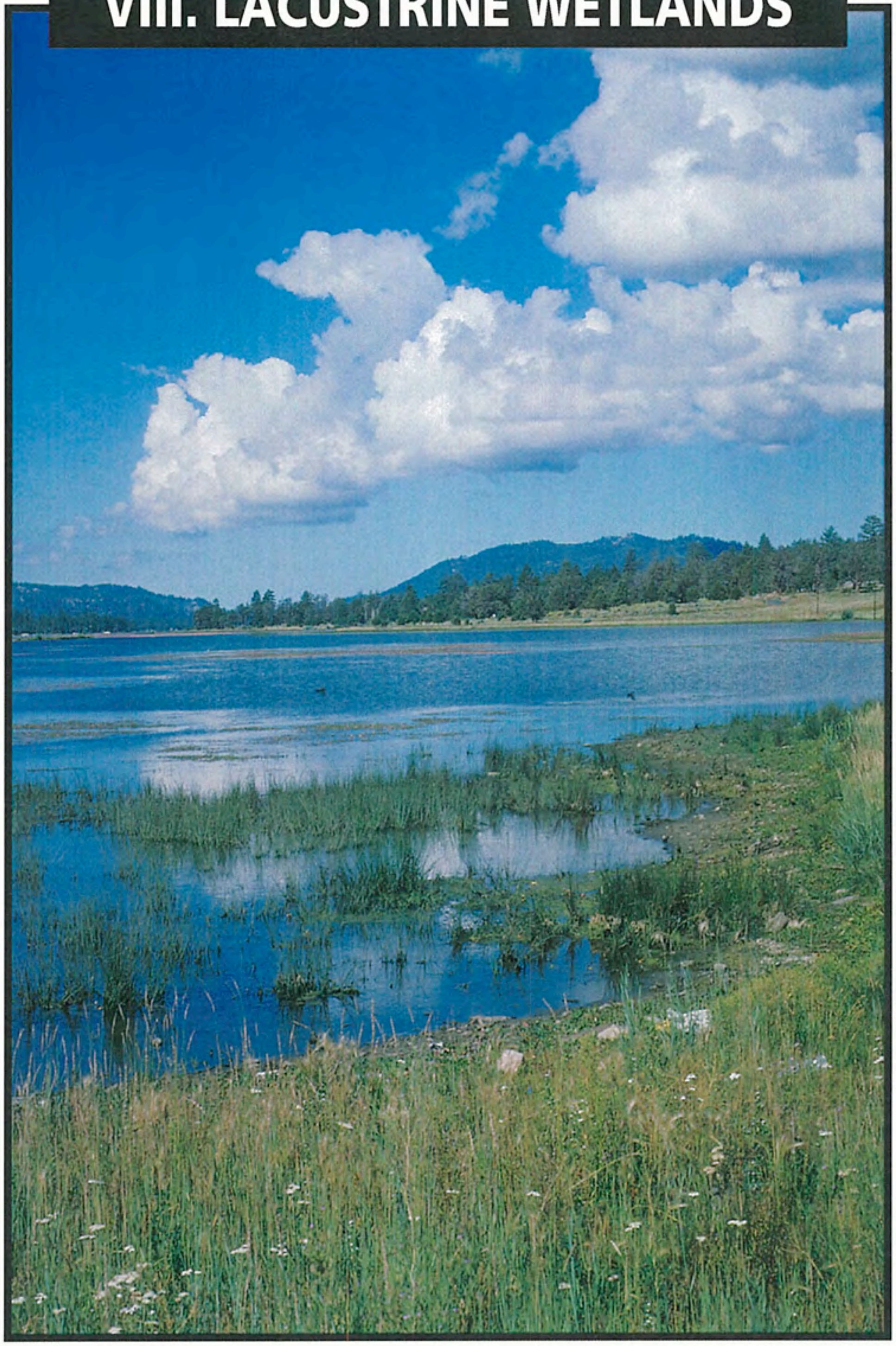
VIII. LACUSTRINE WETLANDS



California, San Bernardino County: Baldwin Lake

LACUSTRINE SYSTEM

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INTRODUCTION

The Lacustrine System as delimited by Cowardin et al. (1979) includes two subsystems: (1) Subsystem Limnetic, considered to be deepwater habitats and not covered by this study; and, (2) Subsystem Littoral, considered here to be wetland habitats. Cowardin et al. (1979:11) define this system as follows:

> *The Lacustrine System...includes wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depressions or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses, or lichens with greater than 30% areal coverage; and (3) total area exceeds 8 ha (20 acres). Similar wetland and deepwater habitats totaling less than 8 ha are also included in the Lacustrine System if an active wave formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth in the deepest part of the basin exceeds 2 m (6.6 feet) at low water. Lacustrine waters may be tidal or nontidal, but ocean- derived salinity is always less than 0.5 [ppt].*

Cowardin et al. also have provided a description of the limits of the Lacustrine System, including: (1) landward boundaries at upland habitats or wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens; and, (2) the approximate contour of the "normal" spillway or pool elevation in dammed river channels, except where palustrine wetlands extend lakeward into the lacustrine environment. The littoral or wetland habitats of the Lacustrine System extend from the shoreward boundary of the system to a depth of 2 meters (6.6 feet) below low water or to the maximum extent of nonpersistent emergents, if these grow at depths greater than 2 meters.

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The Lacustrine System as delimited by Cowardin et al. and adopted here includes the following six classes: Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Rocky Shore, Unconsolidated Shore, and Emergent Wetland (nonpersistent). A key to these classes and their subclasses has been provided in Section IV of this volume. Each of these classes occurs in the study region. A "Key to the Lacustrine Subsystems, Classes, and Subclasses" can be found at the end of this discussion on lakes and before the "Catalogue of the Lacustrine Wetlands."

Excluded from the Lacustrine System in this classification are nonvegetated or sparsely vegetated wetlands that exceed 8 ha in size, but do not have a wave-formed shore and do not exeed 2 m in depth. These wetlands we have included in the Palustrine System as "palustrine lakes." Thus we exclude many water bodies in the study region commonly referred to as "lakes", including dunes lakes (e.g., Oso Flaco Lake, San Luis Obispo Co.; Black Lake, San Luis Obispo Co.; McGrath Lake, Ventura Co.); glacial lakes (e.g., Dollar Lake, San Bernardino Co.); vernal lakes (e.g., Mirror Lake, Ventura Co., Lagunitas Lake, San Bernardino Co., Santa Rosa Lake, Riverside Co.); sag ponds (e.g., Lost Lake, San Bernardino Co.); and some montane meadows (e.g., Bluff Lake, San Bernardino Co.); and, small agricúltural impoundments.

Another regional classification of western lacustrine environments has been offered by Rabe and Chadde (1994) for wetland natural areas in Idaho and western Montana. These authors categorize lacustrine environments into **lentic** systems characterized by open standing water, and **lotic** systems, represented by flowing water. Lentic systems are further divided into aquatic and semiaquatic types. The lentic wetlands are distinguished further by their depth of standing water, which typically varies seasonally in the Northern Rocky Mountains. Thus according to Rabe and Chadde (1994), true aquatic systems represent water bodies with a water depth greater than 0.5 m, while those with a water depth less than 0.5 m are termed semiaquatic. The authors also point out that the seasonal variation in water levels may change the classification of a particular site over the year. In contracting the two systems of classification, Cowardin et al. (1979) uses water depth to differentiate between wetland sytems (lacustrine vs. palustrine), whereas Rabe and Chadde (1994) use water depth to distinguish among different types of water bodies with standing water.

In California, Thorne (1976) provided a broad classification of "lake, pond, and quiet stream" as well as "reservoir semiaquatic" plant communities. Lake, pond and quiet stream habitats are included together because of the similarity in vegetation, e.g., *Azolla filiculoides* Duckweed), *Marsilea vestita* var. *vestita*, and various species of *Polygonum* (Knotweed), *Potomogeton* (Pondweed), *Elatine* (Waterwort) and *Callitriche* (Water-starwort), among a variety of others. Further, reservoir communities are distinguished from those of lake/pond/quiet streams largely due to the limitations placed on plants by water level fluctuations (Thorne 1976). Common taxa in the reservoir communities include some of the same taxa as in former (e.g., *Callictriche* spp., *Elatine* spp.), but also more hardy species of *Verbena, Juncus*, and *Lythrum*. As discussed in Section III, Classification, Thorne's lacustrine categories are overly broad and as a result, neglect the differences among Cowardin et al.'s (1979) wetland systems, well as the individual richness of this wetland system in central and southern California.

LACUSTRINE WETLANDS

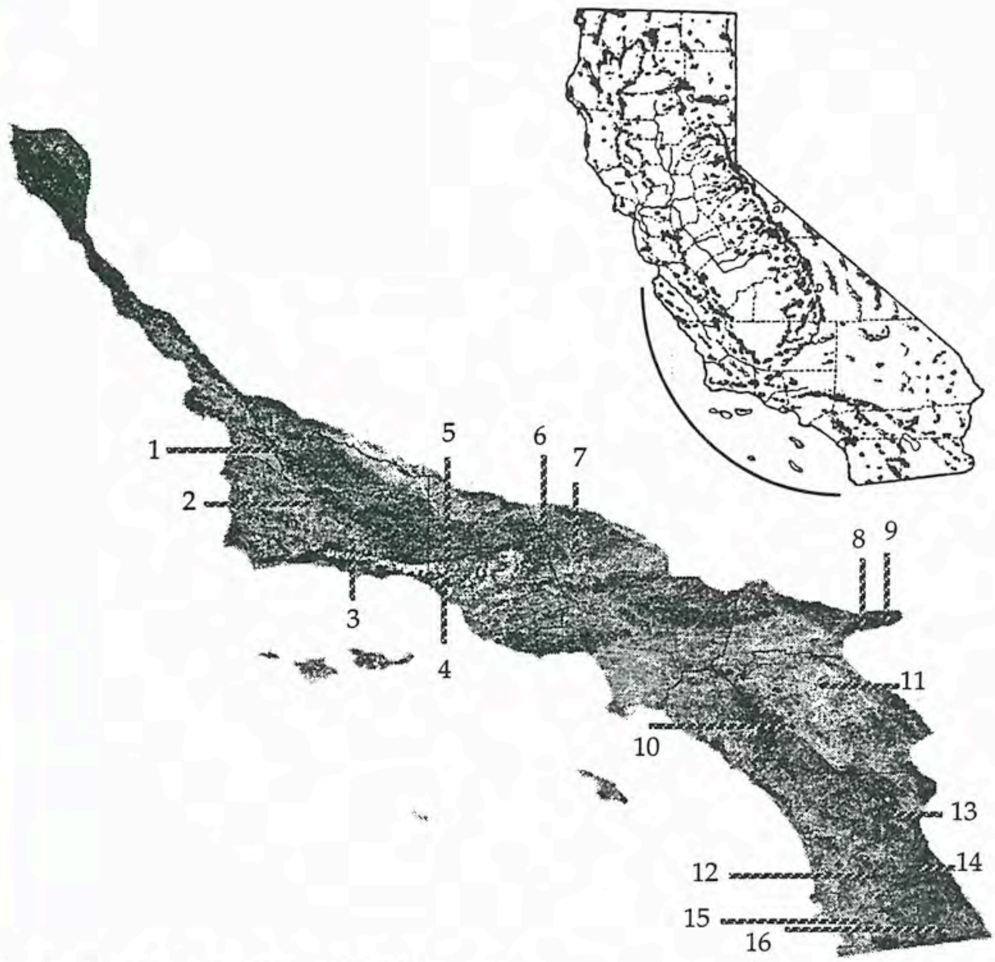
To have a greater appreciation for: (1) the richness of lacustrine types; (2) their numerous ecosystem functions and socio-economic values; (3) the extent of impacts to and losses of lacustrine wetlands; and, (4) the efforts to restore or create them, we believe it is necessary to review the classification of lacustrine environments. The many combinations of lacustrine wetland classes, subclasses, water regimes, water chemistry, and various hydrogeomorphic categories, series and units in a Mediteranean climate offer what may seem a limitless richness of wetland types.

Types of Lakes

We have identified two major types of lakes in this region -- i.e., natural lakes and artificial reservoirs. These distinguished further by their landform, topographic position, flooding regime, and water chemistry.

Natural Lakes. What is most striking about the lacustrine system in central and southern California is its natural rarity. Only four natural lacustrine lakes are found in the study area, while a vast number of artificial lacustrine habitats (i.e., reservoirs) have been created throughout central and southern California (Fig. VIII-1). Each natural lake represents a unique combination of geomorphic position, flooding regime, and water chemistry, and supports a different complement of dominance types.

Playa Lakes. Playa lakes are shallow, intermittent water bodies in arid regions that occupy a playa in the wet season but dry up in the summer (Bates and Jackson 1984). They are commonly thought of as "ephemeral" lakes, as they may be dry not only on a seasonal basis, but on a yearly or multi-year basis, depending on longer term rainfall patterns. Playas themselves are generally



San Luis Obispo Co. 1. Twitchell Reservoir.
Santa Barbara Co. 2. Zaca Lake, 3. Lake Cachuma.
Ventura Co. 4. Lake Casitas, 5. Matilija Lake.
Los Angeles Co. 6. Pyramid Lake, 7. Castaic Lake.
Riverside Co. 8. Lake Elsinor, 9. Mystic Lake.
San Bernardino Co. 10. Big Bear Lake, 11. Baldwin Lake.
San Diego Co. 12. San Vicente Lake, 13. El Capitan Lake, 14. Lake Henshaw, 15. Lake Cuyamaca, 16. Sweetwater Reservoir, 17. Lake Morena.

FIGURE VIII-1. **EXAMPLE WETLAND SITES IN THE LACUSTRINE SYSTEM IN THE CENTRAL AND SOUTHERN CALIFORNIA COAST AND COASTAL WATERSHEDS.** The lacustrine study region extends from the Carmel River watershed south to the Tijuana River watershed as bounded by the United States-Mexican border.

accepted as arid zone basins of greatly varying sizes and origins that, although found above the ground water table, are subject to ephemeral surface water inundation. Motts (1970) also suggests that playas can be considered to have four major defining characteristics: (1) occupation of a basin or topographic valley of interior drainage; (2) a smooth, barren, extremely flat surface with a low gradient; (3) rare inundation that occurs in low rainfall regions where evaporation exceeds precipitation; and, (4) circumference generally more than 2000 to 3000 ft (600 to 900 m) in diameter. Interestingly, the term, *playa*, is derived from Spanish, meaning shore or beach, in reference to the barren flat that forms the lowest portion of the enclosed basin (Motts 1970).

Mystic Lake (Fig VIII-2) is the only playa lake in the study region, as these water bodies are more typical of Transmontane California (i.e., Great Basin and Mojave and Sonoran Desert Provinces). In fact, it is the only playa lake in the Cismontane California Province. Mystic Lake is the remnant of the Pleistocene lake, San Jacinto Lake, and is properly considered a inundated structural basin. Because of a lack of drainage outlet, a characteristic of virtually all playa lakes, the water chemistry is alkaline.

Alkali Montane Lake. - Also basic in water chemistry are alkali montane lakes, which are generally defined as montane internally-drained water bodies. Baldwin Lake, San Bernardino Co. (Figure VIII-3), for example, is the only natural, intermittantly-flooded, alkaline lake in the study region.

Freshwater Montane Lake - Two types of natural, freshwater montane lakes are found in the study region; they are distinguished by their flooding regimes. Lake Cuyamaca, San Diego Co. (Fig VIII-5) is a natural, intermittantly flooded lacustrine ecosystem. The drainage outlet was dammed in recent years, resulting in the permanently flooded Cuyamaca Reservoir (see discussion on Artificial Reservoirs below). Unlike Lake Cuyamaca, however, Zaca Lake, Santa Barbara Co., is permanently-flooded. Zaca Lake is the only permanently-flooded natural lacustrine lake in southern California. It is a basinal waterbody formed by the natural damming of a mountain drainage. Approximately 6.9 ha and 17 m in depth, it is spring-fed and circumneutral.

Artificial Reservoirs. The term reservoir can be used to refer to any pond or lake, whether natural or artificial, from which water may be withdrawn for irrigation or water supply (Bates and Jackson 1984). Reservoirs in central and southern California, however, are not created

FIG. VIII-2. **RIVERSIDE CO., SAN JACINTO VALLEY, MYSTIC LAKE**. View eastward across Mystic Lake toward the San Jacinto Mountains. In the coastal watersheds of central and southern California, Mystic Lake is the only natural playa lake (elevation ca. 1200 ft). Such intermittently-flooded, alkali, lacustrine ecosystems occur more typically in the arid Mojave Desert (Transmontane California) than in the coastal watersheds (Cismontane California) with a predominantly Mediterranean climate.

FIG. VIII-3. **SAN BERNARDINO CO., SAN BERNARDINO MOUNTAINS, BALDWIN LAKE**. View northward across the central portion of Baldwin Lake. Although also natural, intermittently-flooded, and alkali in chemistry, Baldwin Lake is not in a structural valley like Mystic Lake, but is located in the San Bernardino Mountains. It occurs in a rain shadow on the eastern edge of the mountain crest (elevation ca. 6300 ft). As shown here, the waved-formed, unconsolidated shore appears as a ring during flooded conditions. During most of the time when Baldwin Lake is not flooded, the basin functions as a palustine alkali vernal marsh.

exclusively to supply municipal and domestic water, but for a great variety of recreational purposes as well (see Socio-economic Values, discussed below).

Reservoirs do not differ in flooding regime, i.e., they are all permanently flooded, but differ conspicuously in their geomorphic position. Thus in this classification, we recognize different kinds of artificial lacustrine reservoirs based upon whether the original geomorphic unit and water source is a river and river valley/floodplain, a stream in a canyon, or any of several water sources within a montane valley. However, drought and the dramatic yearly fluctuations in rainfall amounts characteristic of the study region, create a variety of lacustrine shore and bottom wetland types that endure flooding regimes varying from intermittently exposed, and semipermanently flooded to temporarily or intermittently flooded. Thus the variable and unpredictable nature of the water regime creates at dry times of the year or during drought, a "bathtub" ring affect, while in high rainfall years certain lacustrine wetland environments are short-lived.

<u>Dammed River Reservoirs</u>. All of the large rivers in the study region, with the exception of the Santa Margarita River, San Diego and Riverside Cos., have a series of large dams built to provide a variety of water-related benefits and resources. Significant among the differences between damming a river and a stream are the sediment loads that affect the created lacustrine environment. Typically rivers carry a much higher sediment load than streams, often limiting the storage capacity and life span of reservoirs. Examples of reservoirs created by the damming of rivers include Lake Henshaw on the San Luis Rey River; San Diego Co. (Fig. VIII-4); Lake Cachuma on the Santa Ynez River, Santa Barbara Co.; Like Piru on the Santa Clara River, Ventura Co.; and Lake Hodges on the Dieguito River. Several other examples of major impoundments can be found in Table VIII-1.

<u>Dammed Canyon Reservoirs</u>. - Dammed Canyon Reservoirs are distinguished by their typically steep-sided, deep lakes that are supply with only small amounts of sediment from the source stream to the created lake. Lake Casitas, Santa Barbara Co., for example, was formed by damming Coyote Creek, a tributary of the Ventura River, while San Clemente Reservoir is created from the damming of San Clemente Creek, a tributary of the Carmel River.

<u>Dammed Montane Valley Reservoirs</u>. - Dammed montane valleys typically create a great complex of lacustrine and associated palustrine wetland types, in large part because of the absence of the typically steep gradient formed by a canyon or river valley. As water levels fluctuate

FIG. VIII-4. **SAN DIEGO CO., SAN LUIS REY WATERSHED, LAKE HENSHAW**. View northward across the lake toward "Monkey Hill". In its present form, Lake Henshaw was created as a result of the damming of the San Luis Rey River. However, the extensive intermittently-flooded margins of the lake form habitats similar to natural intermittent lakes in other montane basins, such as the upper-portion of Lake Cuyamaca.

FIG. VIII-5. **SAN DIEGO CO., CUYAMACA MOUNTAINS, LAKE CUYAMACA**. View westward from a dam that separates the permanently-flooded, artificial Cuyamaca "Reservoir" from Lake Cuyamaca, a natural, intermittently-flooded, lacustrine ecosystem. Most lacustrine environments in the coastal watersheds of central and southern California have been created as a result of the damming of canyons, streams, or rivers. The creation of the Cuyamaca "Reservoir" impacted, but did not destroy, the natural functions and values of the lacustrine wetlands associated with Lake Cuyamaca.

Table VIII-1. **Selected Impoundments of Major Watersheds in Central and Southern California.**

Watershed	Impoundment
Monterey County	
San Clemente Creek	San Clemente Reservoir
Carmel River	Los Padres Reservoir
San Luis Obispo County	
Old Creek	Whale Rock Reservoir
Santa Barbara County	
Santa Maria River	Twitchell Reservoir, Guadalupe Lake
Santa Ynez River	Lake Cachuma, Gibraltar Reservoir, Jameson Lake
Ventura County	
Ventura River	Lake Casitas, Matilija Reservoir
Santa Clara River	Lake Piru
Los Angeles County	
Santa Clara River	Castaic Lake, Pyramid Lake
Santa Ana River	Santiago Reservoir, Peters Canyon Reservoir
Los Angeles River	Chatsworth Reservoir, Encino Reservoir
San Gabriel River	Morris Reservoir, San Gabriel Reservoir
Orange County	
Oso Creek	Upper Oso Reservoir
Riverside County	
San Jacinto River	Lake Elsinor, Canyon Lake, Lake Hemet, Lake Matthews (Temescal Wash)
San Diego County	
Santa Margarita River	Vail Reservoir, Fallbrook Reservoir, Delluz Reservoir, O'Neill Lake
San Luis Rey River	Lake Henshaw
San Marcos Creek	Lake San Marcos
Escondido Creek	Lake Wohlford
San Dieguito River	Sutherland Reservoir, Lake Hodges
San Diego River	Miramar Reservoir, Cuyamaca Reservoir, El Capitan Reservoir, San Vincente Reservoir, Murray Reservoir
Otay River	Lower Otay Reservoir, Upper Otay Reservoir
Sweetwater River	Lake Loveland, Sweetwater Reservoir, Morena Lake, Barrett Lake, Rodriques Reservoir

in this geomorphic setting, the lacustrine shore and bed wetlands in dammed montane valley reservoirs are exceptionally dynamic in water residence time and consequently species composition. Big Bear Lake, San Bernardino Co. (Fig. VIII-6), for example, supports an extensive mosaic of palustrine and riverine wetlands.

In addition to creating artificial lacustrine environments by the damming of rivers and streams, reservoirs are created by the damming of montane valleys and canyons. For example, Lake Casitas, Santa Barbara Co., was created by the damming of a tributary (Coyote Creek) of the Ventura River in a montane canyon (see Figs. VIII-21 and VIII-22). Such differences in geomorphic position are reflected primarily in water regime and chemistry, sedimentation rate, and associated flora and fauna.

Lacustrine Wetland Classes and Subclasses

Cowardin et al. recognizes six classes within the littoral subsystem, and within these, seventeen subclasses. We have accepted this classification at the class level, and have further identified several additional subclasses and subdivisions of existing subclasses (see Section III, Classification, and Section IV, Key, for further clarification of modifications to the Cowardin et al. classification system). Lacustrine classes and subclasses are discussed below and illustrated generally as they pertain to the Lacustrine System.

40.110 Rock Bottom Wetland. The Rock Bottom class includes Subclasses **Bedrock**, and **Rubble**, and pertains to the permanently flooded, intermittently exposed, and semipermanently flooded water regimes in the Lacustrine System. Subclasses Bedrock and Rubble are distinguished primarily in their amount of bedrock, with the former subclass including wetlands with bedrock covering 75% or more of the bottom. Subclass Rubble wetlands have less than 75% areal cover of bedrock, but stones and boulders alone, or in combination with bedrock, cover more than 75% of the surface. This class was not documented during the course of this study, but likely exists at natural lakes, such as Zaca Lake, and at artificial reservoirs such as Big Bear Lake.

40.120 Unconsolidated Bottom Wetland. For the Lacustrine System, the Class Unconsolidated Bottom includes wetlands and deepwater habitats with at least 25% cover of particles smaller than stones, and a vegetative cover less than 30% (Cowardin et al. 1979). Water regimes associated with this class include permanently flooded, intermittantly exposed, and semipermanently flooded. Unconsolidated materials smaller than stones can include **Cobble**

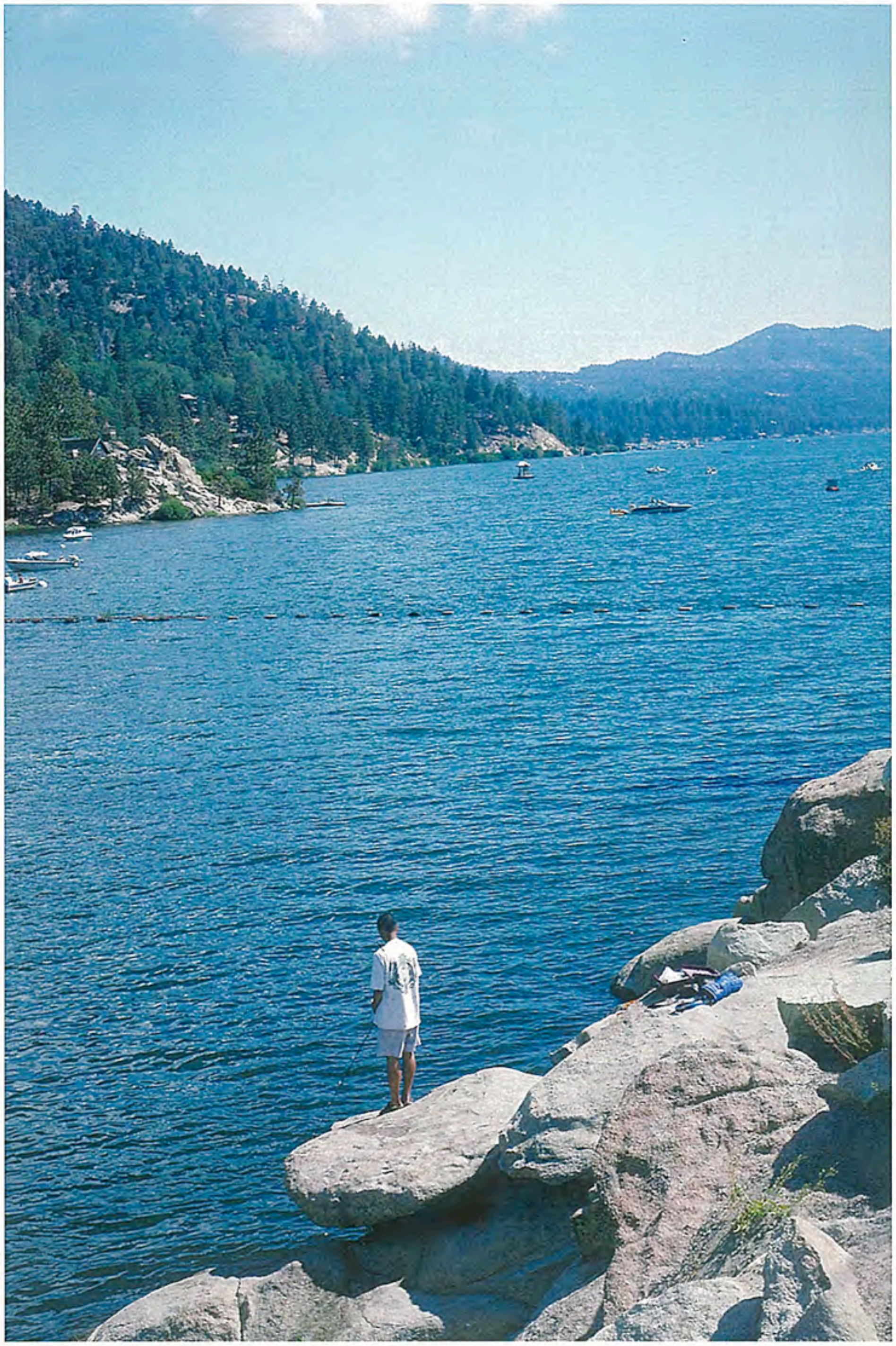


FIG. VIII-6. **SAN BERNARDINO CO., SAN BERNARDINO MOUNTAINS, BIG BEAR LAKE**. View eastward from vicinity of dam, along axis of this artificial lacustrine ecosystem. Big Bear Lake was created by the damming of a montane valley that supported an extensive mozaic of palustrine and riverine wetlands. Today it is known widely for its socio-economic values (e.g, recreation, water supply), but it also supports many types of lacustrine wetlands.

-**Gravel, Sand, Mud,** and **Organic** substrates, representing the subclasses. We have added the Subclass **Vegetated** to include intermittantly exposed, seasonally flooded, and intermittantly flooded lake and reservoir bottoms that can become colonized by annual vascular plants; these then represent the subclasses for this class. Littoral wetlands of the Class Unconsolidated Bottom are typical of lacustrine environments in the southern California coastal watersheds, and therefore are commonly found in both artifical and natural lakes. Examples of a Class Unconsolidated Bottom, Subclass Mud wetland are found at Cuyamaca Lake (Fig. VIII-7) and Baldwin Lake (Fig. VIII-8), while various combinations of vegetated and mud bottoms also were documented at Baldwin Lake.

40.140 Rocky Shore Wetland. The most obvious example of Subclass Rocky Shore within the lacustrine environment in the study region occurs at Big Bear Lake (Fig. VIII-6). Rocky Shore wetlands are defined by Cowardin et al. (1979) with the same percentages of rock and vegetation as in the Class Rock Bottom. Subclasses **Bedrock** and **Rubble** are distinguished primarily in their amount of exposed bedrock. Subclass bedrock includes wetlands with bedrock covering 75% or more of the surface, with less than 30% covered by the macrophytes. Subclass Rubble wetlands have less than 75% areal cover of bedrock, but stones and boulders alone, or in combination with bedrock, cover more than 75% of the shoreline. As in Subclass Bedrock, less than 30% of the shoreline is covered by the macrophytes. Rocky Shore wetlands in both the Riverine and Lacustrine Systems support typically sparse plant and/or animal communities, but are rich in invertebrate life in the Estuarine and Marine Systems.

40.150 Unconsolidated Shore Wetland. Unconsolidated shore wetlands are characteristic of the Lacustrine System with unconsolidated bottom wetlands, and typically lack conspicuous vegetation except during times when the substrate is stable enough to allow seedling establishment. Subclasses in this class include **Cobble-gravel, Sand, Mud, Organic,** and **Vegetated**, as in the Class Unconsolidated Bottom. Examples of lacustrine-littoral unconsolidated shore include the alkaline, intermittantly flooded, sandy shore at Baldwin Lake (Fig. VIII-11), the intermittantly flooded, vegetated shores of Lake Cuyamaca (Fig. VIII-15), and at various reservoirs such as Lake Henshaw (Fig. VIII-16).

40.210 Aquatic Bed Wetland. As discussed in Section VI, Estuarine System, we have expanded the Class Aquatic Bed Wetland to include five subclasses: **Attached Algal, Floating Algal, Aquatic Moss, Rooted Vascular, Floating Vascular**. As might be expected, many water regimes can support aquatic bed wetlands, and these are reflected generally in the five subclasses. Algal beds are more conspicuous and more diverse in other systems (e.g., Marine, Estuarine), but algal beds, particularly represented by the stoneworts (*Chara, Nitella*, etc.) are also found in lacustrine wetlands. In our study area, aquatic bed wetlands are found in both the created and natural lakes. For example, at Lake Casitas (Fig. VIII-17) *Echinodorus berteroi* (Burhead) commonly dominates the rooted-vascular aquatic beds, while *Potomogeton pectinatus* (Pondweed), *Ruppia cirrhosa* (Spiral Ditch-Grass), and *Zannichellia palustris* (Horned Pondweed) are the conspicuous members of the rooted-vascular aquatic bed at Baldwin Lake (Fig. VIII-18).

40.240 Emergent Wetland. Without a formal definition, Cowardin et al. describe the Class Emergent Wetland as one: "characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens" [Cowardin et al. 1979:21]. Although Cowardin et al. suggest that all but the subtidal and irregularly exposed water regimes can be associated with this class, and that emergent wetlands typically are dominated by perennial plants, this is not necessarily the case in the study region. Two subclasses, **Persistent** and **Nonpersistent**, are distinguished by the longevity of the above-ground biomass. Persistent Emergent wetlands are characterized by plants that remain standing greater than one growing season, whereas Nonpersistent Emergent wetlands are characterized either by annual plants, or by perennials that disappear aboveground after each growing season. Various species of *Polygonum* (Knotweed), *Echinodorus*, and *Potomogeton* are commonly found in this type of emergent wetland. Lacustrine-littoral Nonpersistent Emergent Wetlands with *Polygonum emersum* var. *emersum* can be found at Big Bear Lake (Fig. VIII-19, VIII-20), and with *Polygonum emersum* var. *stipulaceum* at Lake Cuyamaca (Fig. VIII-23, VIII-24). Both Lacustrine-Littoral Semipermanently-Flooded Nonpersistent Emergent Wetlands (Fig. VIII-21) and Seasonally-Flooded Nonpersistent Emergent Wetlands (Fig. VIII-22) dominated by *Echinodorus berteroi* can be found at the artificial reservoir, Lake Casitas, on the Ventura River.

Lacustrine Wetland Hydrogeomorphic Units

Lake Water Bodies (HGM Category .150). Lakes are generally defined as any inland body of standing water that is larger and deeper than a pond. The term is often used rather generally, referring to any extensive body of water, including any portion of a river, a lake basin, or a reservoir. A **reservoir** has been defined as any pond or lake, either natural or artificial, from which water may be used as a permanent water source or drawn for irrigation (Bates and Jackson 1984). Therefore, reservoirs may be found in both the lacustrine and palustrine wetland systems. Lacustrine reservoirs are more common than natural lakes in central and southern California, and include, among others, Lake Henshaw (Fig. VIII-5), Big Bear Lake (Fig. VIII-6), and Lake Elsinore.

Lacustrine Channels (HGM Category .270). Lacustrine **channels** are open conduits that carry moving water within the lacustrine environment. Lacustrine channels can be either formerly flooded stream channels that are now part of a larger, still water body, or naturally-formed channels that arise through the processes of limnetic water emergence and flow. Lacustrine channels can be found under a great variety of flooding regimes, from permanently to intermittently flooded. During extended periods of drought, lacustrine channels can be observed in the semipermanently flooded delta of the Santa Ynez River as it enters the reservoir Lake Cachuma.

Lake Shores, Beaches, and Margins (HGM Category .330). A lake **shore** is best considered to be the narrow strip of land bordering a lake (Figs. VIII-11, VIII-12, VIII-13, VIII-14, VIII-15, VIII-16) , whereas a lake **beach** differs in that it is a sloping land form that is generated by the waves and currents of a lake. Lake shores are ubiquitous geomorphic units in the Lacustrine System, and beaches, although less common, also are regularly found throughout the study region.

Lake Beds, Bottoms and Bars (HGM Category .440). Lake **beds** and **bottoms** generally are used equivalently through this classification, but are separate terms because of the Cowardin et al. (1979) Class "Unconsolidated Bottom" (not "unconsolidated 'bottom'") in the Lacustrine System (e.g., Figs. VIII-7, VIII-8, VIII-9, VIII-10). Riverine "beds" are analogous to lake "bottoms." Both bed and bottoms can be thought of as the inundated, permanently flooded substrate of the lacustrine environment. They typically accumulate the sediment and organic debris from dead and dying organisms. **Bars** in the lacustrine environment can be thought of as any bar formed by waves and currents -- i.e., a long, narrow landform, typically running parallel to the shoreline, with water on both sides of the bar -- in a lake. No lacustrine bars were documented during the course of the study.

Lake Deltas (HGM Category .534). Deltaic systems associated with the Lacutrine System are represented by a nearly flat alluvial tract of land at the mouth of a river (Bates and Jackson 1984). Typically deltas are formed from the accumulation of sediment supplied by an associated river, and therefore are characteristic of dammed rivers that drop their sediment load as the river slows and backs up to form a lake. For example, this geomorphic formation can be seen, for example, in Matilija Creek as it enters Matilija Reservoir, in the Santa Ynez River as it enters Lake Cachuma, in the San Jacinto River as it enters Lake Elsinor, and in the San Dieguito River as it enters Lake Hodges, San Diego Co.

Lake Seeps and Springs (HGM Category .719). Seeps and springs are places where water oozes or flows from the earth, and in a lacustrine environment, most are submerged and not obvious unless they are part of the shoreline environment, and then belonging to the Palustrine System. Lacustrine seeps are the main water source for Zaca Lake in Santa Barbara County.

Artificial Structures (HGM Category .900). Virtually all of the artificial structures in lacustrine enviroments are associated with recreational uses, e.g., boat ramps, docks, bouys, weckage, etc., and are particularly conspicuous in reservoirs constructed for recreational purposes, e.g, Lake Casitas, Lake Hodges, Lake Henshaw, etc. These have been described in some detail in Section V, Marine System, and further explanation can be found in the Glossary.

Ecosystem Functions and Socio-Economic Values

The classification of lacustrine wetlands must also include a consideration of the various ecosystem functions and socio-economic values that may distinguish one type of lacustrine wetland from another. We present a brief overview of some of the categories of ecosystem functions and socio-economic values to consider when evaluating a lacustrine wetland for classification.

Ecosystem Functions. Ecosystem functions in the Lacustrine System are processes that are necessary for the self-maintenance of various lacustrine ecosystems (adapted from L. C. Lee & Associates 1993). Different lacustrine ecosystems that may occur on similar hydrogeomorphic units and that may be dominated by the same or related species may have different ecosystem functions (e.g., endangered species habitat) because of the latitude or altitude at which they occur, and thus are considered herein to be different wetland types because of their different functions. In our classification, function must be considered when evaluating a wetland type. We also include maintenance of habitat for particular ecosytem-dependent organisms and for the preservation of the richness of habitats and landforms. In the Lacustrine System, many of the functions are associated in the context of the functions of other wetland systems to which they are adjacent. We have arranged a brief discussion ecosystem functions as proposed by Sather and Smith (1984).

Foodchain Support and Nutrient Cycling. "The food chain support function of wetland is the direct or indirect use of nutrient sources derived from wetlands by heterotrophic organisms (i.e., those that do not produce their own food]" (Sather and Smith 1984:21). Alternatively, Zedler et al. (1990:3) proposed the definition, "...the production of organic matter and its direct or indirect use, in any form, by organisms inhabiting, or associated with, wetland ecosystems." Sather and Smith list and discuss 68 wetland characteristics that are important to food chains; a sampling of these and others relevant to the Lacustrine System are basin morphology, bottom temperature, water depth, watershed runoff characteristics, elevation, exposure, artificial water level fluctuations, land cover of watershed, vegetation form, substrate, salinity and conductivity, and pH. There are many others.

Differences in the complexity of food chain support and in the types of consumers (e.g., migratory waterfowl, fishes, amphibians, reptiles, aquatic insects, molluscs, etc.) also can contribute to the differentiation between types of wetlands that might otherwise have similar hydrogeomorphic units and vegetation physiognomy. These food chain differences also become important when natural wetland types are identified for use as reference sites for comparison against restored or created types for the purpose of assessing the issue of ecosystem success at the artificial sites. Our classification expands the system, class, and subclass hierarchy to include: (1) water regime and chemistry types; (2) categories, series, and units of hydrogeomorphic types (i.e., "habitats"); and, (3) substrate, dominance, or characteristic types to help distinguish wetland types and address the subtle physical and biological differences that might reflect differences in food chain support and other ecosystem functions. The extent or degree of the particular ecosystem function, however, is not necessarily a measure of importance. In California's often small and isolated wetlands, it is the special conditions of food chain support that may make this ecosystem function vital to consumers dependent on a particular wetland type. Identification of wetland types is important to the identification of specialized food chains.

Habitat. Lacustrine wetlands provide habitat function for many groups of organisms or communities of organisms that have been documented or summarized by other researchers (e.g., Barbour and Major 1977). Lakes as habitat for fisheries has been fairly well documented (e.g., Onuf et al. 1978). Migratory water fowl and resident water-dependent birds are also considered typical of, and dependent on, lacustrine environments. For example, at least 55 species of loons, grebes, cormorants, geese, ducks, rails, coots, plovers, avocets, gulls, terns, and kingfishers, as well as rare, threatened or endangered birds (e.g., brown pelican, bald eagle, golden eagle) all utilize the lacustrine wetlands of Lake Cuyamaca and its contiguous reservoir.

Hydrology and Water Quality. The single hydrologic function attibuted to the littoral zone of lacustrine systems is shoreline stabilization (Army Corps of Engineers 1973, Collins 1985). However, shoreline stabilization is accomplished largely by mature, persistent vegetation. This shoreline feature is most effective for substrate stabilization in shallower lacustrine systems that are not subject to large fluctations in water levels or large storm events (Collins 1985). In central and southern California, most lacustrine habitats are created for irrigation, flood control, recreation, and electrical power generation. Only irrigation and flood control can properly be considered hydrologic functions in both natural and created lacustrine systems. Construction and operation of reservoirs, however, often results in steep, erodable surfaces that support a sparse vegetation cover unable to stabilize the shores.

Socio-economic Values. Socio-economic values are society's perception of the worth of the lacustrine ecosystem, typically stemming from whether the system provides a form of benefit or pleasure (adapted from L. C. Lee & Associates 1993). Most of the value derived from the various ecosystem functions that characterize a particular wetland in the Lacustrine System (e.g., fishing for large-mouth bass) is derived from the ability of the lake to provide those ecological functions (e.g., deepwater habitat for adult fishes foraging, littoral habitat for nursery areas).

Consumptive Values. Consumptive values of the Lacustrine System are those that involve the removal of water from a lake or reservoir, as well as the taking of fish and other associated wildife life. Many reservoirs, of course, are constructed so that water can be "consumed" for agricultural as well commercial and municipal purposes. In this sense, water is presumed "renewable", although our experience in the Mediterranean and arid regions of the state suggests that renewal of water is a cyclic but unpredictable phenomenon in the short term. Construction of Lake Casitas on Coyote Creek, a tributary of the Ventura River, for example, was initiated largely by cattlemen and citrus ranchers following a severe drought in the early 1950's to provide water for agricultural and ranching interests. Currently, Lake Casitas provides water and electric power generation to more than 50,000 people. Many reservoirs, however, commonly function well below maximum capacity, giving the lacustrine setting a somewhat unaesthetic appearance of a bath-tub ring, dramatically affecting littoral wetlands. Thus the highly variable nature of the water regime of artificial reservoirs is an overwhelming influence on the types of lacustrine-littoral wetland present on their shores and bottoms. In addition to water consumption, sport-fishing is the main wildlife-related consumptive value in lacustrine systems, with deepwater habitat utilized most heavily. The handbill given to visitors at Lake Casitas, for example, boasts of "record" catches.

Nonconsumptive Values. Perhaps the best known, and in some ways, most significant socio-economic values provided by lacustrine wetland systems are those in the form of recreational boating, waterskiing, canoeing, kayaking, and fishing (catch and release). Research in lacustrine environments (Fig. VIII-21), although of scientific value, is an underappreciated value in Southern California.

Cultural, Aesthetic, and Natural Heritage Values. Cultural values for the natural lakes were extremely high for Native American cultures before Euro-American contact. For example, humans have dwelled along the shores of Zaca Lake for at least 8000 years. The Inezeño Chumash camped regularly along its shores, and constructed houses of the tules (*Scirpus* spp.) that grow there (see Section II, Environmental Setting). Today's Californians also live along the shores of natural lakes and artificial reservoirs. Big Bear Lake is a popular resort for residents of the Los Angeles Basin, as is Baldwin Lake. Zaca Lake, too, is a private resort that provides lake-front vacation housing, in part for the pleasing aesthetic of observing lacustrine-related wildlife.

Impacts and Losses

Impacts to lakes and lacustrine environments include filling, sedimentation, degradation of water quality from primarily agricultural effluents, hydrologic alteration, overdrafting of groundwater basins and water tables, and introduction of exotic animals such as mosquito fish (*Gambusia affinis*). All of these impacts have occurred to varying degrees in the natural and artificial lacustrine environments of the study area, and all of these activities create as well as destroy lacustrine wetlands. Selected examples of these multiple impacts to our natural lakes follow.

In 1774, the Spanish explorer Juan Bautista de Anza was so impressed with Mystic Lake, Riverside Co., that he later described it as:" ...a large and pleasing lake, several leagues in circumference and as full of white geese as of water, they being so numerous that it looked like a large, white grove" (de Anza 1774 as quoted in Feliz 1992). Today, snow geese are rare in the San Jacinto Valley, largely as a result of a loss of wetland habitat by the construction of the State Water Project. Water from the diverted San Jacinto River that formerly created a vast wetland mosaic around Mystic Lake is now being replaced by the provision of reclaimed water through an agreement between the California Department of Fish and Game and the Eastern Municipal Water District. The reclaimed water is piped through an 11 mi pipeline, and provides Mystic Lake wetlands with a final volume of 4500 acre feet of secondarily treated reclaimed water.

Water supplies in Big Bear Basin, the structural basin in which Baldwin Lake occurs, are inadequate for the local municipal and domestic water demands (USFS 1988). Groundwater in the basin is being overdrafted for these competing uses as well as for recreational and downstream commitments. The effects of groundwater overdraft and surface water diversions on bald eagles, as well as on the rare, threatened, and endangered plant species and their habitat are likely adverse. Currently, there is a proposal to increase the level of Baldwin Lake in enhance habitat for the Bald

Eagle and the Shay Meadows Stickleback at the expense of the lacustrine wetlands and adjacent palustrine wetlands (Stephenson 1990; CM Engineering & Associates 1986; Camp Dresser & McKee, Inc. 1986).

Restoration and Creation of Lacustrine Wetlands

To date, there has been no documented attempt to restore a lacustrine wetland in the central and southern California coastal watersheds. However, as stressed many times throughout this chapter, created lacustrine wetlands are, unlike natural ones, commonly encountered through the study area. Table VIII-1 provides an accounting of selected major created lacustrine wetlands ("impoundments") and the water course on which they occur. Other smaller reservoirs or impoundments, both lacustrine and palustrine in nature, are not listed, but also are a visible landscape feature in the coastal watersheds of the state.

Lake Casitas provides an insightful example of the scale of creation efforts of artifical reservoirs in the study region. The earthen dam impounding Lake Casitas took three years to build, requiring 9.2 million cu yd to complete. The lake draws from the 105-mi watershed of the Ventura River, and has a capacity of 254,000 ac ft.

Rare and Threatened Lacustrine Wetlands

Although the majority of lacustrine wetland and deepwater habitats in the region are artificial reservoirs created by damming rivers, montane valleys and canyons, each natural lacustrine wetland environment is both rare and unique, as discussed in the introduction of this chapter. With the possible exception of Zaca Lake, which is privately held, each natural lake faces a series of human-derived threats, such as sedimentation, hydrological alteration, pollution, etc.

One category of rare natural lakes is the dune lake type, none of which are large enough and deep enough to establish the lacustrine environment. They are properly considered "palustrine lakes", despite our earlier publications suggesting such (Ferren and Fiedler 1993). Coastal "lakes" found generally within large coastal dune systems occur at the mouths of river valleys such as the Santa Maria and Santa Clara Rivers. Some of these lakes were probably formed when historic mouths of rivers (i.e, river estuaries) or streams were abandoned for new routes of flow to the ocean. In southern California, the only dune lake that remains is McGrath Lake in Ventura County. The greatest concentration of these lakes is the dune lakes area in San Luis Obispo County (see Chapter IX, Palustrine System, for a more extensive discussion of dune lakes).

Key to the Lacustrine Subsystems, Classes

All habitats (i.e., deepwater habitats) in a lake extending below a depth of 2 meters (6.6 feet) below low water or below the maximum extent of nonpersistent emergent plants, if these grow below 2 meters (all such habitats are excluded from this volume, but are included in the key for the purpose of comparison..**LIMNETIC SUBSYSTEM**

During the growing season of most years, areal cover by vegetation (i.e., submerged rooted-vascular, floating-leaved, and floating such as *Najas, Potamogeton, Myriophyllum*) is 30% or greater...**Aquatic Bed Class**

During the growing season of most years, areal cover by vegetation is less than 30%:

Substrate of bedrock, boulders, rubble, or combinations of these covering 70% or more of the habitat...**Rock Bottom Class**

Substrate of organic material, mud, sand, gravel, or cobbles with less than 70% areal cover of bedrock, boulders, or rubble..............**Unconsolidated Bottom Class**

All habitats (i.e., wetlands) in a lake extending from the shoreline boundary of the system to a depth of 6 meters (6.6 feet) below low water or to the maximum extent of nonpersistent emergent plants, if these grow at depths greater than 2 meters........................... **LITTORAL SUBSYSTEM**

During the growing season of most years, areal cover by vegetation is less than 30%:

Water regimes include permanently or semi-permanently flooded and intermittently exposed; substrate is usually not a soil:

Substrate of bedrock, boulders, rubble, or combinations of these covering 70% or more of the habitat..**Rock Bottom Class**

Substrate of organic material, mud, sand, gravel, or cobbles with less than 70% areal cover of bedrock, boulders, or rubble..
....**Unconsolidated Bottom Class**

Water regimes include seasonally flooded, temporarily flooded, intermittently flooded, saturated, or artificially flooded:

Substrate of bedrock, boulders, rubble of combinations of these covering 70% or more of the habitat..**Rocky Shore Class**

Substrate of organic material, mud, sand, gravel, or cobbles with less than 70% areal cover of bedrock, boulders, or rubble...**Unconsolidated Shore Class**

During the growing season of most years, percentage of area covered by herbaceous vegetation (e.g., algae, submerged aquatic and nonpersistent emergent vascular plants) is 30% or greater:

Vegetation generally consists of algae, submerged rooted aquatic, floating-leaved, or floating types (e.g., *Najas, Potamogeton, Myriophyllum*)..............**Aquatic Bed Class**
Vegetation dominated by nonpersistent emergent types:

During the growing season of most years, vegetation is composed largely of nonpersistent pioneering annuals, nonpersistent perennials, and seedlings of perennials that occur at the time of substrate exposure:

Vegetation occurs on exposed, unconsolidated bottom or bed habitats.....................**Unconsolidated Bottom (Vegetated) Class**

Vegetation occurs on exposed, unconsolidated shore or bank habitats........................**Unconsolidated Shore (Vegetated) Class**

During most years, vegetation is composed largely of nonpersistent perennials that dominate the substrate or flooded littoral habitat ....**Emergent Wetland Class**

Table VIII-2. **TABLE OF HYDROGEOMORPHIC UNITS IN THE LACUSTRINE SYSTEM ARRANGED WITHIN CORERSPONDING WATER REGIMES.**

("00") = Water Regime
(00."0") = Water Chemistry
(00.0."000") = Hydrogeomorphic Unit
(00.0.000."0000") = Dominance Type (Dominant Substrate/Species)

(20.0) NONTIDAL WATER-REGIMES

(21.0) PERMANENTLY-FLOODED NONTIDAL REGIME

(21.0.100.0000) Water Bodies (Hydrogeomorphic Context)

- (21.0.150) Lacustrine Lakes, Reservoirs
  - (21.0.154) Montane Reservoirs
  - (21.0.155) River-Valley Reservoirs
  - (21.0.156) Canyon Reservoirs

(21.0.200.0000) Channels, Drainages, Inverts, Falls

- (21.0.270) Lacustrine Channels

(21.0.300.0000) Shores, Beaches, Banks, Margins

(21.0.400.0000) Beds, Bottoms, Bars

- (21.0.440) Lacustrine Lake/Reservoir Beds/Bottoms
  - (21.0.444) Montane Reservoir Beds/Bottoms
  - (21.0.445) River-Valley Reservoir Beds/Bottoms
  - (21.0.446) Canyon Reservoir Beds/Bottoms

(21.0.500.0000) Flats, Plains, Fans, Washes, Bottomlands, Terraces

- (21.0.530) Deltas
  - (21.0.534) Lake Deltas

(21.0.600.0000) Headlands, Bluffs, Slopes

(21.0.700.0000) Seeps, Springs

- (21.0.720) Springs
  - (21.0.729) Lake Springs

(21.0.800.0000) Palustrine Basins: Pools, Ponds, Meadows, Marshes, Swales

(Table VIII-2 Continued)

(21.0.900.0000) Artificial Structures

(21.0.910) Stationary Artificial Structures
- (21.0.911) Jetties/Breakwaters
- (21.0.912) Bank Revetments
- (21.0.913) Dams/Levees
- (21.0.914) Earthen Berms/Dikes
- (21.0.915) Dredge Poils
- (21.0.916) Pilings/Piers
- (21.0.917) Platforms
- (21.0.918) Boat Ramps
- (21.0.919) Wreckage

(21.0.920) Floating Artificial Structures
- (21.0.921) Hulls
- (21.0.922) Docks
- (21.0.923) Buoys

(22.0) INTERMITTENTLY-EXPOSED NONTIDAL REGIME (also see Regime 21.0)

(22.0.100.0000) Water Bodies (Hydrogeomorphic Context)

(22.0.150) Lacustrine Lakes, Reservoirs
- (22.0.154) Montane Reservoirs
- (22.0.155) River-Valley Reservoirs
- (22.0.156) Canyon Reservoirs

(22.0.200.0000) Channels, Drainages, Inverts, Falls

(22.0.270) Lacustrine Channels

(22.0.300.0000) Beaches, Shores, Banks

(22.0.330) Lacustrine Lake/Reservoir Shores
- (22.0.334) Montane Reservoir Shores
- (22.0.335) River-Valley Reservoir Shores
- (22.0.336) Canyon Reservoir Shores

(22.0.400.0000) Beds, Bottoms, Bars

(22.0.440) Lacustrine Lake/Reservoir Beds/Bottoms
- (22.0.444) Montane Reservoir Beds/Bottoms
- (22.0.445) River-Valley Reservoir Beds/Bottoms
- (22.0.446) Canyon Reservoir Beds/Bottoms

(22.0.490) Lake Bars

(22.0.500.0000) Flats, Plains, Fans, Washes, Bottomlands, Terraces

(Table VIII-2 Continued)

(22.0.500.0000) Flats, Plains, Fans, Washes, Bottomlands, Terraces

(22.0.530) Deltas
(22.0.534) Lake Deltas

(22.0.600.0000) Headlands, Bluffs, Slopes

(22.0.700.0000) Seeps, Springs

(22.0.720) Springs
(22.0.729) Lake Springs

(22.0.800.0000) Palustrine Basins: Pools, Ponds, Meadows, Marshes, Swales

(22.0.900.0000) Artificial Structures

(22.0.910) Stationary Artificial Structures
(22.0.911) Jetties/Breakwaters
(22.0.912) Bank Revetments
(22.0.913) Dams/Levees
(22.0.914) Earthen Berms/Dikes
(22.0.915) Dredge Poils
(22.0.916) Pilings/Piers
(22.0.917) Platforms
(22.0.918) Boat Ramps
(22.0.919) Wreckage

(22.0.920) Floating Artificial Structures
(22.0.921) Hulls
(22.0.922) Docks
(22.0.923) Buoys

(23.0) SEMIPERMANENTLY-FLOODED NONTIDAL REGIME (see Regime 21.0)

(23.0.100.0000) Water Bodies (Hydrogeomorphic Context)

(23.0.150) Lacustrine Lakes, Reservoirs
(23.0.154) Montane Reservoirs
(23.0.155) River-Valley Reservoirs
(23.0.156) Canyon Reservoirs

(23.0.200.0000) Channels, Drainages, Inverts, Falls

(23.0.270) Lacustrine Channels

(Table VIII-2 Continued)

(23.0.300.0000) Shores, Beaches, Banks, Margins

(23.0.330) Lacustrine Lake/Reservoir Shores
(23.0.334) Montane Reservoir Shores
(23.0.335) River-Valley Reservoir Shores
(23.0.336) Canyon Reservoir Shores

(23.0.400.0000) Beds, Bottoms, Bars

(23.0.440) Lacustrine Lake/Reservoir Beds/Bottoms
(23.0.444) Montane Reservoir Beds/Bottoms
(23.0.445) River-Valley Reservoir Beds/Bottoms
(23.0.446) Canyon Reservoir Beds/Bottoms

(23.0.490) Lake Bars

(23.0.500.0000) Flats, Plains, Fans, Washes, Bottomlands, Terraces

(23.0.530) Deltas
(23.0.534) Lake Deltas

(24.0) SEASONALLY-FLOODED NONTIDAL REGIME

(24.0.100.0000) Water Bodies, Hydrogeomorphic Context

(24.0.150) Lacustrine Lakes, Reservoirs
(24.0.151) Montane Freshwater Lakes
(24.0.152) Montane Alkali Lakes
(24.0.153) Playa Lakes

(24.0.200.0000) Channels, Drainages, Inverts, Falls

(24.0.270) Lacustrine Channels

(24.0.300.0000) Shores, Beaches, Banks, Margins

(24.0.330) Lacustrine Lake/Reservoir Shores
(24.0.331) Montane Freshwater Lacustrine-Lake Shores
(24.0.332) Montane Alkali Lacustrine-Lake Shores
(24.0.333) Playa Lake Shores
(24.0.334) Montane Reservoir Shores
(24.0.335) River-Valley Reservoir Shores
(24.0.336) Canyon Reservoir Shores

(24.0.360) Beaches
(24.0.362) Lake Beaches

(Table VIII-2 Continued)

(24.0.400.0000) Beds, Bottoms, Bars

(24.0.440) Lacustrine Lake/Reservoir Beds/Bottoms
(24.0.441) Montane Freshwater Lake Beds/Bottoms
(24.0.442) Montane Alkali Lake Beds/Bottoms
(24.0.443) Playa Lake Beds/Bottoms

(24.0.490) Lake Bars

(24.0.500.0000) Flats, Plains, Fans, Washes, Bottomlands, Terraces

(24.0.530) Deltas
(24.0.534) Lake Deltas

(24.0.600.0000) Headlands, Bluffs, Slopes

(24.0.700.0000) Seeps, Springs

(24.0.710) Seeps
(24.0.719) Lake Seeps

(24.0.720) Springs
(24.0.729) Lake Springs

(24.0.800.0000) Palustrine Basins: Pools, Ponds, Meadows, Marshes, Swales

(24.0.900.0000) Artificial Structures

(24.0.910) Stationary Artificial Structures
(24.0.911) Jetties/Breakwaters
(24.0.912) Bank Revetments
(24.0.913) Dams/Levees
(24.0.914) Earthen Berms/Dikes
(24.0.915) Dredge Poils
(24.0.916) Pilings/Piers
(24.0.917) Platforms
(24.0.918) Boat Ramps
(24.0.919) Wreckage

(24.0.920) Floating Artificial Structures
(24.0.921) Hulls
(24.0.922) Docks
(24.0.923) Buoys

(27.0) TEMPORARILY-FLOODED NONTIDAL REGIME

(Table VIII-2 Continued)

(27.0.300.0000) Shores, Beaches, Banks, Margins

(27.0.330) Lacustrine Lake/Reservoir Shores
(27.0.331) Montane Freshwater Lake Shores
(27.0.332) Montane Alkali Lake Shores
(27.0.333) Playa Lake Shores
(27.0.334) Montane Reservoir Shores
(27.0.335) River-Valley Reservoir Shores
(27.0.336) Canyon Reservoir Shores

(27.0.360) Beaches
(27.0.362) Lake Beaches

(28.0) INTERMITTENTLY-FLOODED NONTIDAL REGIME

(28.0.100.0000) Water Bodies (Hydrogeomorphic Context)

(28.0.150) Lacustrine Lakes, Reservoirs
(28.0.151) Montane Freshwater Lakes
(28.0.152) Montane Alkali Lakes
(28.0.153) Valley Playa Lakes

(28.0.200.0000) Channels, Drainages, Inverts, Falls

(28.0.300.0000) Shores, Beaches, Banks, Margins

(28.0.330) Lacustrine Lake/Reservoir Shores
(28.0.331) Montane Freshwater Lacustrine-Lake Shores
(28.0.332) Montane Alkali Lacustrine-Lake Shores
(28.0.333) Playa Lake Shores

(28.0.360) Beaches
(28.0.362) Lake Beaches

(28.0.400.0000) Beds, Bottoms, Bars

(28.0.440) Lacustrine Lake/Reservoir Beds/Bottoms
(28.0.441) Montane Freshwater Lake Beds/Bottoms
(28.0.442) Montane Alkali Lake Beds/Bottoms
(28.0.443) Playa Lake Beds/Bottoms

(28.0.490) Lake Bars

(28.0.500.0000) Flats, Plains, Fans, Washes, Bottomlands, Terraces

(28.0.540) Deltas
(28.0.544) Lake Deltas

(Table VIII-2 Continued)

(28.0.600.0000) Headlands, Bluffs, Slopes

(28.0.700.0000) Seeps, Springs

(28.0.710) Seeps
    (28.0.719) Lake Seeps

(28.0.720) Springs
    (28.0.729) Lake Springs

(28.0.800.0000) Palustrine Basins: Pools, Ponds, Meadows, Marshes, Swales

(28.0.900.0000) Artificial Structures

(28.0.910) Stationary Artificial Structures
    (28.0.911) Jetties/Breakwaters
    (28.0.912) Bank Revetments
    (28.0.913) Dams/Levees
    (28.0.914) Earthen Berms/Dikes
    (28.0.915) Dredge Poils
    (28.0.916) Pilings/Piers
    (28.0.917) Platforms
    (28.0.918) Boat Ramps
    (28.0.919) Wreckage

(28.0.920) Floating Artificial Structures
    (28.0.921) Hulls
    (28.0.922) Docks
    (28.0.923) Buoys

CATALOGUE OF LACUSTRINE WETLANDS

This catalogue includes major lacustrine wetland types identified during the course of the study. The catalogue is arranged by class and subclass as identified using the preceding key. There was no attempt on the part of the authors to include all types of wetlands from each level of the hierarchy. Instead, we attempted to include examples of types from various classes, subclasses, water regimes, salinities, hydrogeomorphic units, and dominance types. Illustrated and described examples of lacustrine wetland types occur at the end of this catalogue and are cited herein by figure number within the appropriate wetland type. For each wetland type we have assessed the likelihood of jurisdiction under Section 404 of the Clean Water Act. Section 404 of the Clean Water Act regulates the discharge of dredged and fill material into "waters of the Unites States", and is administered jointly at the federal level by the U.S. Army Corps of Engineers and U.S. Environmental Protection Agency.

40.000 SYSTEM LACUSTRINE
41.000 SUBSYSTEM LITTORAL
41.120 CLASS UNCONSOLIDATED BOTTOM

41.123 SUBCLASS MUD

Wetland Type No.: 41.123(28.1.441.1800)
LACUSTRINE-LITTORAL UNCONSOLIDATED-BOTTOM (MUD) INTERMITTENTLY-FLOODED MONTANE-LAKE-BED WETLAND. San Diego Co., Cuyamacha Mountains, Cuyamacha Lake. **Section 404 Jurisdiction:** This named wetland is regulated to the ordinary high water mark and may seasonally qualify as a jurisdictional wetland. **FIG. VIII-7**

Wetland Type No.: 41.123(28.3.442.1800)
LACUSTRINE-LITTORAL UNCONSOLIDATED-BOTTOM (MUD) INTERMITTENTLY-FLOODED ALKALI MONTANE-LAKE-BED WETLAND. San Bernardino Co., San Bernardino Mountains, Baldwin Lake. **Section 404 Jurisdiction:** This named wetland is regulated to the ordinary high water mark. **FIG. VIII-8**

* * * *

40.000 SYSTEM LACUSTRINE
41.000 SUBSYSTEM LITTORAL
41.120 CLASS UNCONSOLIDATED BOTTOM

41.123 SUBCLASS VEGETATED

Wetland Type No.: 41.125(28.3.442.1800,5541,5554,5559)
LACUSTRINE - LITTORAL UNCONSOLIDATED - BOTTOM - VEGETATED (MUD, CHENOPODIUM, HELIOTROPIUM, SUAEDA) INTERMITTENTLY-FLOODED ALKALI MONTANE-LAKE-BED WETLAND. San Bernardino Co., San Bernardino Mountains, Baldwin

Lake. **Section 404 Jurisdiction:** This named wetland is regulated to the ordinary high water mark and may seasonally qualify as a jurisdictional wetland. **FIG. VIII-9, FIG. VIII-10**

* * * *

40.000 SYSTEM LACUSTRINE
41.000 SUBSYSTEM LITTORAL
41.150 CLASS UNCONSOLIDATED SHORE

41.152 SUBCLASS SAND

Wetland Type No.: 41.152(28.3.332.1600)
LACUSTRINE-LITTORAL UNCONSOLIDATED-SHORE (SAND) INTERMITTENTLY-FLOODED ALKALI MONTANE-LAKE-SHORE WETLAND. San Bernardino Co., San Bernardino Mountains, Baldwin Lake. **Section 404 Jurisdiction:** This named wetland is regulated to the ordinary high water mark and may seasonally qualify as a jurisdictional wetland. **FIG. VIII-11**

* * * *

40.000 SYSTEM LACUSTRINE
41.000 SUBSYSTEM LITTORAL
41.150 CLASS UNCONSOLIDATED SHORE

41.153 SUBCLASS MUD (MIXED FINES)

Wetland Type No.: 41.153(28.1.331.1700)
LACUSTRINE - LITTORAL UNCONSOLIDATED - SHORE (MIXED - FINES) INTERMITTENTLY -FLOODED MONTANE-LAKE-SHORE WETLAND. San Diego Co., Cuyamaca Mountains, Lake Cuyamaca. This named wetland is regulated to the ordinary high water mark. **FIG. VIII-12**

* * * *

40.000 SYSTEM LACUSTRINE
41.000 SUBSYSTEM LITTORAL
41.150 CLASS UNCONSOLIDATED SHORE

41.155 SUBCLASS VEGETATED

Wetland Type No.: 41.155(24.1.331.7000)
LACUSTRINE-LITTORAL UNCONSOLIDATED-SHORE VEGETATED (MIXED-VASCULAR-PLANTS) SEASONALLY-FLOODED MONTANE-LAKE-SHORE WETLAND. San Diego Co., Lake Henshaw. **Section 404 Jurisdiction:** This named wetland is regulated to the ordinary high water mark and may seasonally qualify as a jurisdictional wetland. **FIG. VIII-16**

Wetland Type No.: 41.155(24.1.334.1700,5544,5592,6823,6825)
LACUSTRINE-LITTORAL UNCONSOLIDATED-SHORE (MIXED-FINES, CYPERUS, ELEOCHARIS, LIMOSELLA, RORRIPA) SEASONALLY-FLOODED MONTANE-RESERVOIR-SHORE WETLAND. San Bernardino Co., San Bernardino Mountains, Big Bear

Lake, Grout Bay. **Section 404 Jurisdiction:** This named wetland is regulated to the ordinary high water mark and may seasonally qualify as a jurisdictional wetland. **FIG. VIII-14**

Wetland Type No.: 41.155(24.1.334.1700,7000)
LACUSTRINE-LITTORAL UNCONSOLIDATED-SHORE (MIXED-FINES, MIXED-VASCULAR-PLANTS) SEASONALLY-FLOODED MONTANE-RESERVOIR-SHORE WETLAND. San Bernardino Co., San Bernardino Mountains, Big Bear Lake, Grout Bay. **Section 404 Jurisdiction:** This named wetland is regulated to the ordinary high water mark and may seasonally qualify as a jurisdictional wetland. **FIG. VIII-13**

Wetland Type No.: 41.155(28.1.334.7000)
LACUSTRINE-LITTORAL UNCONSOLIDATED-SHORE VEGETATED (MIXED-VASCULAR-PLANTS) INTERMITTANTLY-FLOODED MONTANE-LAKE-SHORE WETLAND. San Diego Co., Cuyamaca Mountains, Cuyamaca Lake. **Section 404 Jurisdiction:** This named wetland is regulated to the ordinary high water mark and may seasonally qualify as a jurisdictional wetland. **FIG. VIII-15**

* * * *

40.000 SYSTEM LACUSTRINE
41.000 SUBSYSTEM LITTORAL
41.210 CLASS AQUATIC BED

41.214 SUBCLASS ROOTED VASCULAR

Wetland Type No.: 41.214(23.1.446.6112)
LACUSTRINE-LITTORAL AQUATIC-BED ROOTED-VASCULAR (ECHINODORUS BERTEROI) SEMIPERMANENTLY-FLOODED CANYON-RESERVOIR-BOTTOM WETLAND. Ventura Co., Coyote Creek Watershed, Lake Casitas. **Section 404 Jurisdiction:** This named wetland is regulated as an "other water" of the United States. **FIG. VIII-17**

Wetland Type No.: 41.214(28.1.152.6152, 6154,6161)
LACUSTRINE-LITTORAL AQUATIC-BED ROOTED-VASCULAR (POTAMOGETON, RUPPIA, ZANNICHELLIA) INTERMITTANTLY-FLOODED ALKALI MONTANE-LAKE WETLAND. San Bernardino Co., San Bernardino Mountains, Baldwin Lake. **Section 404 Jurisdiction:** This named wetland is regulated as an "other water" of the United States. **FIG. VIII-18**

* * * *

40.000 SYSTEM LACUSTRINE
41.000 SUBSYSTEM LITTORAL
41.240 CLASS EMERGENT WETLAND

41.242 SUBCLASS NONPERSISTENT

Wetland Type No.: 41.242(21.1.154.5581)
LACUSTRINE-LITTORAL EMERGENT-NONPERSISTENT (POLYGONUM EMERSUM VAR. EMERSUM) PERMANENTLY-FLOODED MONTANE-RESERVOIR WETLAND. San Bernardino Co., San Bernardino Mountains, Big Bear Lake. **Section 404 Jurisdiction:** This named wetland is regulated to the ordinary high water mark as an "other water" of the United States. **FIG. VIII-19**

Wetland Type No.: 41.242(21.1.154.5581)
LACUSTRINE-LITTORAL EMERGENT-NONPERSISTENT (POLYGONUM EMERSUM VAR. EMERSUM) PERMANENTLY-FLOODED MONTANE-RESERVOIR WETLAND. San Bernardino Co., San Bernardino Mountains, Big Bear Lake. **Section 404 Jurisdiction:** This named wetland is regulated to the ordinary high water mark as an "other water" of the United States. **FIG. VIII-20**

Wetland Type No.: 41.242(23.1.156.6112)
LACUSTRINE-LITTORAL EMERGENT-NONPERSISTENT (ECHINODORUS BERTEROI) SEMIPERMANENTLY-FLOODED CANYON-RESERVOIR WETLAND. Ventura Co., Coyote Creek Watershed, Lake Casitas. **Section 404 Jurisdiction:** This named wetland is regulated to the ordinary high water mark as an "other water" of the United States. **FIG. VIII-21**

Wetland Type No.: 41.242(23.1.446.6112)
LACUSTRINE-LITTORAL EMERGENT-NONPERSISTENT (ECHINODORUS BERTEROI) SEASONALLY-FLOODED CANYON-RESERVOIR-BED WETLAND. Ventura Co., Coyote Creek Watershed, Lake Casitas. **Section 404 Jurisdiction:** This named wetland is regulated to the ordinary high water mark and may seasonally qualify as a jurisdictional wetland. **FIG. VIII-22**

Wetland Type No.: 41.242(28.1.151.5582)
LACUSTRINE-LITTORAL EMERGENT-NONPERSISTENT (POLYGONUM EMERSUM VAR. STIPULACEUM) INTERMITTANTLY-FLOODED MONTANE-LAKE WETLAND. San Diego Co., Cuyamaca Mountains, Cuyamaca Lake. **Section 404 Jurisdiction:** This named wetland is regulated to the ordinary high water mark as an "other water" of the United States. **FIG. VIII-23**

Wetland Type No.: 41.242(28.1.151.5582)
LACUSTRINE-LITTORAL EMERGENT-NONPERSISTENT (POLYGONUM EMERSUM VAR. STIPULACEUM) INTERMITTANTLY-FLOODED MONTANE-LAKE WETLAND. San Diego Co., Cuyamaca Mountains, Cuyamaca Lake. **Section 404 Jurisdiction:** This named wetland is regulated to the ordinary high water mark as an "other water" of the United States. **FIG. VIII-24**

LACUSTRINE WETLAND No.: 41.123(28.1.441.1800), Fig. VIII-7, Fig. VIII-8.

NAME: **LACUSTRINE-LITTORAL UNCONSOLIDATED-BOTTOM (MUD) INTERMITTENTLY-FLOODED MONTANE-LAKE-BED WETLAND**

CLASSIFICATION:

System: 40 lacustrine
Subsystem: 41 lacustrine littoral
Class: 41.120 unconsolidated-bottom
Subclass: 41.123 unconsolidated-bottom (mud)
Water Regime: (28) intermittantly-flooded
Water Chemistry: (28.1) freshwater
HGM Unit: (28.1.441) montane-lake-bed
Substrate/Dominance Type: (28.1.441.1800) Mud types

DESCRIPTION: The unconsolidated bottom of the only natural freshwater montane lake in the study region, when flooded, is represented by the subclass aquatic bed, with characteristic species that include *Polygonum emersum* var. *stipulaceum*, among others. When desiccated, as shown in Fig. 7, the montane lake-bed may become sparsely vegetated with annual species.

SPECIES: Characteristic: None. Associated: None.

ECOSYSTEM FUNCTIONS: Lake Cuyamaca serves as habitat for a large number of water birds, many of whom forage on the lake-bed.

REFERENCE EXAMPLES: Lake Cuyamaca, Cuyamaca Mountains, San Diego County.

IMPACTS: The natural outlet of Lake Cuyamaca as been dammed to create the contiguous reservoir Cuyamaca Reservoir. Additional impacts include invasion by exotic species, trampling, water quality degradation, and drought.

CONSERVATION EFFORTS: Lake Cuyamaca is protected within the Cuyamaca Rancho State Park.

LITERATURE: None.

Wetland Type No.: 41.123(28.1.441.1800)

FIG. VIII-7. **LACUSTRINE-LITTORAL UNCONSOLIDATED-BOTTOM (MUD) INTERMITTENTLY-FLOODED MONTANE-LAKE-BED WETLAND**. San Diego Co., Cuyamaca Mountains, Lake Cuyamaca. View northwestward across partially-exposed bottom of this intermittent montane lake.

Wetland Type No.: 41.123(28.3.442.1800)

FIG. VIII-8. **LACUSTRINE-LITTORAL UNCONSOLIDATED-BOTTOM (MUD) INTERMITTENTLY-FLOODED ALKALI MONTANE-LAKE-BED WETLAND**. San Bernardino Co., San Bernardino Mountains, Baldwin Lake. View southward across exposed lake-bed and flooded aquatic-bed wetlands.

LACUSTRINE WETLAND *No.: 41.125(28.3.442.1800, 5541, 5554, 5559)*, **Fig. VIII-9., VIII-10**

NAME: ***LACUSTRINE-LITTORAL UNCONSOLIDATED-BOTTOM-VEGETATED (MUD, CHENOPODIUM, HELIOTROPIUM, SUAEDA) INTERMITTENTLY-FLOODED ALKALI MONTANE-LAKE-BED WETLAND***

CLASSIFICATION:

System: 40 lacustrine
Subsystem: 41 lacustrine littoral
Class: 41.120 unconsolidated bottom
Subclass: 41.125 vegetated
Water Regime: (28) intermittantly-flooded
Water Chemistry: (28.3) saline
HGM Unit: (28.3.441) montane lake-bed
Substrate/Dominance Type: (28.3.442.1800) Mud
Substrate/Dominance Type: (28.3.442.5541) *Chenopodium*
Substrate/Dominance Type: (28.3.441.5554) *Heliotropium*
Substrate/Dominance Type: (28.3.441.5559) *Heliotropium*

DESCRIPTION: The unconsolidated bottom of the only natural alkali montane lake in the study region, when flooded, is represented by the subclass aquatic bed, with characteristic species that include *Zannichellia palustris, Ruppia cirrhosa, Potomogeton* spp. and others. When desiccated, as shown here, the montane lake-bed becomes vegetated with annual species.

SPECIES: Characteristic: *Suaeda california, Chenopodium macrospermum, Heliotropium currissavicum*. Associated: *Atriplex rosea, Bassia hyssopifolia.*

ECOSYSTEM FUNCTIONS: Baldwin Lake serves as foraging and nesting habitat for several raptors, including the bald eagle.

REFERENCE EXAMPLE: Baldwin Lake, San Bernardino Mountains, San Bernardino Co.

IMPACTS: Proposed is a plan to raise the lake level to enhance endangered species habitat for the bald eagle and the shay meadows stickleback. Groundwater in the Big Bear Basin is being overdrafted for competing domestic and municipal uses as well as recreational and downstream committments.

CONSERVATION EFFORTS: Lands north of Baldwin Lake have been purchased by The Nature Conservancy (TNC), and are to be designated as the "North Baldwin Lake and Holcomb Valley Special Interest Area" within the San Bernardino Forest.

LITERATURE: U.S. Forest Service 1988; Stephenson 1990.

Wetland Type No.: 41.125(28.3.432.1800,5231,5564,5569)

FIG. VIII-9. **LACUSTRINE-LITTORAL UNCONSOLIDATED-BOTTOM-VEGETATED (MUD, *CHENOPODIUM, HELIOTROPIUM, SUAEDA*) INTERMITTENTLY-FLOODED ALKALI MONTANE-LAKE-BED WETLAND**. San Bernardino Co., San Bernardino Mountains, Baldwin Lake. View northward from exposed lake-bed to vegetated lake-shore.

Wetland Type No.: 41.125(28.3.432.1800,5231,5564,5569)

FIG. VIII-10. **LACUSTRINE-LITTORAL UNCONSOLIDATED-BOTTOM-VEGETATED (MUD, *CHENOPODIUM, HELIOTROPIUM, SUAEDA*) INTERMITTENTLY-FLOODED ALKALI MONTANE-LAKE-BED WETLAND**. San Bernardino Co., San Bernardino Mountains, Baldwin Lake. View of exposed lake-bed and adjacent lake-shore habitats. Plants dominant or characteristic of the intermittently-flooded alkali lake-bed include *Atriplex rosea, Bassia hyssopifolia, Chenopodium macrospermum, Heliotropium curassavicum,* and *Suaeda calceoliformis*.

Wetland Type No.: 41.152(28.3.332.1600)

FIG. VIII-11. **LACUSTRINE-LITTORAL UNCONSOLIDATED-SHORE (SAND) INTERMITTENTLY-FLOODED ALKALI MONTANE-LAKE-SHORE WETLAND**. San Bernardino Co., San Bernardino Mountains, Baldwin Lake. View northward along eastern shore of lake. Rack is composed of dead aquatic-bed plants of *Ruppia cirrhosa;* adjacent, upslope vegetation is dominated by *Distichlis spicata.*

Wetland Type No.: 41.153(28.1.331.1700)

FIG.VIII-12. **LACUSTRINE-LITTORAL UNCONSOLIDATED-SHORE (MIXED-FINES) INTERMITTENTLY-FLOODED MONTANE-LAKE-SHORE WETLAND**. San Diego Co., Cuyamaca Mountains, Lake Cuyamaca. View of exposed, unconsolidated shore southward toward Jeffrey Pine Forest.

Wetland Type No.: 41.155(24.1.334.1700,7000)

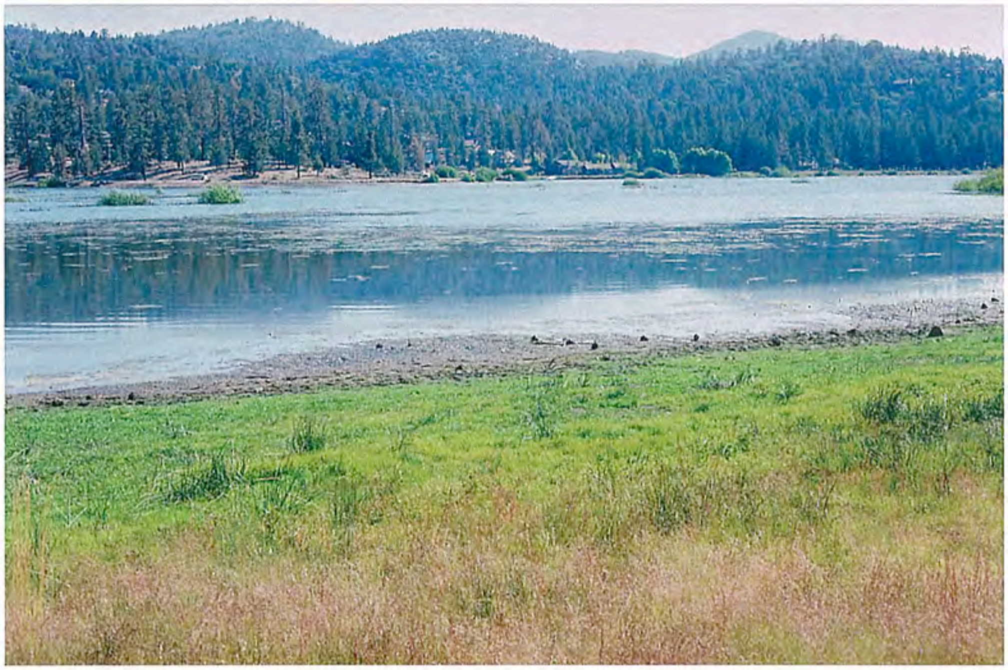


FIG. VIII-13. **LACUSTRINE-LITTORAL UNCONSOLIDATED-SHORE-VEGETATED (MIXED-FINES, MIXED VASCULAR-PLANTS) SEASONALLY-FLOODED MONTANE-RESERVOIR-SHORE WETLAND**. San Bernardino Co., San Barnardino Mountains, Big Bear Lake, Grout Bay. View northeastward from unconsolidated-shore (sand and mixed-fine) dominated by nonpersistent emergent vegetation to intermittently-exposed and permanently-flooded unconsolidated-bottom habitats.

Wetland Type No.: 41.155(24.1.334.1700,5544,5592,6823,6825)

FIG. VIII-14. **LACUSTRINE-LITTORAL UNCONSOLIDATED-SHORE (MIXED-FINES, *CYPERUS, ELEOCHARIS, LIMOSELLA, RORRIPA*) SEASONALLY-FLOODED MONTANE-LAKE-SHORE WETLAND**. San Bernardino Co., San Bernardino Mountains, Big Bear Lake, Grout Bay. View of substrate dominated by nonpersistent, mixed-dominance, vascular plants such as *Cyperus squarrosus, Eleocharis bella, Limosella aquatica*, and *Rorripa curvisiliqua*.

Wetland Type No.: 41.155(28.1.331.7000)

FIG.VIII-15. **LACUSTRINE-LITTORAL UNCONSOLIDATED-SHORE-VEGETATED (MIXED-VASCULAR-PLANTS) INTERMITTENTLY-FLOODED MONTANE-LAKE-SHORE WETLAND**. San Diego Co., Cuyamaca Mountains, Lake Cuyamaca. View northwestward along southeastern margin of lake. Nonpersistent dominant or characteristic plants include many annual aquatic species such as *Eleocharis bella, Gnaphalium palustre*, *Juncus bufonius*, *Limosella aquatica, Lythrum hyssopifolia,* and *Veronica peregrina*.

Wetland Type No.: 41.155(24.1.331.7000)

FIG. VIII-16. **LACUSTRINE-LITTORAL UNCONSOLIDATED-SHORE-VEGETATED (MIXED-VASCULAR-PLANTS) SEASONALLY-FLOODED MONTANE-LAKE-SHORE WETLAND**. San Diego Co., Lake Henshaw. View eastward along southern shore of lake. Nonpersistent dominant or characteristic plants include many annual species such as *Echinodorus berteroi*, *Cyperus* spp., *Juncus bufonius*, *Lotus* spp., and *Polygonum* spp., and small or nonpersistent biennials or perennials such as *Lythrum hyssopifolium, Phyla nodiflora.*

Wetland Type No.: 41.214(23.1.446.6112)

FIG. VIII-17. **LACUSTRINE-LITTORAL AQUATIC-BED ROOTED-VASCULAR (*ECHINODORUS BERTEROI*) SEMIPERMANENTLY-FLOODED CANYON-RESERVOIR-BOTTOM WETLAND**. Ventura Co., Coyote Creek Watershed, Lake Casitas. View of shallow lake bottom supporting plants of *Echinodorus berteroi*.

Wetland Type No.: 41.214(28.3.152.6152,6154,6161)

FIG. VIII-18. **LACUSTRINE-LITTORAL AQUATIC-BED ROOTED-VASCULAR (*POTAMOGETON, RUPPIA, ZANNICHELLIA*) INTERMITTENTLY-FLOODED ALKALI MONTANE-LAKE WETLAND**. San Bernardino Co., San Bernardino Mountains, Baldwin Lake. View of aquatic-bed species including *Potamogeton pectinatus, Ruppia cirrhosa, Zannichellia palustris.*

Wetland Type No.: 41.242(21.1.154.5581)

FIG. VIII-19. **LACUSTRINE-LITTORAL EMERGENT-NONPERSISTENT (*POLYGONUM EMERSUM* VAR. *EMERSUM*) PERMANENTLY-FLOODED MONTANE-RESERVOIR WETLAND.** San Bernardino Co., San Bernardino Mountains, Big Bear Lake. View westward across toward emergent wetland composed of flowering plants of *Polygonum emersum* var. *emersum.*

Wetland Type No.: 41.242(21.1.154.5581)

FIG. VIII-20. **LACUSTRINE-LITTORAL EMERGENT NONPERSISTENT (*POLYGONUM EMERSUM* VAR. *EMERSUM*) PERMANENTLY-FLOODED MONTANE-RESERVOIR WETLAND**. San Bernardino Co., San Bernardino Mountains, Big Bear Lake.

Wetland Type No.: 41.242(23.1.156.6112)

FIG. VIII-21. **LACUSTRINE-LITTORAL EMERGENT-NONPERSISTENT (*ECHINODORUS BERTEROI*) SEMIPERMANENTLY-FLOODED CANYON-RESERVOIR WETLAND**. Ventura Co., Coyote Creek, Lake Casitas. View southeastward across shallow embayment of the lake. Nonpersistent emergent wetland dominated by *Echinodorus berteroi*.

Wetland Type No.: 41.242(23.1.446.6112)

FIG. VIII-22. **LACUSTRINE-LITTORAL EMERGENT-NONPERSISTENT (*ECHINODORUS BERTEROI*) SEASONALLY-FLOODED CANYON-RESERVOIR-BED WETLAND**. Ventura Co., Coyote Creek Watershed, Lake Casitas. View northwestward along northern shore of lake. Flooded emergent wetland (lower left) is dominated by *Echinodorus berteroi* and is adjacent to exposed unconsolidated-shore (lower right) and unconsolidated-shore-vegetated (right center).

Wetland Type No.: 41.242(28.1.151.5582)

FIG. VIII-23. **LACUSTRINE-LITTORAL EMERGENT-NONPERSISTENT (*POLYGONUM EMERSUM* VAR. *STIPULACEUM*) INTERMITTENTLY-FLOODED MONTANE-LAKE WETLAND**. San Diego Co., Cuyamaca Mountains, Lake Cuyamaca. View northeastward toward emergent wetland dominated by *Polygonum emersum* var. *stipulaceum* and upland evergreen-forest dominated by *Pinus jeffreyi*.

Wetland Type No.: 41.242(28.1.151.5582)

FIG. VIII-24. **LACUSTRINE-LITTORAL EMERGENT-NONPERSISTENT (*POLYGONUM EMERSUM* VAR. *STIPULACEUM*) INTERMITTENTLY-FLOODED MONTANE-LAKE WETLAND**. San Diego Co., Cuyamaca Mountains, Lake Cuyamaca. View northward along western margin of lake.