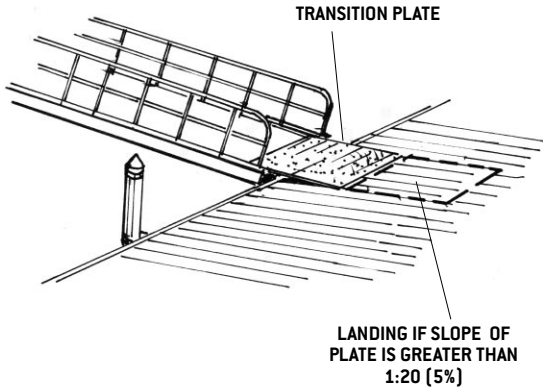
requirements. This would include a ramp connecting a fixed pier or a float with fixed switchback ramps.

Gangway Alterations

Gangways on existing boating facilities may be repaired or replaced without triggering the requirement to increase the gangway length. However, if the areas altered contain primary functions (such as a boat slip or boat dock), existing gangways are considered part of the path of travel to the altered primary function area and must be made accessible, if the cost to do so is not disproportionate. The Department of Justice has determined that it is not disproportionate to spend up to an additional 20 percent of the overall costs of alterations to the primary function areas to make the path of travel accessible.



GANGWAY CONNECTING FLOATING PIER



TRANSITION PLATES

Transition Plates

Transition plates are sloping pedestrian walking surfaces located at the end of a gangway. Gangways are not required to have landings at the end, if transition plates are provided. If the slope of a transition plate is greater than 1:20 (5%), the transition plate must have a landing at the non-gangway end of the transition plate and comply with other ADAAG ramp requirements.

Handrail Extensions

ADAAG addresses handrail height, diameter, and extensions provided to the end of the gangway. Other specifications regarding vertical supports are not addressed by ADDAG, but may be addressed in local building codes. Handrail extensions are not required where gangways and transition plates connect and both are provided with handrails. ADAAG does not require handrails on sloped surfaces that have a rise of less than 6 inches or a projection less than 72 inches, or a slope of 1:20 (5%) or less. Where handrail extensions are provided, they do not need to be parallel with the ground or floor surface, since the surface may be moving due to water conditions.

Cross Slope

The cross slopes of gangways, transition plates and floating piers that are part of an accessible route must be designed and constructed to not exceed a maximum of 2 percent (1:50). Gangways and piers that are part of an accessible route are expected to be designed and constructed to meet the 2 percent requirement. Once placed in the water,

measurements, absent live loads, are to be made from a static condition (i.e., absence of movement that results from wind, waves, etc.). Where floating piers are grounded out due to low water conditions, slope requirements would not apply.

Elevators and Platform Lifts

In addition to regular elevators, limited use/limited application elevators (smaller, slower elevators used for low-traffic, low-rise facilities) or platform lifts that comply with ADAAG may be used instead of gangways as part of an accessible route connecting floating piers.

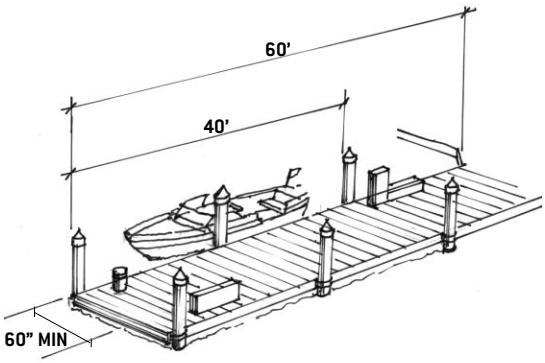
Boat Slips

A boat slip is the portion of a pier, main pier, finger pier, or float where a boat is berthed or moored, or used for embarking or disembarking. Where boat slips are provided, the number of boat slips required to be accessible must comply with the table shown to the right. In these guidelines, boarding piers that are not part of boat launch ramps are also classified as boat slips. For purposes of these guidelines, piers not typically thought of as providing boat slips where boats can be moored, such as a fuel pier, are also included in determining the total number of slips at the facility.

If boat slips at a facility are not identified or demarcated by length, each 40 feet of boat slip edge along the perimeter of a pier will be counted as one boat slip. For example, a new boating facility will provide a single 60-foot pier with boats moored parallel to the pier on both sides. The pier has 120 feet of boat slip edge, which equates to three boat slips. According

NUMBER OF ACCESSIBLE BOAT SLIPS REQUIRED

Total Slips in Facility	Minimum Accessible Slips
1-25	1
26-50	2
51-100	3
101-150	4
151-300	5
301-400	6
401-500	7
501-600	8
601-700	9
701-800	10
801-900	11
901-1000	12
1001 and over	12 plus 1 for each 100 or fraction thereof



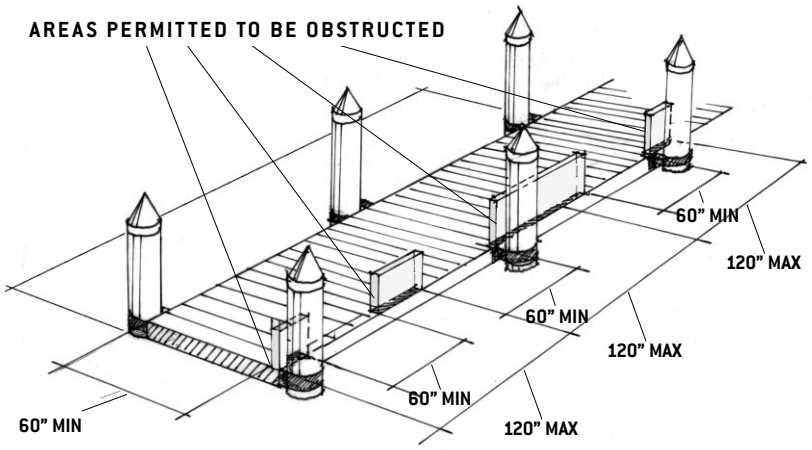
REQUIRED CLEAR SPACE FOR 60-FOOT PIER

to the table, one slip must be accessible, with clear pier space at least 40 feet long and a minimum width of 60 inches. In this case, the width of the pier is not considered when totaling the amount of boat slip edge, since it is not designed for mooring. Another new boating facility plans to provide a single pier that is 25 feet long and 3 feet wide and will allow boats to moor on both sides and on one end. The pier has 53 feet of boat slip edge, which equates to two boat slips. According to the table, one slip must be accessible, and the width of the pier must be increased to a minimum of 60 inches.

Dispersion

Accessible boat slips must be dispersed throughout the various types of slips a facility provides, but a facility does not have to provide more accessible boat slips than required in the table. Accessible slips may be grouped on one pier if the requirement for different types of slips is met. Types could include shallow-water or deep water; transient or longer-term lease; covered or uncovered; and whether slips are equipped with features such as telephone, water, electricity, or cable connections.

Accessible boat slips do not need to be marked and are not reserved in the same way as accessible vehicle parking spaces. For example, facilities should hold the accessible slips open for persons with disabilities until all other slips are filled. At that point, the slip may be made available for general use. For seasonal slip holders, accessible slips should be held until the expiration period for slip contracts has expired. Marina operators may choose to make

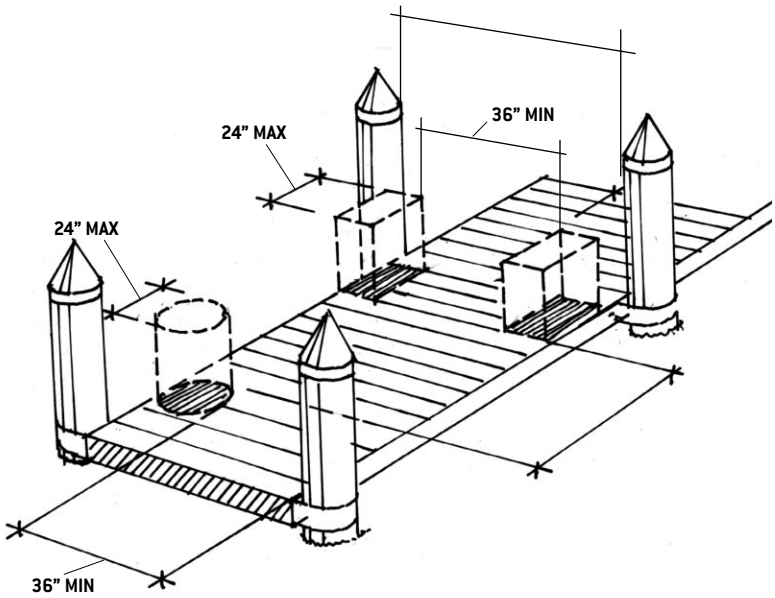


PIER CLEARANCE

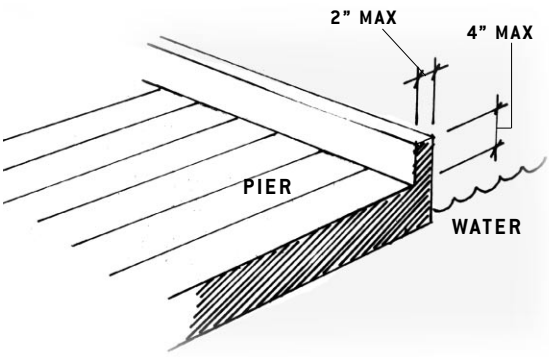
information regarding accessible boat slips available in promotional material or a facility guide. Ensuring that accessible slips are available to persons with disabilities is an operational issue and operators should contact the Department of Justice for further information.

Accessible Boat Slips

Accessible boat slips must have clear pier space at least 60 inches wide and as long as the slip. Providing more than 60 inches wide clear space will improve safety for people with disabilities, especially on floating piers. This space is the minimum necessary for individuals with disabilities to have sufficient space adjacent to their boat slip to use a chair lift or transfer device for getting on or off their vessel and provide a turning space for changing directions. Every 10 feet of linear pier edge serving the accessible slips must



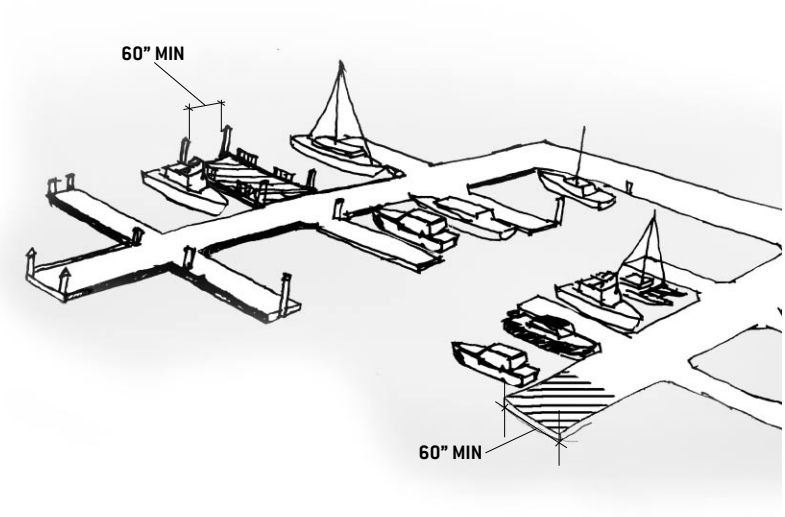
PIER CLEARANCE SPACE REDUCTION



E PROTECTION AT PIER

have at least one continuous clear opening that is at least 60 inches wide. There are three exceptions:

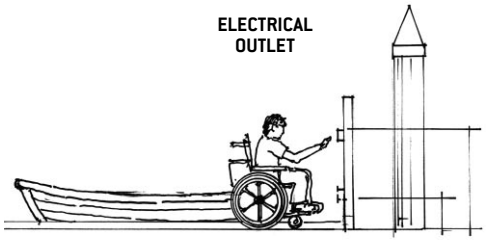
- The width of the clear pier space may be 36 inches wide for a length of 24 inches, as long as multiple 36-inch segments are separated by segments that are 60 inches minimum clear in width and 60 inches minimum clear in length, and the clear openings are at least 60 inches deep.
- Edge protection is not required, but if provided, it can be 4 inches high maximum and 2 inches deep maximum at the continuous clear openings.
- In alterations, facilities with finger piers must have at least one accessible finger pier, which is the length of the boat slip and a minimum of 60 inches wide. Other accessible slips can be located perpendicular to the end of the pier with



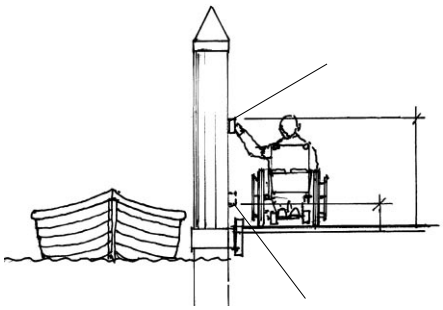
ACCESSIBLE FINGER PIERS

clearance extending the width of the slip. In facilities without finger piers, at least one accessible slip must be parallel to the pier and be a minimum of 60 inches wide (shown above).

Cleats and other boat securement devices at accessible slips do not have to comply with ADAAG reach range requirements. However, clear space must be provided at each securement device and each device must be located on an accessible route. This reach range exception does not apply to other controls and operating mechanisms such as hose bibbs, water supply hoses, outlets for electrical power, telephones, or cable TV.



FORWARD REACH RANGES



SIDE REACH RANGES

Boarding Piers at Boat Launch Ramps

A boarding pier (sometimes called a courtesy pier or a launch dock) is the part of a pier where a boat is temporarily moored for embarking and disembarking. A boat launch ramp is a sloped surface designed for launching and retrieving trailered boats and other watercraft to and

from a body of water. The provisions for boarding piers cover only those that are associated with boat launch ramps. Boarding piers that are not part of a boat launch ramp are classified as “boat slips” for purposes of these guidelines.

If boarding piers at boat launch ramps are provided, at least 5 percent but not less than one, must comply with these guidelines and be served by an accessible route. The exceptions for gangways, previously described above, may be applied to boarding piers (see pages 5–8).

In addition, gangways connecting floating boarding piers may exceed the maximum slope specified in the guidelines, if the total length of the gangway is at least 30 feet.

ADAAG ramp requirements do not apply to the portion of the accessible route serving a floating boarding pier or skid pier if it is located within a boat launch ramp. For example, a facility provides a chain of floats on a launch ramp to be used as an accessible boarding pier. At high water, the entire chain is floating and a transition plate connects the first float to the surface of the launch ramp. As the water level decreases, segments of the chain rest on the launch ramp surface, matching the slope of the launch ramp. An accessible route must serve the last float because it would function as the boarding pier at the lowest water level, before it possibly grounded out. Because the entire chain also functions as a boarding pier, it must comply with all ADAAG provisions, including the 60-inch minimum clear pier width provision.

Another facility provides a non-floating boarding pier that is supported by piles and divides a launch area into two launch ramps. An accessible route must connect the boarding pier with other accessible buildings, facilities, elements and spaces on the site. Although the boarding pier is located within a launch ramp, because the pier is *not* a floating pier or a skid pier, no exceptions apply. To comply with ADAAG, the accessible route could run down between the two launch ramps. Or, the fixed boarding pier could be relocated to the side of one of the launch ramps, which would allow the slope of the launch ramps to remain unchanged since the accessible route would run outside the launch ramps.

Boarding Pier Clearances

The entire length of accessible boarding piers must comply with the same technical provisions that apply to boat slips. There is no minimum length for the pier. However, the accessible boarding pier should be at least as long as other piers provided at the facility. If no other boarding pier is provided, it should be at least as long as what would have been provided if no access requirements applied. For example, at a launch ramp, if a 20-foot accessible boarding pier is provided, the entire 20 feet must comply with the pier clearance requirements. If a 60-foot accessible boarding pier is provided, the entire 60 feet must comply with the pier clearance requirements.

Launch Ramps Without Boarding Piers

There are no specific provisions that address access to launch ramps without boarding piers. The Department of Justice advises that if there are no applicable scoping requirements (i.e., how many features must be accessible), then a reasonable number, but at least one, must be accessible. It is recommended that an accessible route serve at least one launch ramp. The portion of the accessible route located within the launch ramp is not required to comply with the slope requirements for accessible routes.

More Information

You can obtain copies of the recreation facility guidelines, which include boating facilities, and further technical assistance from the U.S. Access Board at **www.access-board.gov**, **1-800-872-2253**, or **1-800-993-2822** (**TTY**).

Appendix 5

Photos of Boat Launching Site Designs from Various States

Parking Lots

Accessways/Pathways

Shore Protection

Before

After

Before

After

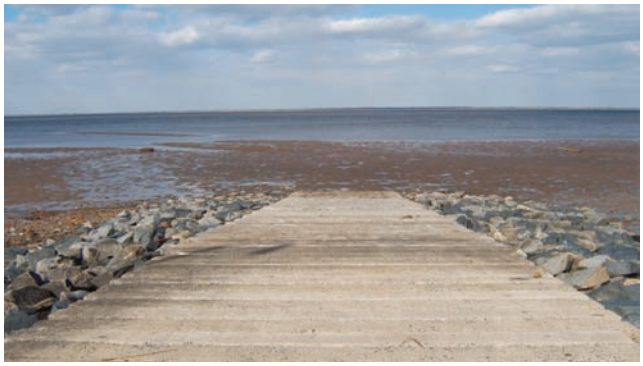
Shore Protection

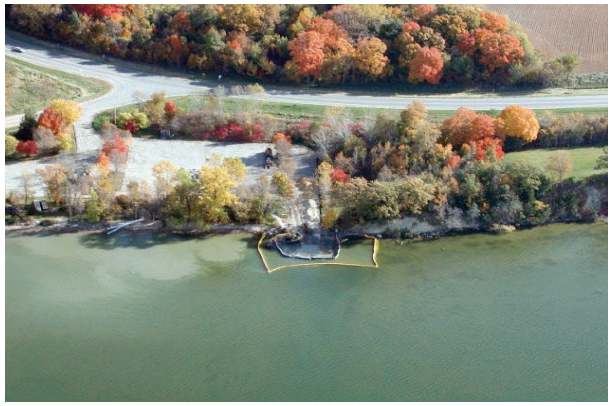
Restrooms

Ramps

Ramps

Ramps





Boarding Docks

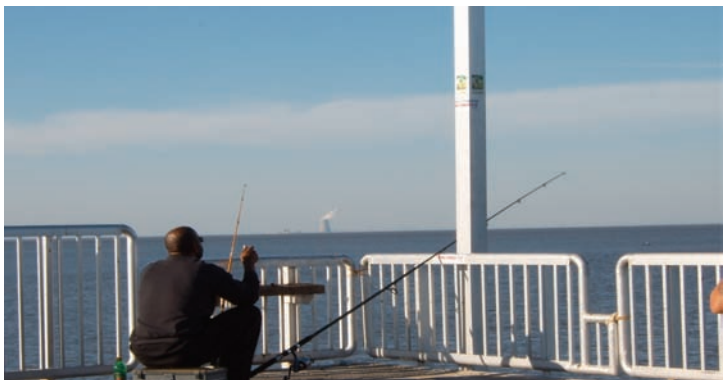
Boarding Docks

Materials

Gangways

Breakwaters/Jetties

Fishing Piers

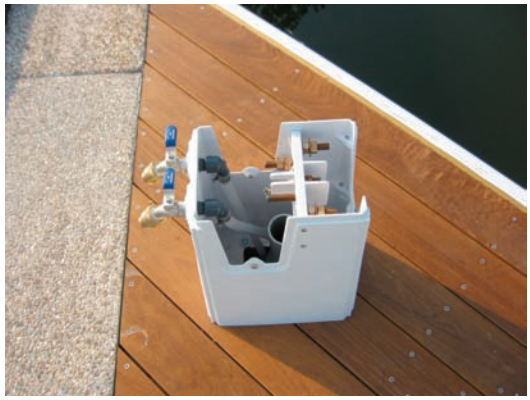


Marinas

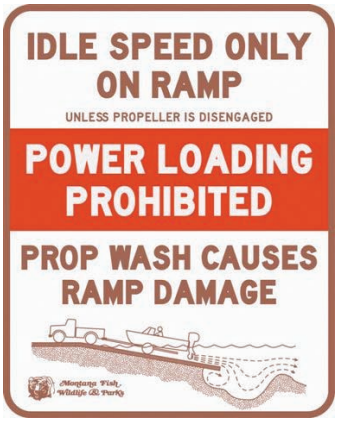
Anchoring

Fueling Stations

Utilities



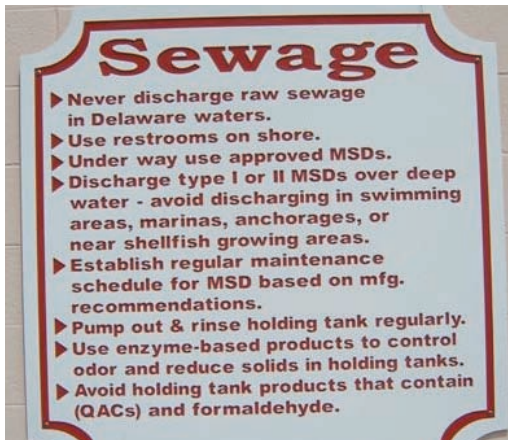
Signs

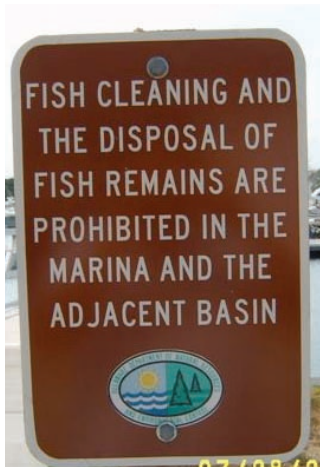

IDLE SPEED ONLY
ON RAMP
UNLESS PROPELLER IS DISENGAGED
POWER LOADING
PROHIBITED
PROP WASH CAUSES
RAMP DAMAGE


ATTENTION FISHERMAN
THE HARVEST OF AMERICAN AND
HICKORY SHAD IS PROHIBITED IN THE
NANTICOKE RIVER AND ITS
TRIBUTARIES
IMMEDIATELY RELEASE ALL
AMERICAN AND HICKORY SHAD
YOU CATCH
AMERICAN SHAD
THANK YOU FOR YOUR COOPERATION
DIVISION OF FISH AND WILDLIFE


PROHIBITED SHELLFISH AREA
DO NOT HARVEST
OYSTERS, CLAMS,
OR MUSSELS
SHELLFISH NOT FIT FOR HUMAN CONSUMPTION
PLEASE REFER TO THE
DELAWARE FISHING GUIDE
FOR DETAILS OR CALL
302 739 4590


DELAWARE SEASHORE STATE PARK
PARK OFFICE
INDIAN RIVER MARINA
MARINA IMPROVEMENTS UNDERWAY
ACCESS LIMITED


Sewage
Never discharge raw sewage in Delaware waters.
Use restrooms on shore.
Under way use approved MSDs.
Discharge type I or II MSDs over deep water - avoid discharging in swimming areas, marinas, anchorages, or near shellfish growing areas.
Establish regular maintenance schedule for MSD based on mfg. recommendations.
Pump out & rinse holding tank regularly.
Use enzyme-based products to control odor and reduce solids in holding tanks.
Avoid holding tank products that contain (QACs) and formaldehyde.


FISH CLEANING AND
THE DISPOSAL OF
FISH REMAINS ARE
PROHIBITED IN THE
MARINA AND THE
ADJACENT BASIN


NO SWIMMING, FISHING,
CRABBING OR PARKING
ON BOAT RAMP

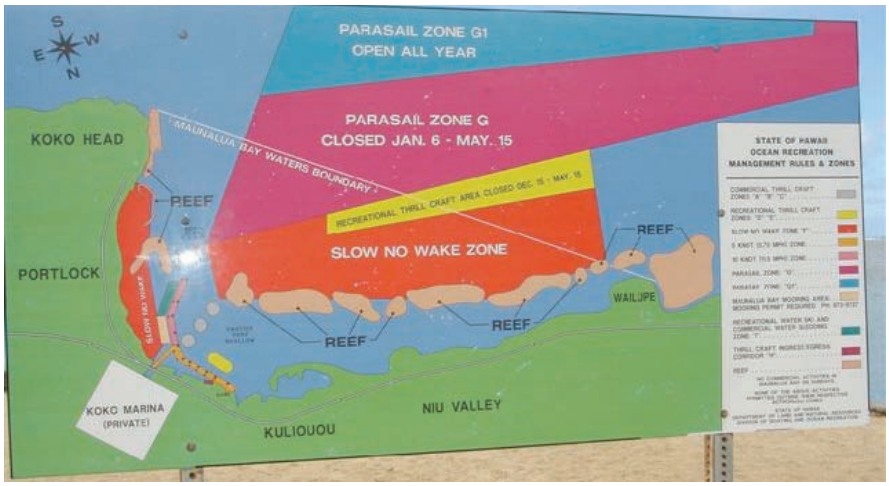

JOHN C. LAND, III
BOATING AND SPORTS FISHING FACILITY
LAKE MARION
CLARENDON COUNTY LEGISLATIVE DELEGATION
SC DEPARTMENT OF NATURAL RESOURCES
CLARENDON COUNTY COUNCIL
SANTEE COOPER
Santee
Cooper

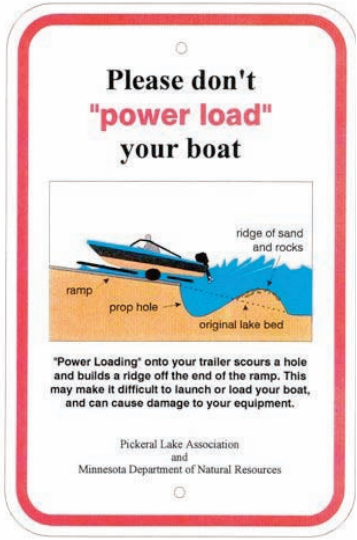

SLOW
NO WAKE
BY ORDER OF: S... D.N.R. & E.C.


CAUTION
RAMP WITH
GRADE 15%
AT LOW TIDE


MAKE
READY
AREA
18 MIN
PARKING
LIMIT

Signs


PARASAIL ZONE G1
OPEN ALL YEAR
PARASAIL ZONE G
CLOSED JAN. 6 - MAY. 15
SLOW NO WAKE ZONE
KOKO HEAD
PORTLOCK
REEF
WAILUPE
KOKO MARINA
(PRIVATE)
KULIOUOU
NIU VALLEY
STATE OF HAWAII
OCEAN RECREATION
MANAGEMENT RULES & ZONES


Please don't
"power load"
your boat
ridge of sand
and rocks
ramp
prop hole
original lake bed
"Power Loading" onto your trailer scours a hole and builds a ridge off the end of the ramp. This may make it difficult to launch or load your boat, and can cause damage to your equipment.
Pickeral Lake Association
and
Minnesota Department of Natural Resources


ASHTABULA PORT AUTHORITY
TRANSIENT
DOCK EXPANSION
This project was funded
in cooperation with
the Division of
Watercraft/
Waterways Safety Fund,
Ohio Department of Natural Resources


TIE DOWN
AREA
15 MIN
PARKING
LIMIT

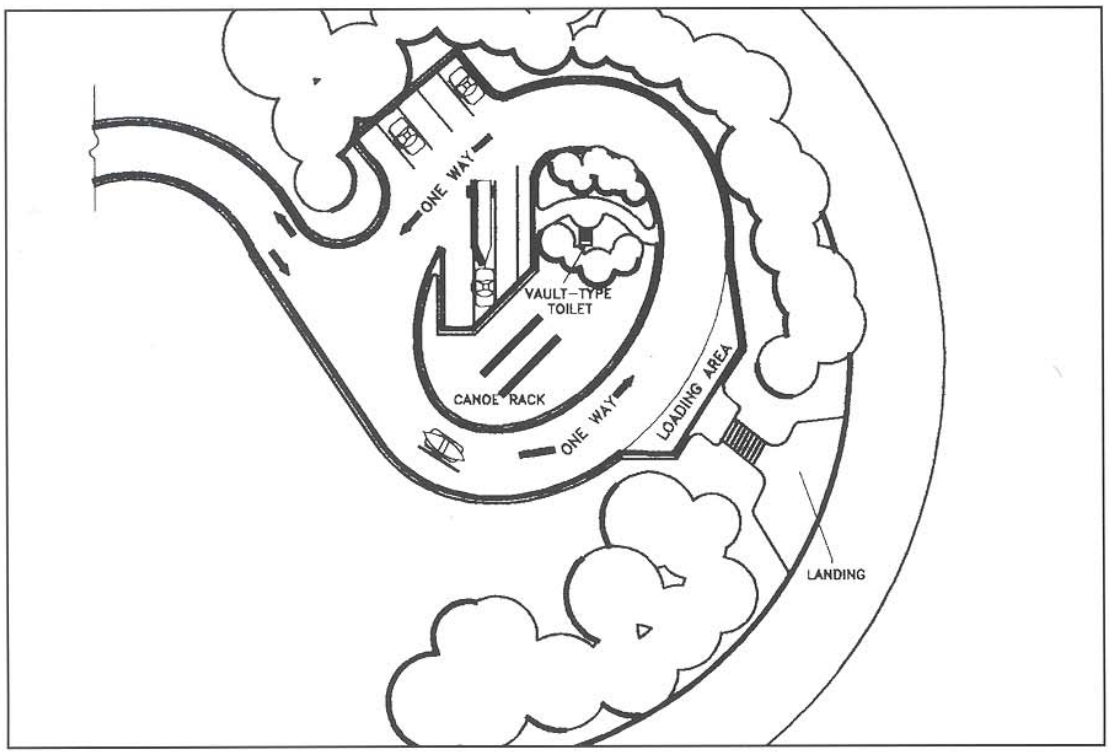

BUCKLE-UP
DNREC
Division of Fish and Wildlife
Office of Boating Education and Safety
Water Skiers, PWC Riders, and
12 and under, it's the Law!


THIS IS A
CARRY IN – CARRY OUT
BOATING ACCESS FACILITY
CARRY OUT
WHAT YOU CARRY IN
TRASH BARRELS ARE
NOT PROVIDED
PLEASE HELP KEEP
YOUR ACCESS AREA CLEAN

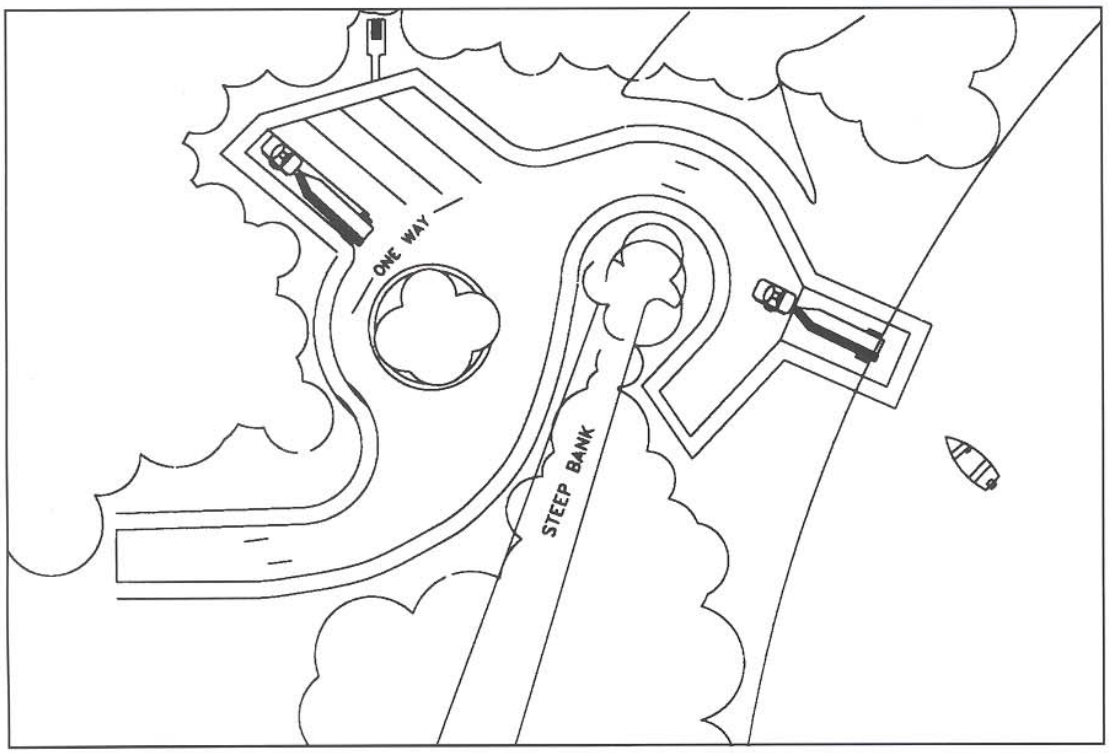

ALUM CREEK STATE PARK
HOME OF THE
Alum Creek Sailing Association
www.alumcreeksailing.com
OPEN TO ALL SAILORS AND
FUTURE SAILORS
Docks and Facility Privately Funded by the Alum Creek Sailors
ACSA

Appendix 6

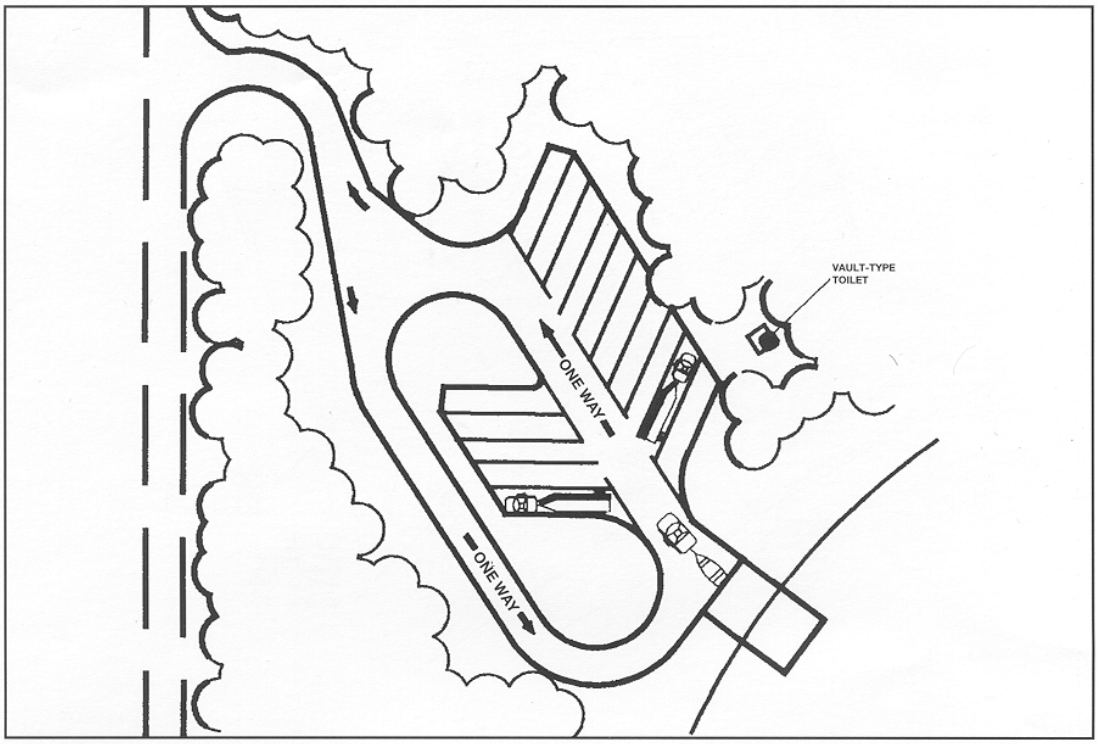
Examples of Boat Launching Site Designs from Various States



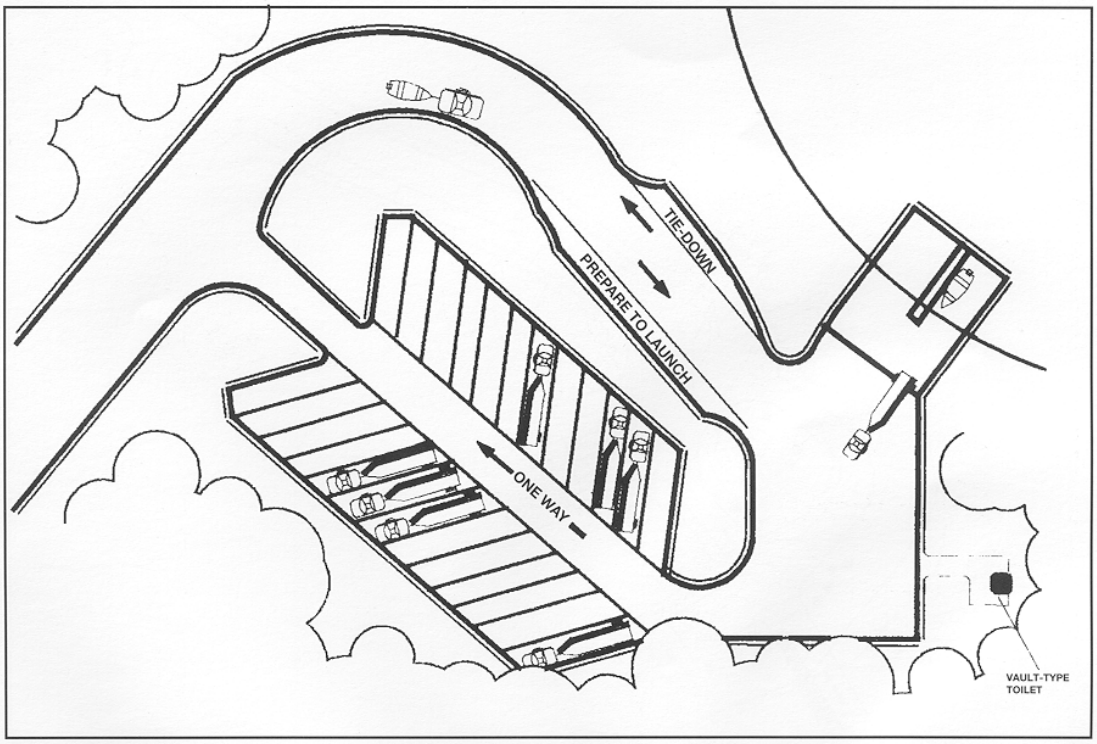
A design for a carry-down site for canoes and small boats. Recreation Division, Michigan Department of Natural Resources.



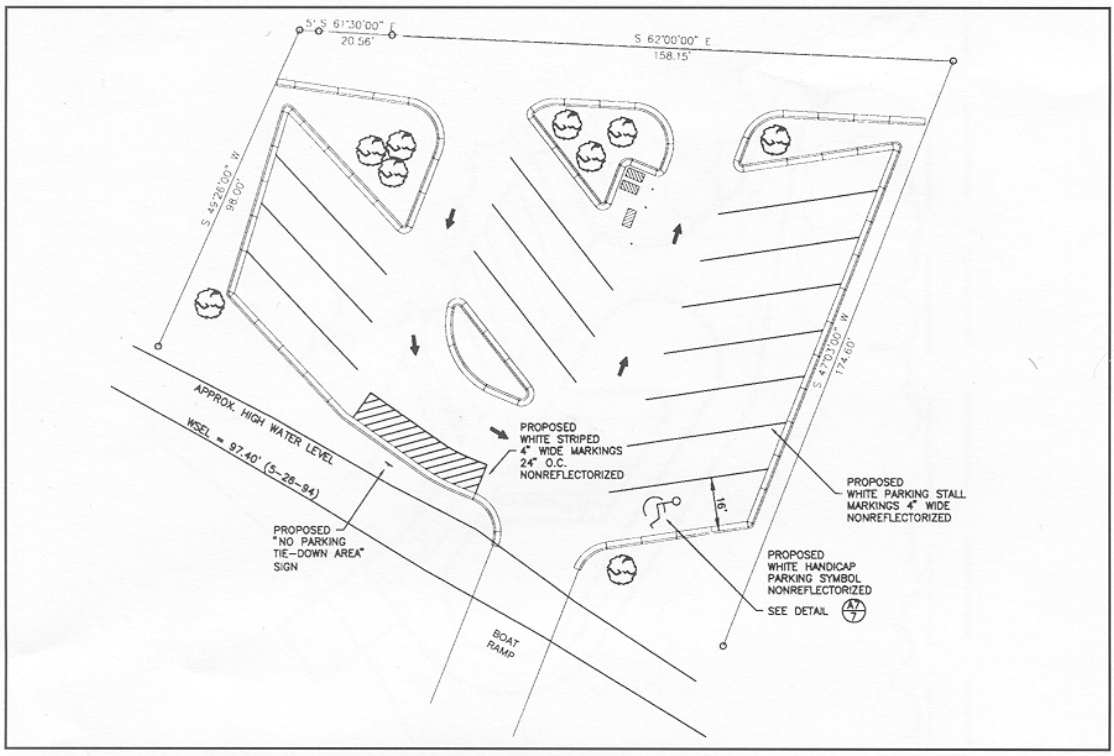
A riverbank site design. Recreation Division, Michigan Department of Natural Resources.



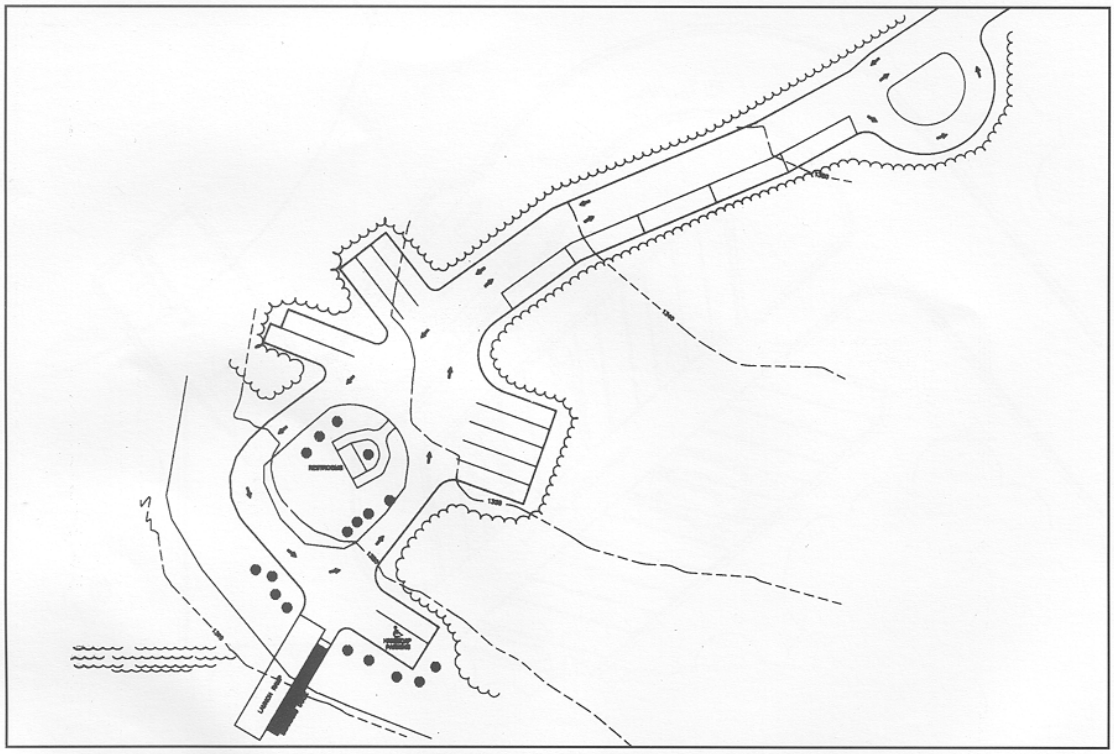
A design for a single ramp without a boarding dock. Recreation Division, Michigan Department of Natural Resources.



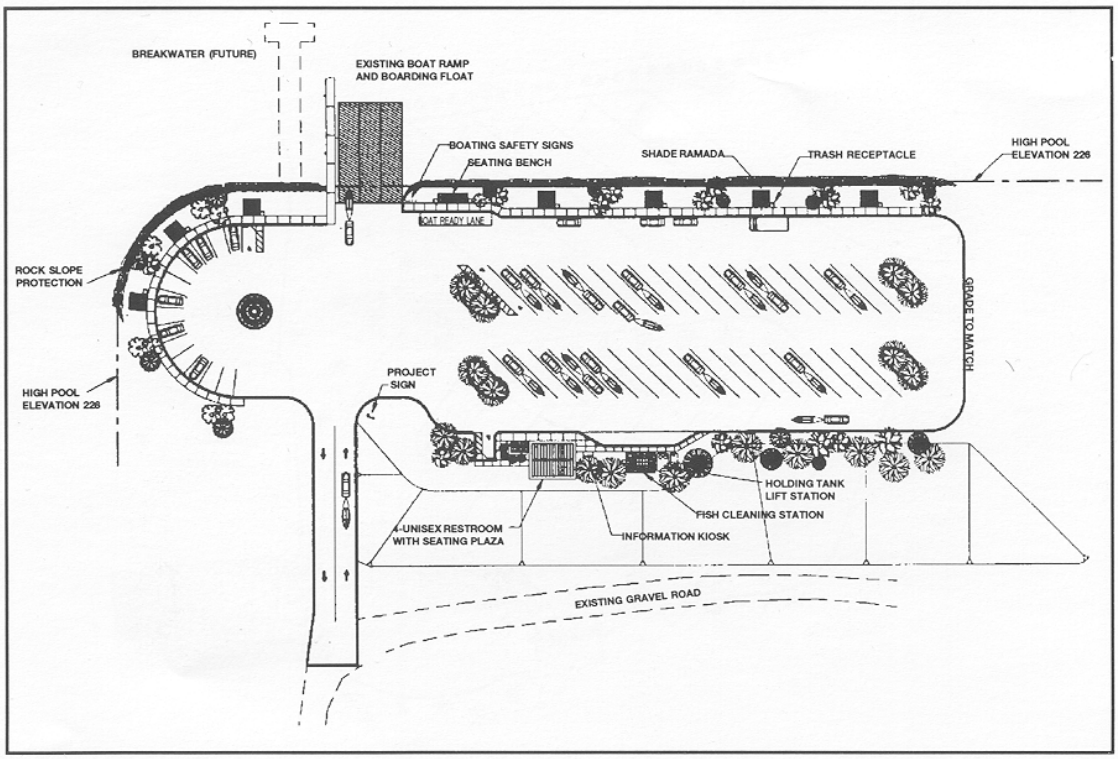
A design for a site with two launching ramps divided by a boarding dock. Recreation Division, Michigan Department of Natural Resources.



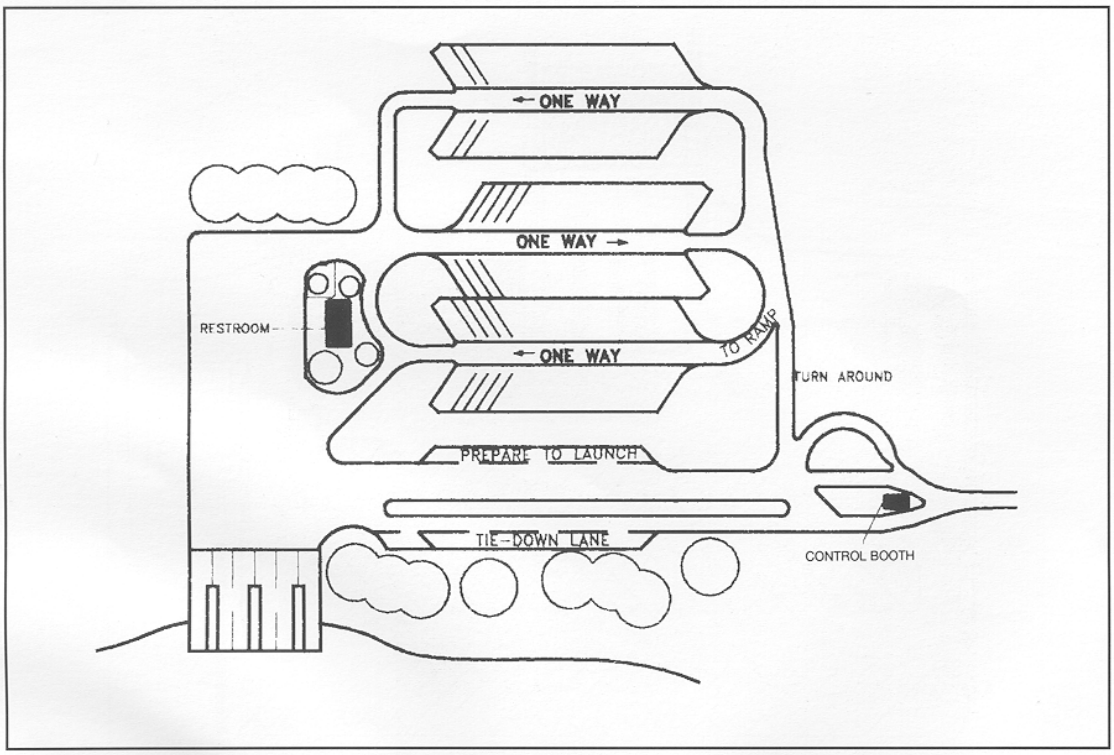
The Powers Lake facility, on a site that has a steep slope. Wisconsin Department of Natural Resources.



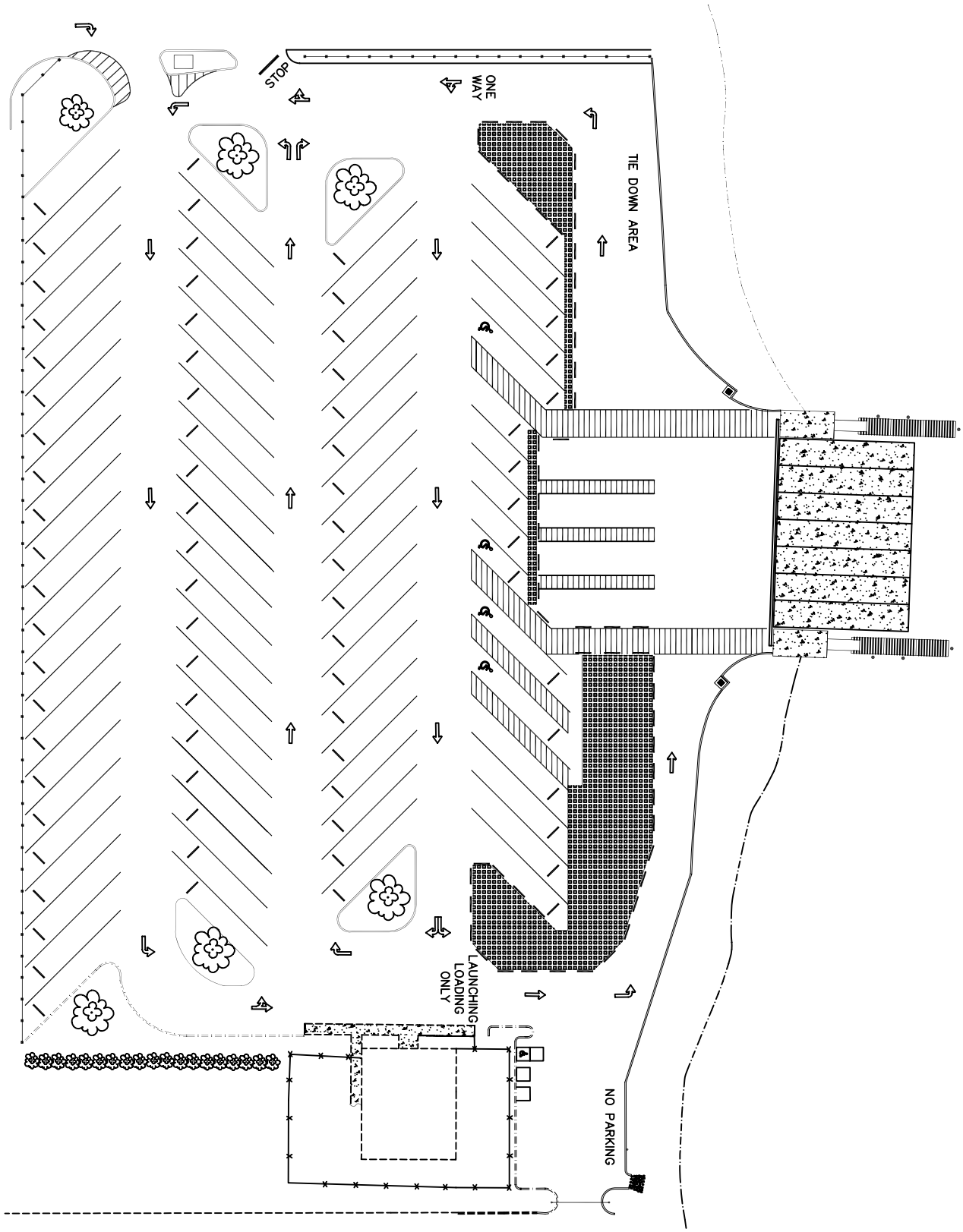
The Winter Dam site, a single-ramp facility with parking for 15 vehicle-trailer units. Wisconsin Department of Natural Resources.



The San Luis Reservoir site, which provides parking for 40 vehicle-trailer units and 16 cars. California Department of Boating and Waterways.



A design for a 6-ramp facility with parking for 105 vehicle-trailer units. Recreation Division, Michigan Department of Natural Resources.

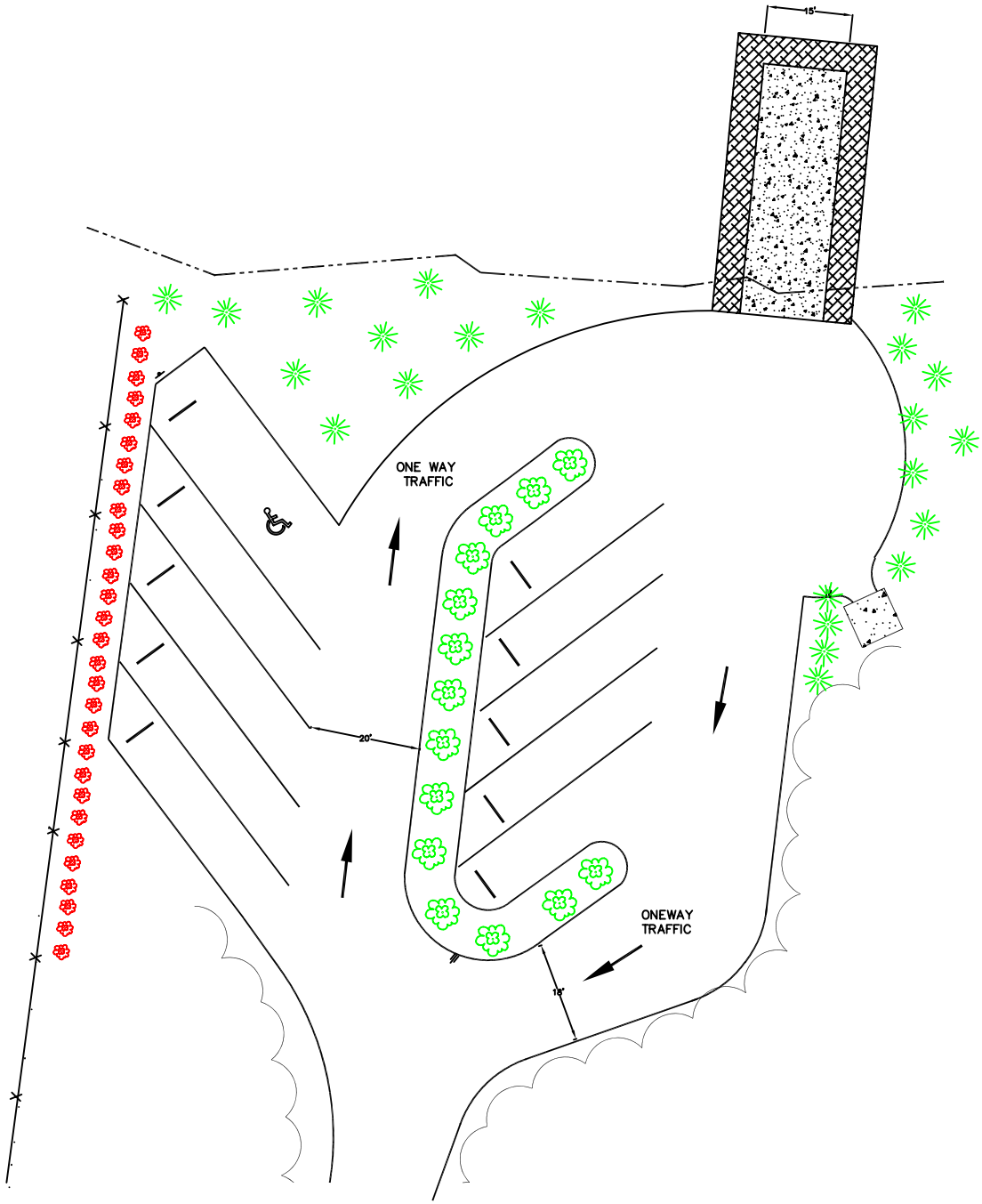


BOATING ACCESS AREA
SHORELINE FACILITY

NOT TO SCALE

SITE CAPACITY

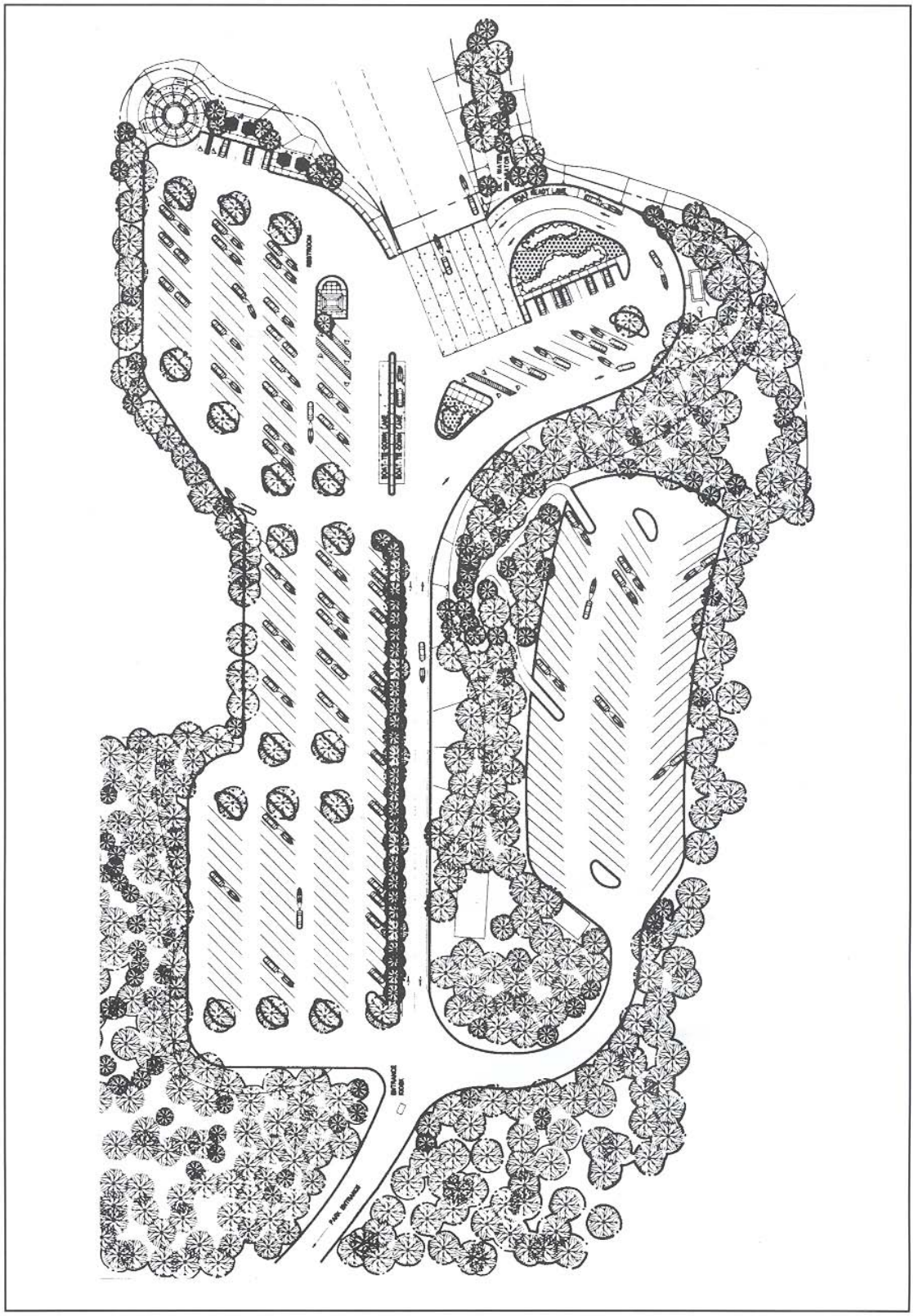
68 CAR/TRAILER UNITS
3 ACCESSIBLE CAR/TRAILER UNITS
1 ACCESSIBLE VAN UNIT
4 CAR UNITS



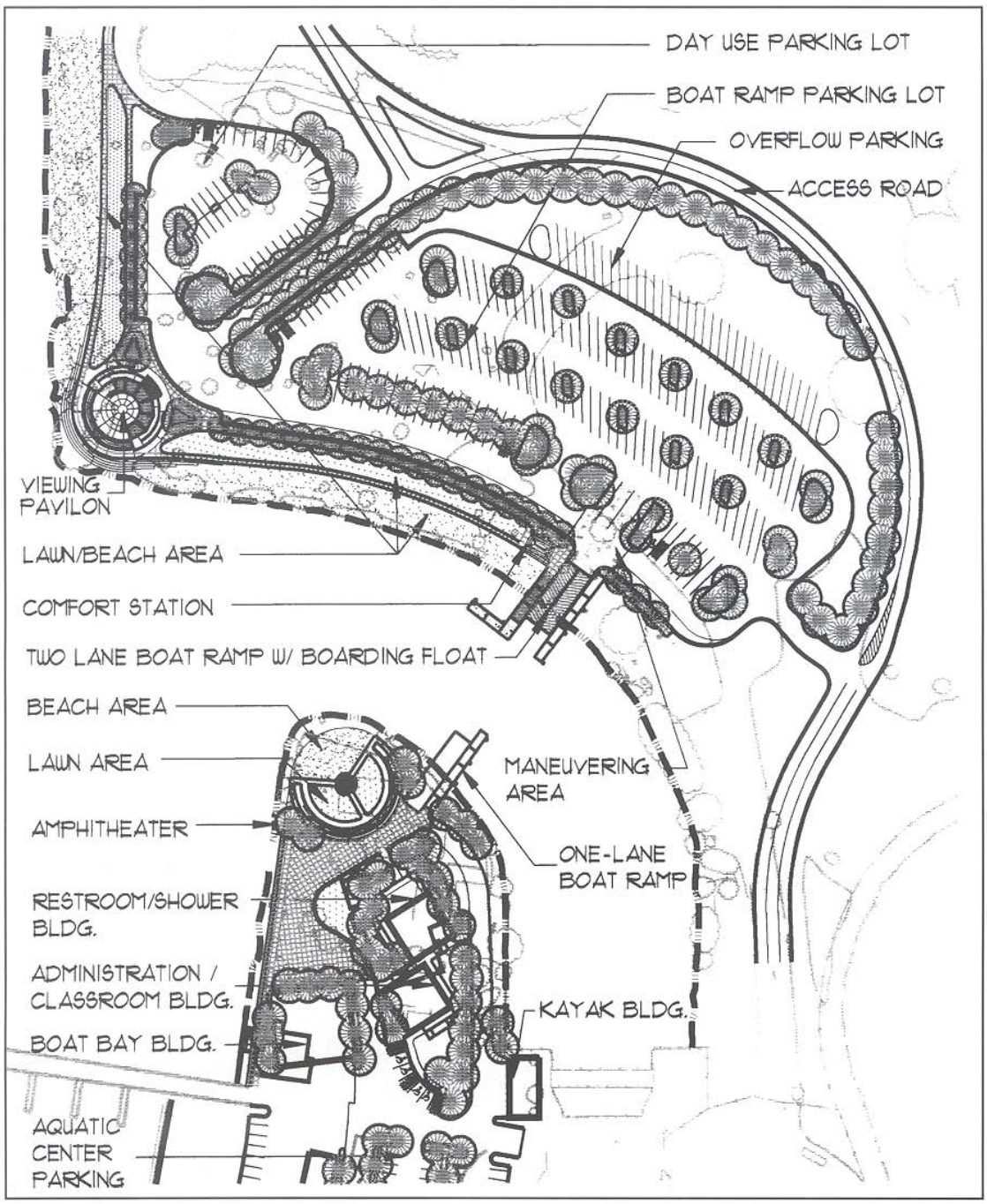
BOATING ACCESS AREA
INLAND FACILITY
NOT TO SCALE

SITE CAPACITY

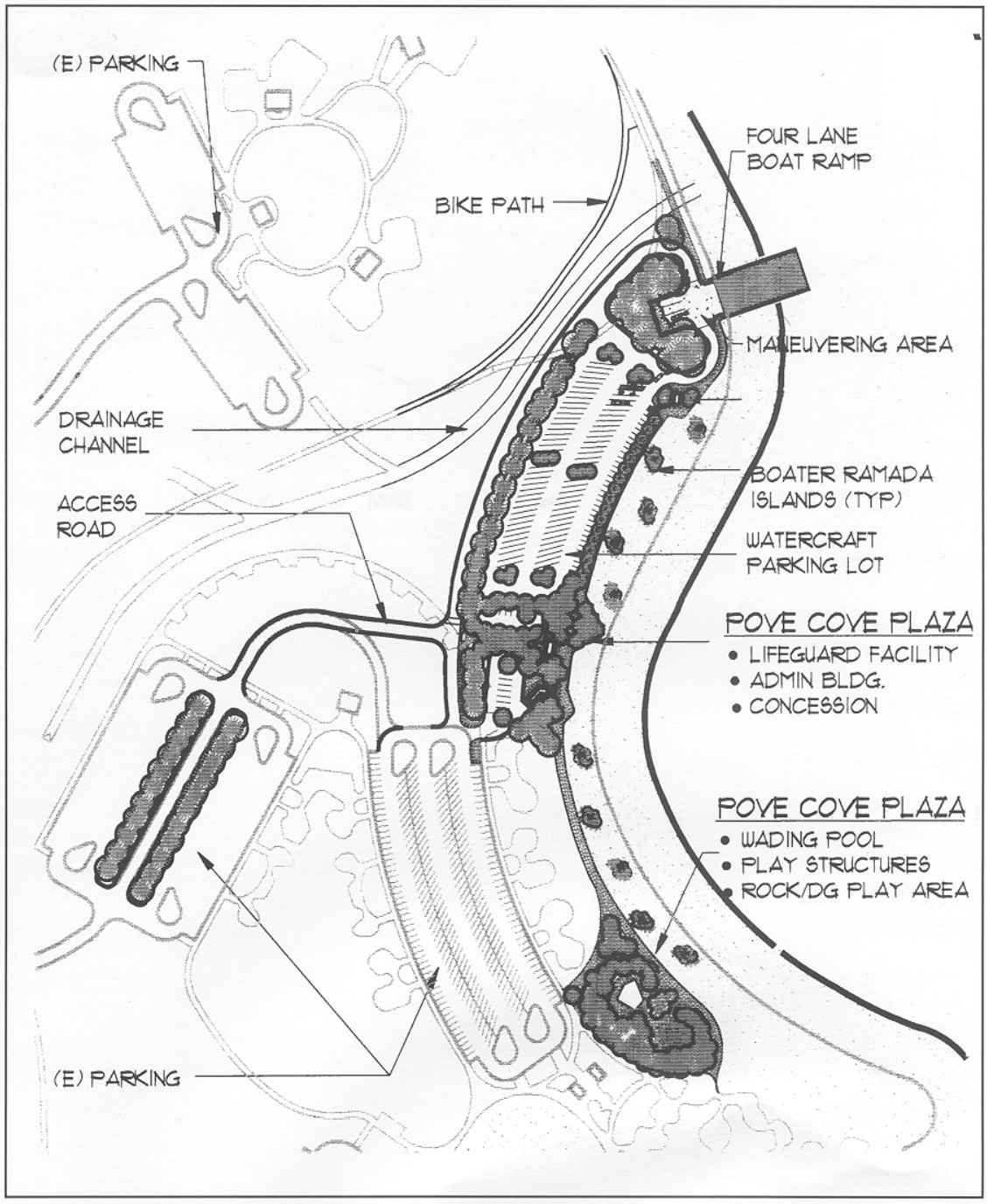
8 CAR/TRAILER UNITS
1 ACCESSIBLE VAN/TRAILER UNIT
1 CAR UNIT



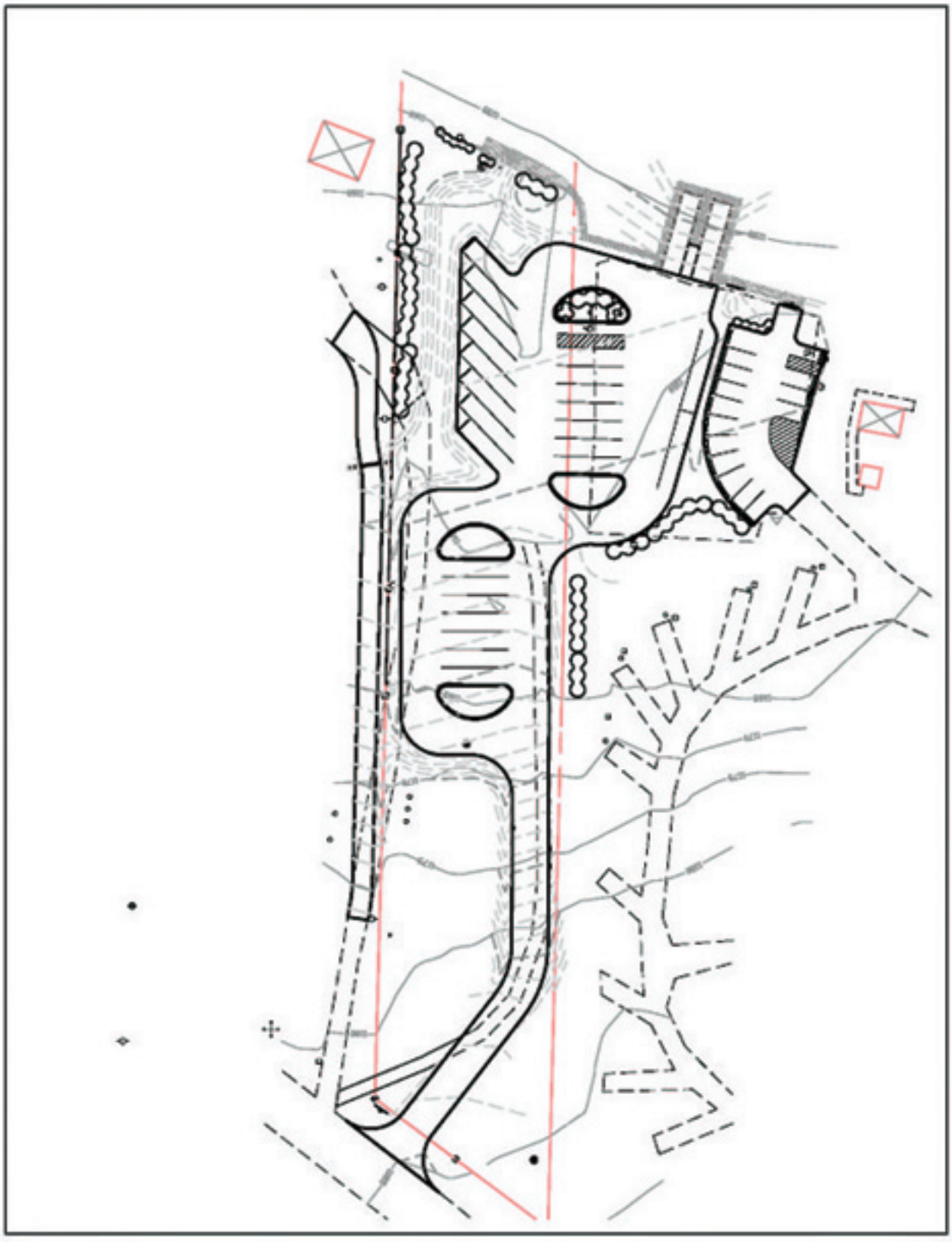
The Lime Saddle Boating Facility, on Lake Oroville. California Department of Boating and Waterways.



The Nimbus Point Boating Facility on Lake Natoma, which combines a boat launching facility with Sacramento State University's aquatic center for boating and safety education and training. California Department of Boating and Waterways.



The Power Cove Boating Facility, designed for personal watercraft, on Perris Lake. California Department of Boating and Waterways.



DEVELOPMENT PLAN
GREEN LAKE WATER ACCESS – CO. PARK #5

Figures/Photos