THE NATURAL RESOURCES OF SAN DIEGUITO & BATIQUITOS LAGOONS

STATE OF CALIFORNIA
DEPARTMENT OF FISH AND GAME
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OF

SAN DIEGUITO AND BATIQUITOS LAGOONS

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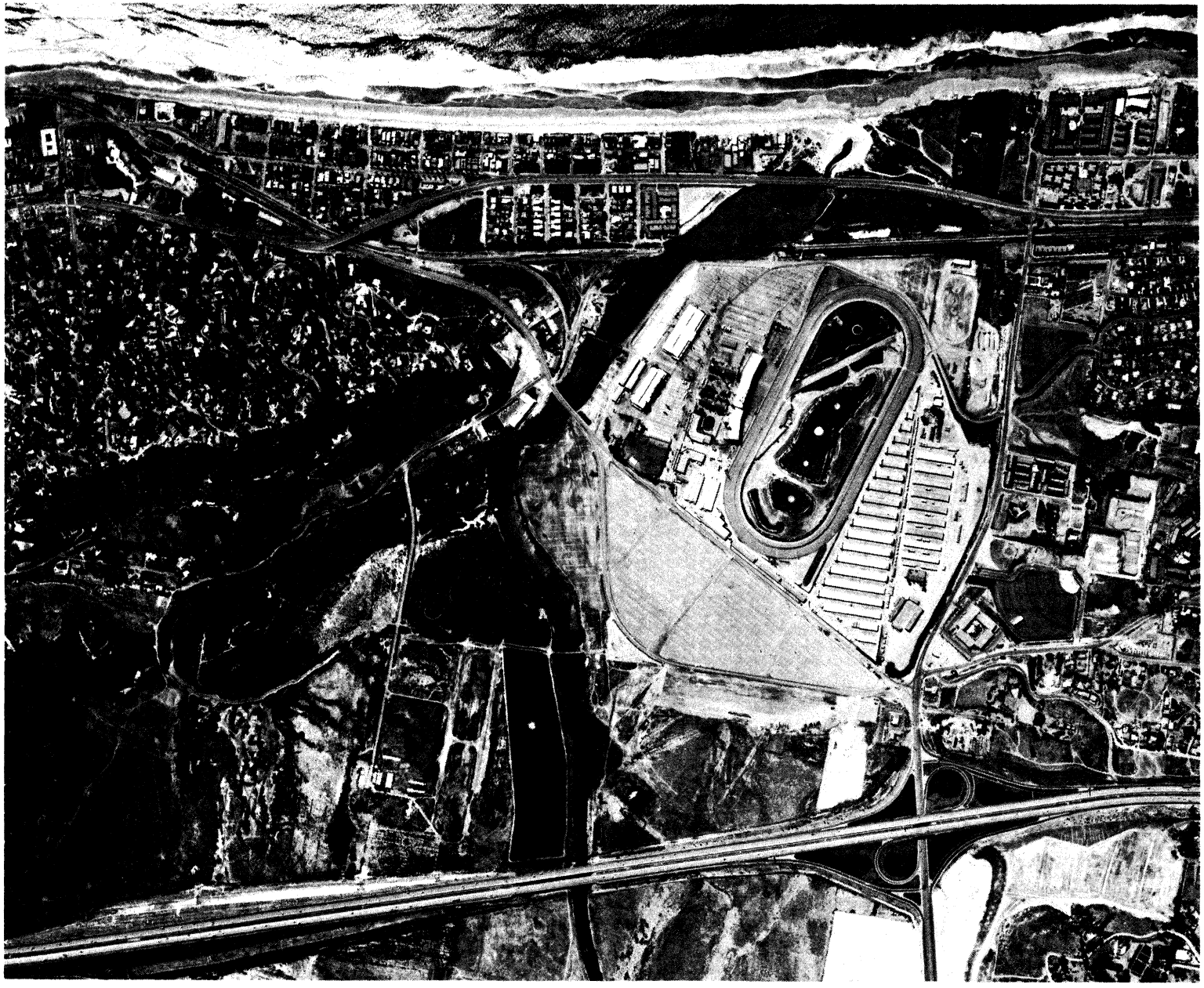

SAN DIEGUITO LAGOON PALAMAR PICTURES, SAN DIEGO SEPTEMBER, 1973

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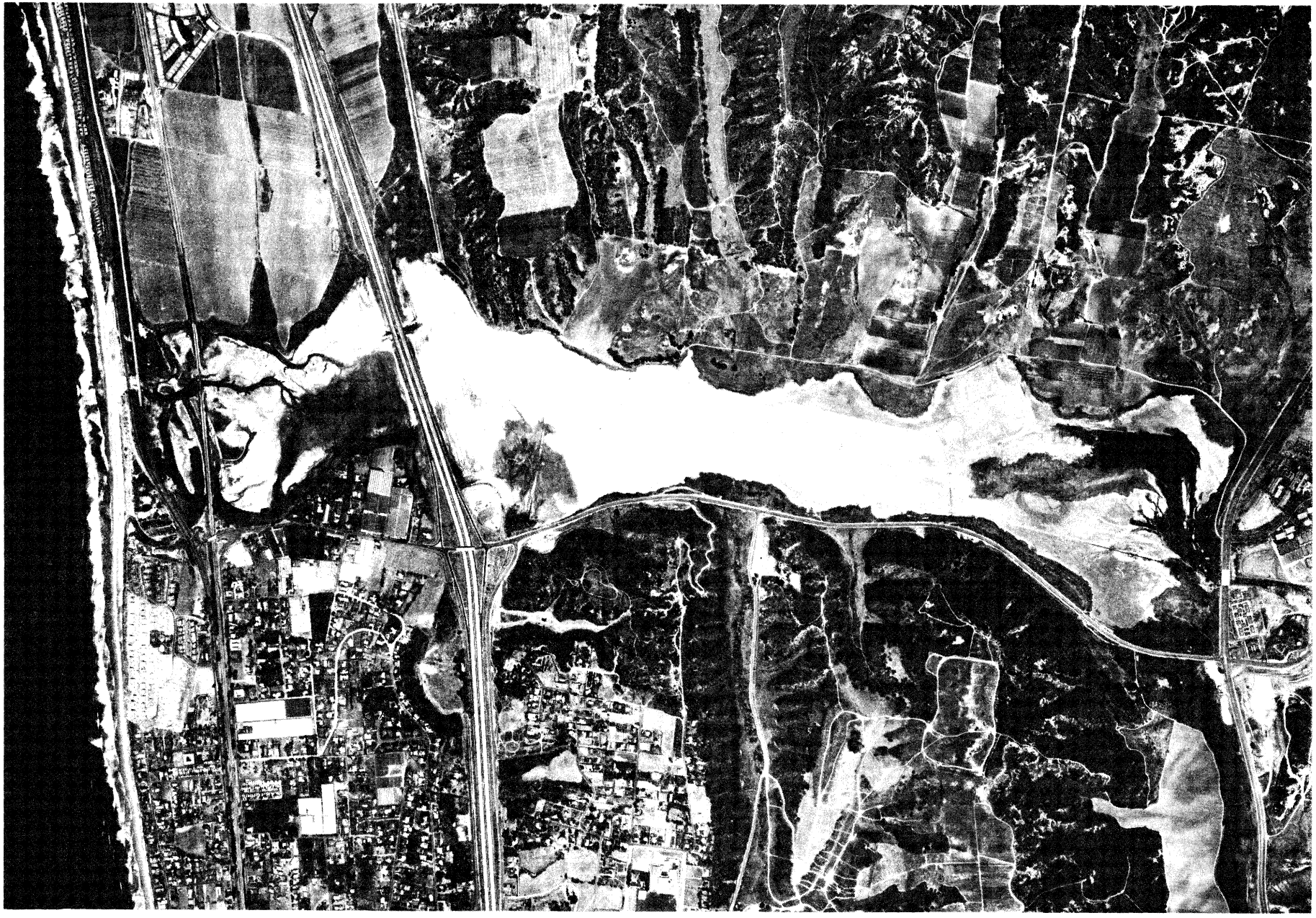

BATIQUITOS LAGOON PALAMAR PICTURES, SAN DIEGO AUGUST, 1973

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INTRODUCTION

The purpose of this report is to document the natural resources of two coastal lagoons in northern San Diego County, namely San Dieguito and Batiquitos lagoons; and, to discuss the existing and future uses of these wetlands and their immediate environs.

San Dieguito and Batiquitos lagoons differ in their past geological and natural resource characteristics and with regard to present land uses. Hence, despite the fact that many of their contemporary features and problems are similar, the two lagoons are often described and discussed separately in this report.

During the past half-decade, the value of southern California's lagoons, estuaries and other coastal wetlands as vital, highly fertile, natural resources, has been recognized and expressed by a wide spectrum of local, state and federal agencies (Resources Agency, 1972, County of San Diego, 1973 and City of Del Mar, 1973a). This concern has been similarly expressed by an increasing number of government-citizen organizations (e.g. Torrey Pines Community Planning Group, 1974; San Dieguito Lagoon Committee, 1974).

The California Department of Fish and Game has played a central role in attempting to protect and enhance the remaining 25% of southern California wetlands which have survived the ingress of urbanization and commercial development since 1900 (U.S. Dept. Interior, 1972). To this end, the Department has published a series of reports documenting California's coastal wetlands resources, including four covering wetlands in southern California (Upper Newport Bay, Frey et al., 1970; Goleta Slough, Speth et al., 1970; Los Penasquitos Lagoon, Mudie et al., 1974; and San Diego Bay, Browning et al., 1973). The following report is an extension of that effort.

In contrast to the larger estuaries or lagoons of obvious regional or state-wide significance, such as San Diego and Humboldt bays, the lagoons discussed in this report are small, and hence, primarily of local interest. Yet, they are the focal points of government-citizen attention and planning, designed to meet the dual needs of protecting the interests of both private investments and the well-being of the public-at-large. Local planners must decide whether these small, degraded lagoons should be restored to some semblance of their historical estuarine condition, marked by a regular ebb and flow of tides, or whether they should be altered and manipulated to become aquatic playgrounds, marinas or saltwater lakes; controlled ponds for fish or shellfish raising (mariculture); or real estate for suburban or commercial developments.

Because San Dieguito and Batiquitos lagoons now stand at a critical crossroad with respect to the choice of either restoring their past resource values or engineering new artificial environments, much emphasis in this report has been placed on documenting the historical changes that have occurred in these lagoons. It is hoped that these historical data will both serve to clarify the ecological nature of the contemporary wetland resources and to provide perspectives which will be useful in reaching final planning decisions.

SUMMARY

San Dieguito and Batiquitos lagoons are located in the central coastal plain of San Diego County; the former lagoon about 20 miles,and the latter about 28 miles,north of the city of San Diego. San Dieguito Lagoon lies on the northern edge of the city of Del Mar and is confined to a 200-foot wide channel, extending about 1-1/2 miles inland from the Pacific Ocean. Batiquitos Lagoon, located between the unincorporated city of Leucadia and the city of Carlsbad, has an average width of about 1/2 mile and extends inland for about 2-1/2 miles.

Historically, both lagoons were large, deep ocean embayments, until at least 2,000 years ago, at which time they became filled with river-borne silts and marine-originated sand.

The environs of both lagoons was occupied for thousands of years by California Indians, who utilized shellfish and other wildlife from the area. Archeological findings at San Dieguito Lagoon indicate a human occupancy of nearly 50,000 years. Little is known about the condition of the lagoons at the time of Spanish settlement, but some early descriptions of the surroundings suggest a greater fresh water influence across the flood plains and in the lagoons.

Recent history has shown many changes in both lagoons. The construction of the Del Mar fair grounds and race track greatly reduced the acreage of San Dieguito Lagoon. No such major changes have affected Batiquitos Lagoon, but agricultural encroachment and railroad, highway and access road construction around and through Batiquitos, as well as San Dieguito, have altered both lagoons significantly the last eighty years. And

historically, periodic major floods and sedimentation from a disturbed watershed also have been significant factors in the changing configuration of both lagoons.

The effective drainage basin for San Dieguito Lagoon is the 43 square mile watershed downstream from Lake Hodges. The mean seasonal rainfall in this basin varies from 10 inches along the coast to 32 inches in the mountains; the mean seasonal run off at the mouth of the San Dieguito River is 43,400 acre feet.

The 46 square mile San Marcos River drainage basin comprises the watershed of Batiquitos Lagoon. Mean seasonal precipitation for this drainage varies from 10 to 16 inches, from the coast to the mountains. It is estimated that 100 year flood discharges would deliver 15,000 cubic feet per second into Batiquitos Lagoon.

The entrances of both lagoons have long been blocked from tidal exchange by broad sand bars. Elimination of tidal influence has caused a water characteristic pattern in the lagoons of high salinities in the dry season and low salinities in the wet season. Parts of both lagoons also dry up during the summer season. This pattern of changing salinity and water surface was stabilized by the addition of sewage effluent to both lagoons. But, nutrient-rich effluent presented another set of water characteristics and problems--decaying organic matter, oxygen depletion, sludge build-up, odors and insects. However, water characteristics of both lagoons reverted to the former regime of wide ranging salinities and varying water surfaces, when sewage effluent was diverted to the San Diego metropolitan sewer system and an ocean outfall.

Most of the wetlands and adjacent upland areas of both San Dieguito and Batiquitos lagoons are privately owned. Public ownership is limited at Batiquitos to the South Carlsbad State Beach parcel and at San Dieguito to the State-owned southern California exposition grounds and small parcels north of the lagoon, and the 4-acre Del Mar City Bluff Preserve at the mouth of San Dieguito.

There is public access to portions of both lagoons, but there are no roads or other access facilities for public use of the lagoon areas. Present demand for access is primarily to observe wildlife, as neither lagoon furnishes such attractions as hunting, fishing or picnicking opportunities, which would require improved access. Future access needs will depend upon improvement of the aesthetic and ecological qualities of both lagoons.

Jurisdiction of San Dieguito Lagoon is divided between the cities of Del Mar and San Diego; Batiquitos Lagoon falls entirely within the jurisdiction of the County of San Diego. Several proposals have been made for the public acquisition of large areas in or adjacent to both lagoons. The City of Del Mar has proposed securing the entire 100-year flood way at San Dieguito Lagoon for open space, preservation of natural amenities and demarcation of the city from urban areas to the north. San Diego County has proposed public acquisition of the entire wetland area of Batiquitos Lagoon and the adjacent northern hill slope and southeastern bluffs.

At present the principal land use in and around San Dieguito Lagoon consists of the Del Mar horse racing facilities, commercial-recreational use in the form of grounds and parking lots at the Southern California Exposition fairgrounds. Two major highways, several local roads and the

railway right-of-way also constitute a major land use at San Dieguito. Remnants of an old airport and the old sewage pond sites are gradually being reclaimed by natural processes. Lands surrounding the San Dieguito Lagoon are developed, primarily for residences and agriculture. Several land use plans have been proposed for the San Dieguito Lagoon area by the city and county of San Diego and by the city of Del Mar. Each of these proposals speaks to conservation of parts or all of the undeveloped San Dieguito wetlands and flood plain.

The entire wetland area of Batiquitos Lagoon is relatively undeveloped, although it is transversed by two major highways, a local road and the railroad. Some of the surrounding lands are undeveloped, but most are developed for agriculture and residential development. County land use plans also exist for Batiquitos Lagoon. Essentially similar to those proposed for San Dieguito, they include preservation of open space and flood plain zoning. But, the undeveloped, attractive rural setting of Batiquitos Lagoon also has promoted several county plans for its development as a regional park.

The habitats of both lagoons and environs are classified into: a) channels and ponds, b) mudflats and salt flats, c) marsh, d) upland transition grassland and e) riparian. Ninety-four plant species have been recorded from the San Dieguito Lagoon wetlands, and 54 plants from Batiquitos Lagoon. Marsh and salt flats occupy about 31% of the San Dieguito habitats; about 16% is in channels and ponds; the remainder is

upland and riparian habitat. At Batiquitos Lagoon the largest portion (57.0%) of its habitats consists of barren salt flats; channels and ponds add another 12.0%. Two-thirds of the remaining Batiquitos habitat is marshy and the balance is mostly upland grasslands.

Despite the adverse environmental changes that have occurred in the past three or four decades, both lagoons continue to support many numbers and kinds of waterfowl, shore birds, and other water-associated birds, like herons, egrets, grebes, loons, gulls, etc. Sixty-three species of water-associated birds have been recorded at San Dieguito Lagoon and 75 species at Batiquitos Lagoon. Rare and endangered bird species also occur in both lagoon wetlands, including the California least tern. Both lagoons are among the few sites in southern California where this rare tern still nests. Also seen about the lagoons and their environs are many species of raptors and upland birds.

In addition to the bird life, several species of mammals, reptiles and amphibians are found in both lagoons. Quantitative data are not available on these animals, but because of larger acreages of upland and grassland habitat, San Dieguito Lagoon probably supports larger numbers of mammals, reptiles and amphibians.

Because of the instability of aquatic conditions in both lagoons, little marine life is present. Only 4 species of fish are known to San Dieguito and only 6 in Batiquitos. No living marine shellfish exist in San Dieguito Lagoon, although a variety of mollusk shells found in the channel sediments indicate the existence of several tidal lagoon species in the recent past. By far the greatest number of invertebrates sampled in San Dieguito Lagoon are aquatic insects, a good source of food for various fish and wildlife species. Batiquitos Lagoon, on the other hand,

still maintains large, living populations of ghost shrimps and polychaete worms near the lagoon entrance. The presence of large, dead populations of marine organisms and shellfish remains, indicates that in recent history there were large populations of marine invertebrates at Batiquitos, too. Further inland, good insect populations also exist at Batiquitos.

Both lagoons serve as broad bands of uncluttered "open space," a rare commodity on the southern California coast.

Recreational and educational uses, such as bird watching, nature study and scientific study, are the primary resource uses at San Dieguito Lagoon. Groups of 25 to 50 preschool and elementary school children use the lagoon area for nature study; and local colleges and universities use the lagoon almost continually for scientific studies. Dogs and horses are often exercised near the mouth of the lagoon and motorcyclists frequently use the central lagoon area.

Some bait fishing exists in Batiquitos Lagoon, but resource use there is principally non-appropriative and recreational. No records are available concerning aesthetic or natural history enjoyment or study, but bird and conservation groups, local schools, colleges and universities, use Batiquitos Lagoon in the same way, and probably to the same extent, that they use San Dieguito. The undeveloped eastern basin of Batiquitos Lagoon has been used as a test flight area for helicopters from Palamar Airport.

The natural resources of both San Dieguito and Batiquitos lagoons are presently in a degraded condition. The lagoons are centered in areas

of rapidly increasing populations, where there is pressure for additional development and increased amounts of open space and recreational opportunity. Hence, local, state and federal agencies are "under the gun" to plan for the future use of resources at San Dieguito and Batiquitos lagoons.

There are basically three options, or alternatives, to planning for the future of these two important wetlands: 1) preserve the lagoons as they currently exist, 2) restore these areas to their former natural condition, or 3) develop the lagoons into artificial environments for commercial and/or public-recreational usage. For the purpose of this report, it is assumed that planning will be based on the objective of obtaining optimum natural resource values for these presently degraded lagoons. Hence, this report deals with the problems of resource maintenance and enhancement, and conflicts in resource use, from the point of view that the natural resource values of San Dieguito and Batiquitos lagoons will be improved.

At present the principal problems facing the lagoon resources involve lagoon entrance maintenance, flood control and sedimentation, pollution, and development and encroachment, the latter including commercial-recreational and residential development, marinas and sand mining and industrial development of the environs. There can be no doubt that both San Dieguito and Batiquitos lagoons now stand at a critical crossroad with respect to the choice of restoring their past resource values or engineering them into new, artificial environments. Resolving natural amenities and economic growth is never an easy task. This report stands as a guideline to whoever is faced with making that choice.

RECOMMENDATIONS

San Dieguito and Batiquitos lagoons are important wetlands for wildlife. While both have been altered, San Dieguito much more than Batiquitos, each retains living resource values. More importantly, each lagoon possesses great potential for the enhancement of its resource values. Therefore, to maintain the existing resources and to enhance them where possible, the Department of Fish and Game recommends that:

1. The existing wetlands of San Dieguito and Batiquitos lagoons be acquired with public funds and maintained for their natural resource and aesthetic values. Open space and coastal wetlands are becoming rare and increasingly valued commodities in southern California. The Department endorses the proposals by local government for public acquisition of large areas of both lagoons. Batiquitos Lagoon ranks high on the Department's priority list of coastal wetlands recommended for acquisition.

2. Studies be made to determine the best method(s) of improving the productivity of the lagoons as aquatic systems. Returning the lagoons to estuarine conditions will solve existing problems; that is, extreme ranges in salinities, lack of circulation, build-up of nutrient-rich sludge, odors and undesirable insects. Studies should explore the feasibility of establishing permanent tidal flows and dredging parts of the wetlands to increase tidal prism.

Economic and engineering factors, as well as biological factors, will have to be considered. Efforts should be made to enlist the assistance of the U. S. Army Corps of Engineers. The results of such studies would not only benefit the lagoon under study, but could be applied as well to other southern California lagoons.

3. Tertiary-treated waste water be utilized when available to support a freshwater biota at the upper portions of each lagoon. The Department supports the concept of reuse of waste water for enhancement of wildlife resources.

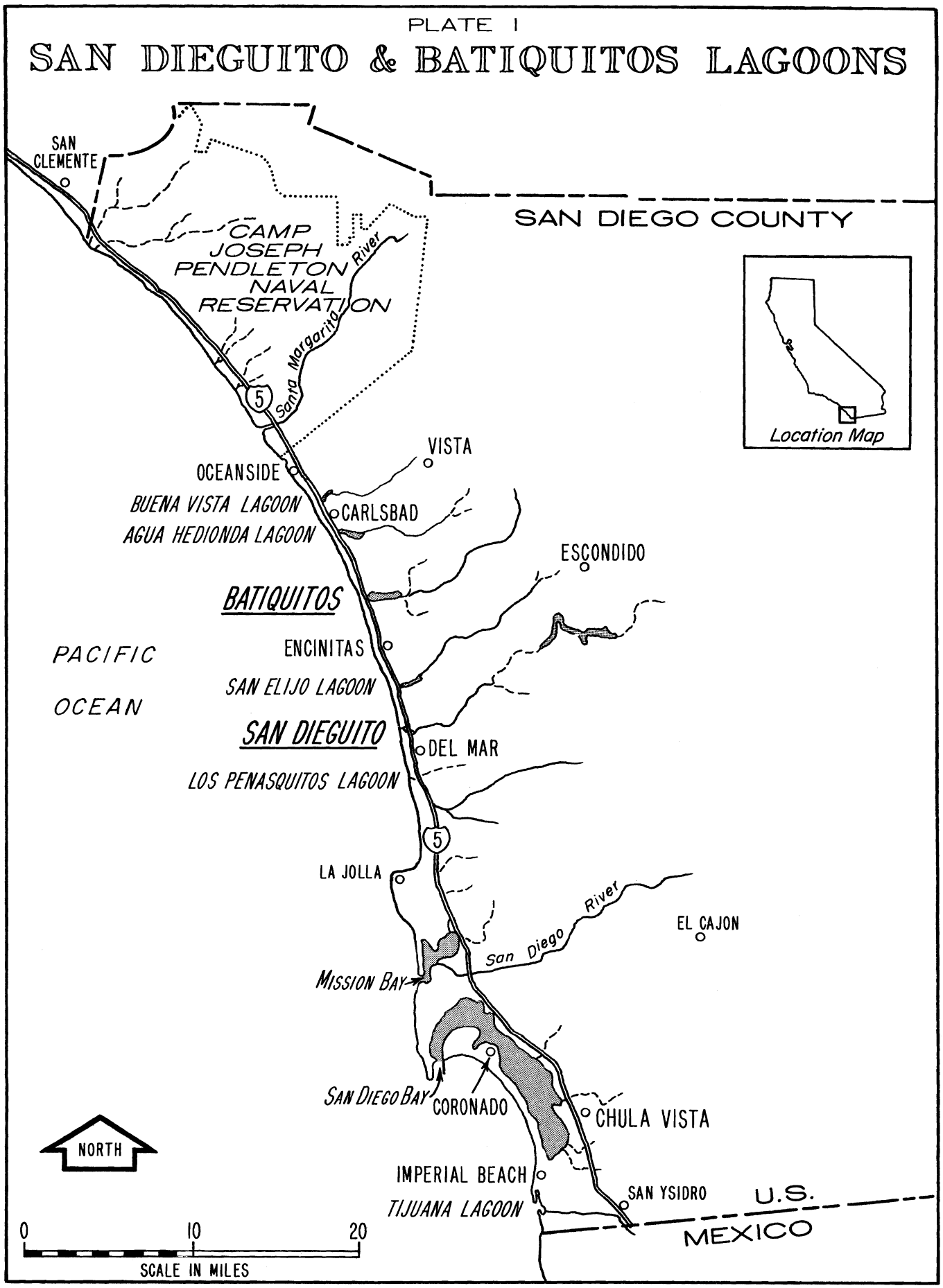
4. Filling of existing or potential wetlands be prohibited, except for purposes of improving estuarine productivity. Coastal wetland habitats comprise some of the most productive ecosystems known, and support a wide variety of wildlife and fish, including several endangered species. Destruction by filling (and dredging) has reduced these vital habitats to a critically low point throughout the State.

5. Any flood control or dredging project for either lagoon be designed and carried out in a manner to improve lagoon values for fish and wildlife. Wherever possible, non-structural measures and effective land use zoning should be used for flood control in both lagoon areas. However, structural flood control programs, if necessary, can be designed to enhance, rather than degrade, valuable lagoon habitats.

6. Any study to enhance the fish and wildlife values of Batiquitos Lagoon include a determination of methods to reduce siltation into that lagoon. Eventually siltation will interfere with efforts to restore tidal action or to create a freshwater marsh area in Batiquitos Lagoon.

PLATE 1

SAN DIEGUITO & BATIQUITOS LAGOONS



THE LAGOONS AND THEIR ENVIRONS

Location and General Description

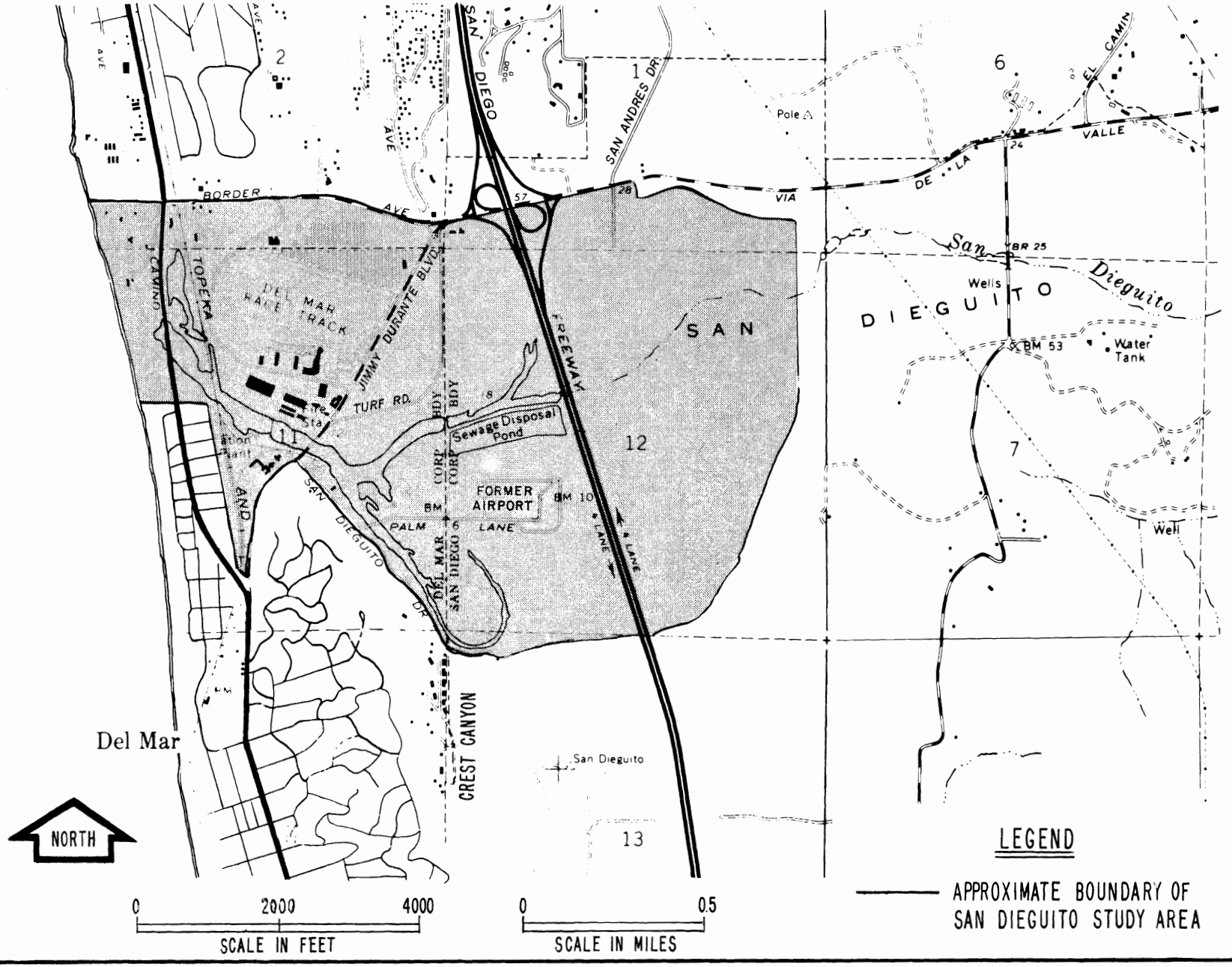
San Dieguito and Batiquitos lagoons are located in the central portion of San Diego County's coastal plain (Plate 1). San Dieguito Lagoon (Plate 2), which is often called Del Mar Lagoon, lies in the San Dieguito River basin on the northern border of the City of Del Mar (about 20 miles north of central San Diego City) and south of the unincorporated coastal community of Solana Beach. Batiquitos Lagoon (Plate 3) is about 8 miles north of San Dieguito Lagoon between the unincorporated community of Leucadia and the City of Carlsbad.

Since the construction of the Del Mar racetrack, fairground, and parking facilities, San Dieguito Lagoon has been confined to a single main channel of less than 200 feet in width, extending inland about 1-1/2 miles. The lagoon channel is joined by the San Dieguito River flood channel about three-quarters of a mile inland from the lagoon's mouth. The lagoon channel system is shallow with an average water depth of about 2 feet and is surrounded by roughly 269 acres of salt marsh and maritime grassland. East of, and isolated by Interstate-5 Highway is a remnant of former San Dieguito wetlands. This area includes about 330 acres of flood plain and presently is comprised of grassland and remnants of the upper salt marsh of the original lagoon.

Batiquitos Lagoon extends inland from the Pacific Ocean for about 2.5 miles, and has an average width of about 1/2 mile. Only the western portion of the lagoon and the San Marcos Creek delta contain permanent water-filled channels, which are separated by islands of salt marsh or brackish water marsh. Most of the lagoon area (about 340 acres) comprises a barren salt flat which is inundated by 4 to 6 inches of water during the rainy season.

PLATE 2

SAN DIEGUITO LAGOON AREA



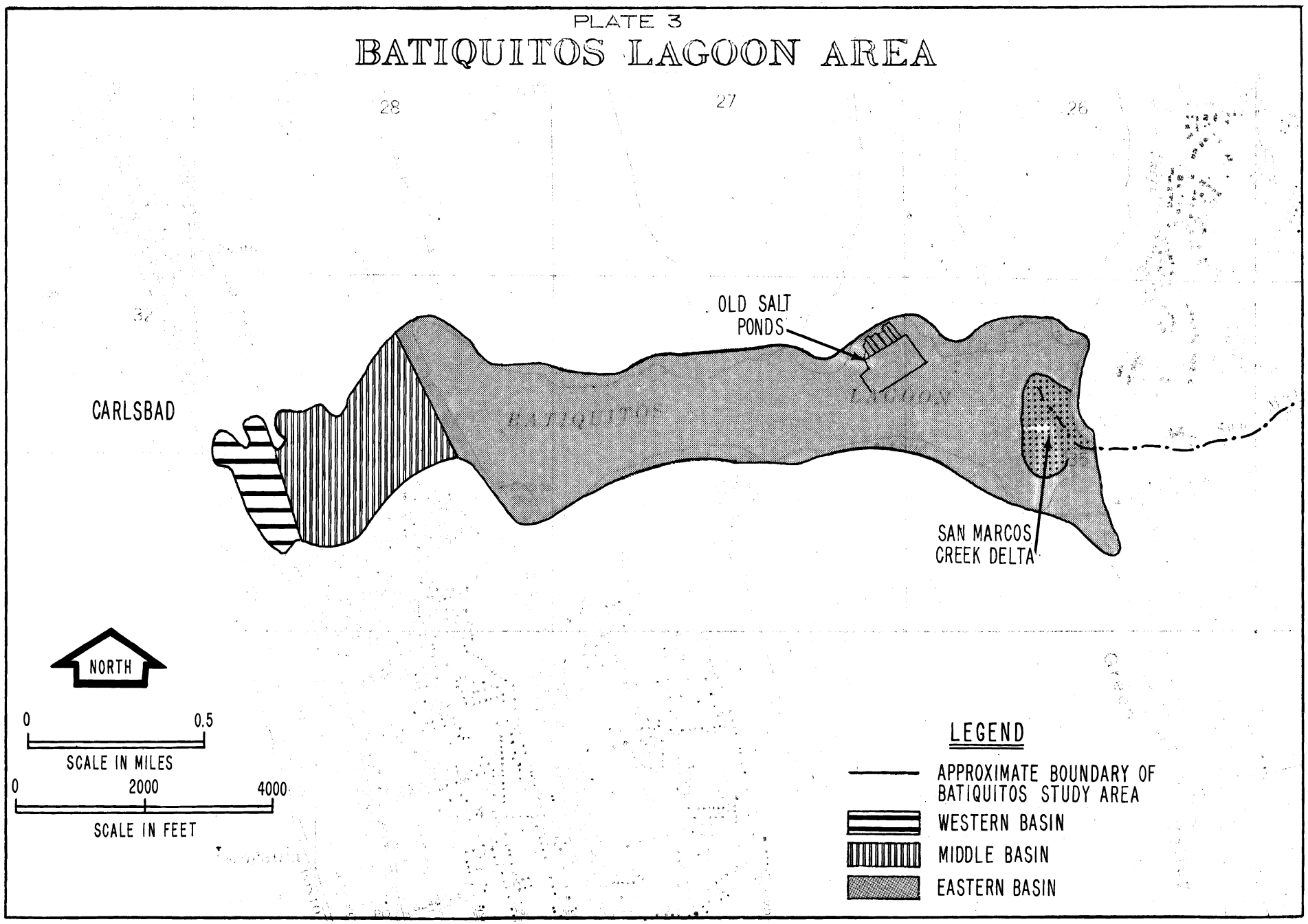
Sand bars separate both lagoons from the ocean for most of the year, preventing tidal exchange. These sand bars are temporarily removed (for a few days or weeks) only by major floods (10-year floods) or by bulldozing through the bars to drain the lagoon waters. The former natural drainage patterns of both lagoons have been considerably changed by two sets of man-made alterations: 1) the construction of the California Southern Railroad (1883-88) and the Santa Fe Railroad (1934), the Pacific Coast Highway (1912 and 1927) and the highway, Interstate-5 (1965-66), which have dissected the lagoon channel systems and constricted their courses to the bridge underpasses; and 2) by the construction of upstream dams, at Lake Hodges and Lake Sutherland on the San Dieguito River and at Lake San Marcos on the San Marcos River, the dams have greatly reduced the volume and scouring potential of the flood waters entering the lagoons.

History

In common with the other coastal lagoons in southern California, both San Dieguito and Batiquitos lagoons are remnants of former deep water embayments. These particular embayments originated 10 to 25 thousand years ago when melting of the polar icecaps caused the sea level to rise and flood the deeply-scoured lower basins of San Dieguito and San Marcos rivers, forming large tidal lagoons or bays which probably extended inland as far as El Camino Real. Shells, dated by radiocarbon methods, and found 6 feet below the surface of San Dieguito Lagoon (Scott, Mudie & Bradshaw, 1975) and Batiquitos Lagoon, suggest that both lagoons were large, deep-water, ocean embayments until approximately 2,000 years ago, after which they became filled with river-borne silt and with marine sand. Because the San Dieguito River drainage basin (345 square miles) is much larger than the San Marcos drainage basin (46 square miles), San Dieguito Lagoon

PLATE 3

BATIQUITOS LAGOON AREA



probably filled more rapidly with river-transported sediment than Batiquitos Lagoon (Chang, 1974). Hence, today, the San Dieguito wetlands largely comprise marsh or grassland-covered silt or clay sediments, cut deeply by narrow, former tidal channels; whereas, Batiquitos Lagoon is still largely an unvegetated, playa-like, sediment deposition basin.

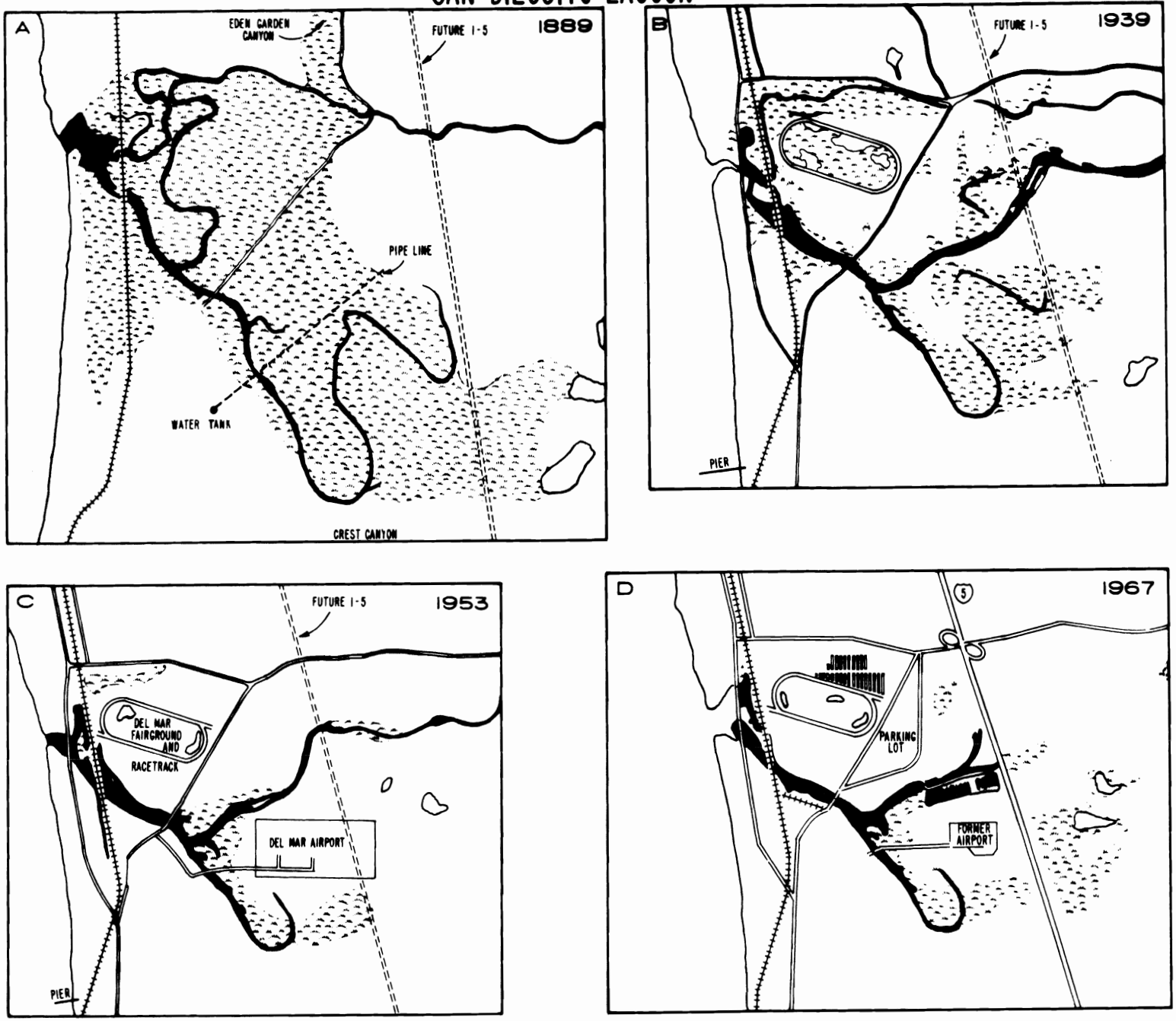
The hill slopes and bluffs fringing both lagoons were occupied for thousands of years by California Indians. Shell material excavated from middens on these hills provide ample evidence that (up until 4,000 years ago) the lagoons abounded in shellfish, including scallops, cockles (*Chione*) and oysters, and that an abundance of shellfish was harvested from Batiquitos Lagoon by Indians as recently as 800 years ago (Miller, 1966). The Batiquitos midden material is of special archeological interest because it is the youngest dated shell material for the San Diego coastal area. Conversely, the San Dieguito midden near the lagoon entrance also is of great archeological interest because of its recently-revealed antiquity (nearly 50,000 years old). This revelation suggests that ancient man may have migrated into North America and lived on the shores of southern California's coastal lagoons at least 30,000 years earlier than was previously known (Bada *et al.*, 1974; Ortutay, 1974).

Little is known about the condition of the lagoons at the time of the first Spanish settlement in 1769. The Portola expedition moved north along the innermost fringes of the lagoons, hence there are no reports as to whether or not the entrance channels of the lagoons were open. However, the valleys were described (Pourade, 1961) as very green and well-covered with grass, with flowing streams or ponds of water, and with thickets of riparian vegetation, such as wild roses and wild grapes--suggesting that in former

PLATE 4

HISTORICAL CHANGES IN CHANNELS & MARSHLANDS

SAN DIEGUITO LAGOON



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times more fresh water flowed over the flood plains and into the lagoons. It is of interest that the Mexican-Spanish word "batiqui" means water hole, hence the name of Batiquitos Lagoon may have originated from the word "batiquitos," meaning small water holes.

A comparison of the available historical records (e.g. hydrographic charts, topographic maps, aerial photos) of the lagoon areas has revealed that the two lagoons differ greatly with respect to the changes that have occurred in their wetland areas during the past 80 years; hence, these recorded historical changes are discussed separately.

San Dieguito Lagoon

Before the turn of the century an extensive salt marsh (604 acres) extended nearly two miles (Plate 4A). The construction of the Del Mar fairgrounds and racetrack, which commenced in 1935, greatly reduced the acreage of lagoon channels and marshland by approximately 200 acres, yet it appears that the lagoon entrance remained open (at least periodically) up until at least 1941 (Plate 4B). An early report on the water resources of San Diego County (Ellis and Lee, 1919), that was conducted prior to the completion of Lake Hodges dam in 1919, stated that "only the Santa Margarita, San Dieguito and Soledad [streams] are able to keep narrow channels open through beach deposits."

Other testimony indicating that the entrance channel of San Dieguito Lagoon formerly was more or less continuously open to tidal exchange comes from the following records:

a. A brochure called "Del Mar," distributed by the South Coast Land Company in about 1910, stated that there were " . . . several miles of lagoons of salt water and connected [sic] with the Pacific the year-round" (Goodkind, 1974).

b. A letter from Dr. Fred Baker to zoologist, Professor William Ritter (dated September 30, 1906), stated that there were oysters on the pilings in Del Mar Slough, two to three specimens of bay scallops (*Aequipectin aequisculcatus*) on the channel banks, and hornshells (*Cerithidea sacrata*) and razor clams ("probably *Solecurtus californianus*") inland from the beach area. These molluscs are only known to survive in lagoons which are more or less continuously open to tidal water exchange.

c. An interview with an executive board member of the San Elijo Alliance,[1] during which Mr. Thomas Clotfelder described fishing for halibut in the main channel of San Dieguito Lagoon until early in the 1940's and recalled the presence of cord-grass (*Spartina foliosa*). Cord-grass, which only survives in tidal lagoons, has been absent from San Dieguito since about 1963.

During a 3-year study (1938-41) of the salt marshes of San Diego County (Purer, 1942), it was reported that the entrance channel of San Dieguito Lagoon was dry during the summer months. However, the fact that the channel water salinity did not depart significantly from the salinity of ocean water (34 parts per thousand) during the dry summer, fall and early winter months of 1939-40 strongly indicates that there was a significant exchange of tidal water between lagoon and ocean during that time.

The entrance of San Dieguito Lagoon was blocked by an extensive sand barrier by July 1953 (aerial photo; Fletcher, 1973), and it has remained closed since that time except during the winter flood of 1966 and whenever it has been deliberately opened by bulldozing to drain the lagoon for water quality purposes.

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[1] A local conservation organization dedicated to the preservation of San Elijo Lagoon and other San Diego County lagoons.

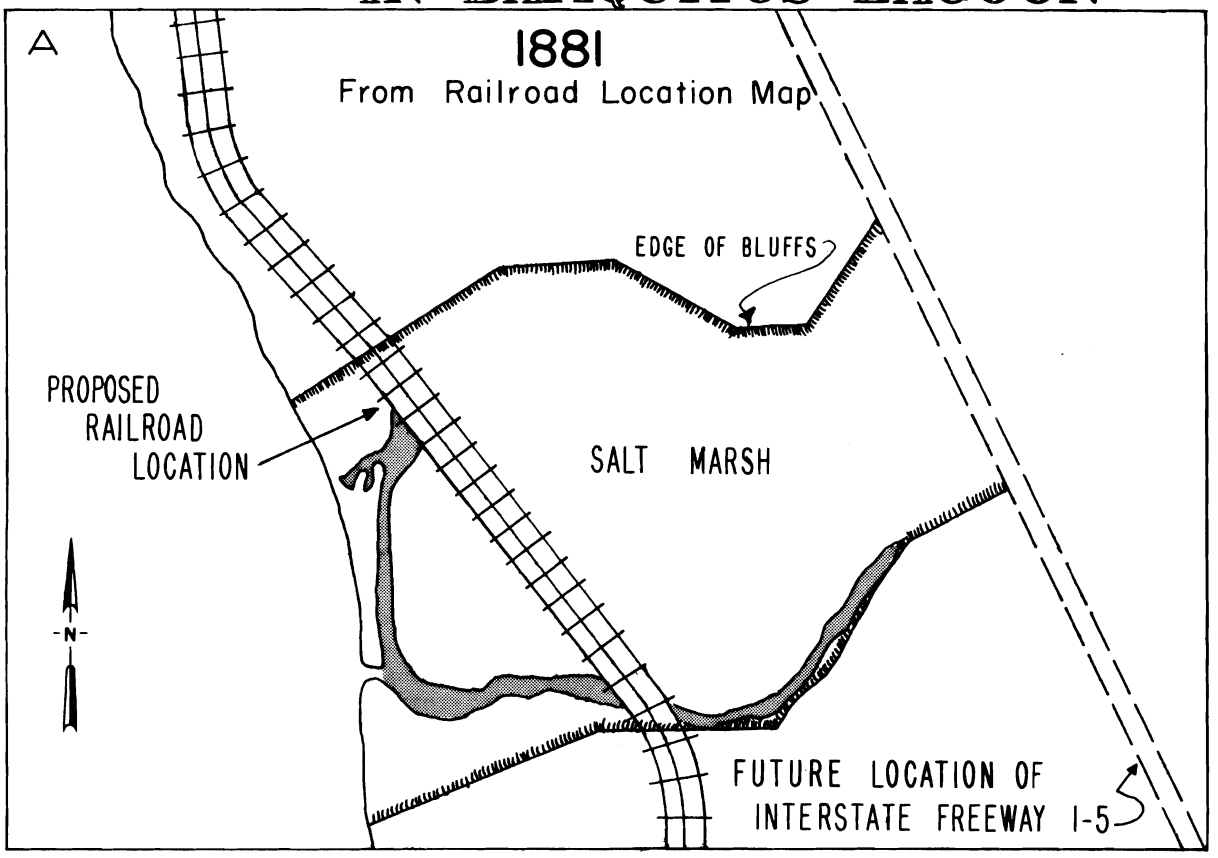
Until about 1939 farming continued in the upper portions of San Dieguito Lagoon, west of the present Interstate-5. Thereafter, this upland area was cleared for the construction of the Del Mar Airport runway, buildings and concrete bunkers, which were used during World War II. The buildings, which were subsequently used for light manufacturing industry (until about 1970), now have been demolished; but several paved or dirt roads still criss-cross this area.

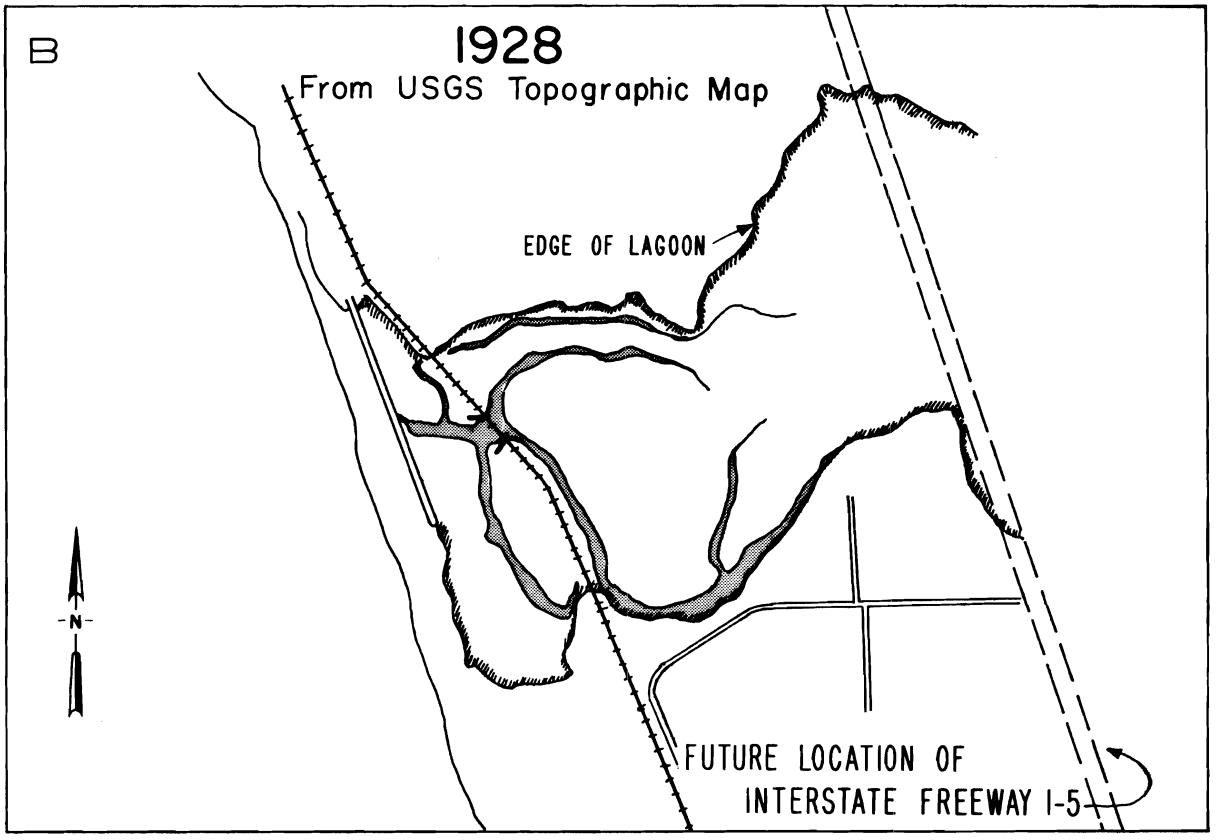
Other historical changes that have altered the San Dieguito Lagoon and wetlands include: 1) filling of the former marsh area south of the lagoon between Pacific Coast Highway and the railroad, which filling began around 1905 with the seaside development of the South Coast Land Company (City of Del Mar, 1974); 2) development and filling of the marsh area to the west and east of Jimmy Durante Blvd. on the south side of the lagoon channel, including a portion of the lagoon channel (Plate 4B); 3) diking of the north side of the lagoon channel by 1953 (Plate 4C); 4) progressive eastward and southward extension of fill in the former area of marshland between Turf Road and the freeway(Plate 4D); 5) the virtual isolation and degradation of the eastern half (51.3%)of the original lagoon and marsh ecosystem by the completion of the Interstate-5 Highway in 1966(Plate 4D);and, most recently(1973-74), filling of the flood plain at the south end of San Andreas Drive, formerly called Banana Street (Plate 2). Fillings and other land use changes have significantly altered approximately 1/3 acres of the original 604-acre wetland.

The discharge of sewage effluent into the San Dieguito Lagoon from 1940 to 1974 has had a major effect on its wildlife resources. This impact is discussed in the Water Quality section of this report.

PLATE 5

HISTORICAL CHANGES IN BATIQUITOS LAGOON





Batiquitos Lagoon

In contrast to the San Dieguito Lagoon, almost no changes in the configuration of the channels and the distribution of wetland areas can be observed from the available historical maps and photos of Batiquitos Lagoon (Dr. J. S. Bradshaw, pers. comm.). Exceptions are those alterations which have taken place in the lagoon entrance area west of the freeway (Plate 5) and at the extreme eastern end of the lagoon just west of El Camino Real (Plate 3).

An 1881 railroad survey map shows that Batiquitos Lagoon was connected with the ocean by a narrow channel, located towards the southern end of the beach, with the main channel extending a short distance inland along the southern lagoon border (Plate 5). This survey map, however, is the only one known to show an open lagoon entrance. By 1928, the entrance area had shifted to the north end of the beach (Plate 5) and a channel had formed along the base of the north hill slope. These changes possibly occurred during the major flood in 1896, that washed out the railroad between Oceanside and San Diego (Harmon, undated). This shift in the channel entrance position also appears to be confirmed by the fact that the sediment at the south end of the western lagoon is composed entirely of marine sand and shell, whereas that in the vicinity of the present entrance channel on the north side of the lagoon consists of a thin layer of marine sand over a much thicker layer of alluvial silty clay, such as characterizes the backwater areas of tidal lagoon channels.

Today, most of the remnant lagoon channels are less than two feet deep; the deepest portion in the vicinity of the 1881 entrance was about 4-1/2 feet deep (Harmon, undated).

The expansion of the San Marcos Creek alluvial fan into the eastern lagoon basin (Plate 3) that has occurred since 1928, clearly indicates that the shallow lagoon basin (average elevation less than 2 feet above mean sea level or about 5 feet above mean low low water datum) is gradually being filled by terrestrial sediments from the San Marcos Creek drainage.

The extent to which the sediment-filling of Batiquitos Lagoon has been accelerated by the development of the surrounding uplands is presently unknown. Commercial farming operations commenced in Carlsbad in about 1914, with emphasis on vegetables and grains; followed by flower, bulb and avocado production in 1922 (Harmon, undated). Yet, major changes in the lagoon shoreline between 1928 and 1970 are not apparent except for the San Marcos Creek delta area. The increase in the size of the San Marcos Creek delta may reflect the intensive suburban development that has occurred more recently in this basin (e.g., La Costa and the City of San Marcos on San Marcos Creek, and residential development east of Encinitas on the Encinitas Creek tributary). A conspicuous increase has been observed in the volume of sand in the Encinitas Creek Valley during the past half-decade, and it is possible that this sand will be transported into Batiquitos Lagoon by the next major flood (John W. Rutherford, pers. comm.).

Unlike the San Dieguito Lagoon, little deliberate land-filling has occurred in Batiquitos Lagoon other than that associated with the construction of the major north-south transportation routes. A 1-1/2 acre fill occupies the site of the new Leucadia sewage pumping station in the western lagoon basin. Unstabilized soil from this fill has eroded and washed into the lagoon.

During 1901 and 1902, the California Salt Company operated 25 acres of salt-evaporation ponds in the eastern lagoon basin (Plate 3). Highly saline water for the operation was pumped from wells drilled 30 to 50 deep in the dry lagoon. The earthern dikes of the abandoned ponds still remain. In addition, another low dike is located to the south of the old salt ponds. It may have been constructed by a duck-hunting club that formerly operated in Batiquitos Lagoon.

Historical records indicate that the eastern basin of Batiquitos Lagoon was dry for most of the year from at least the beginning of the century until about 1967. By this time, however, secondarily-treated sewage effluent was being discharged into the lagoon and began to create a permanent pond at the eastern end.

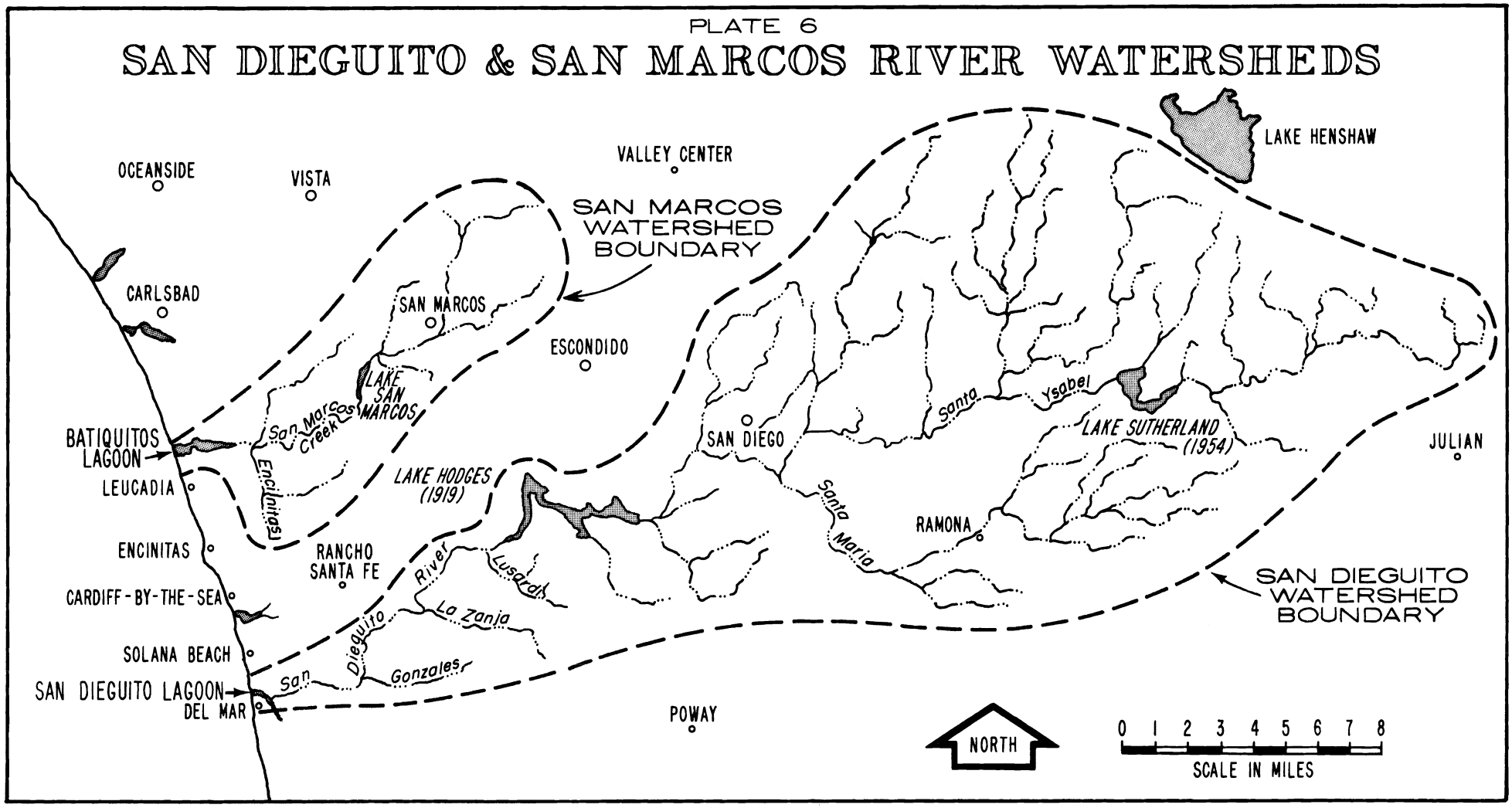
Geology and Hydrology

San Dieguito and Batiquitos lagoons both occupy the river-cut, alluvium-filled basins of ancient river valleys (Kennedy and Moore, 1971). The 345 square mile San Dieguito drainage basin extends inland to the Cuyamaca Range north of Julian, to an elevation of over 5,700 feet (Plate 6). The mean seasonal rainfall in this basin varies from a minimum of 10 inches along the coast to 32 inches in the mountains (Calif. Dept. Water Resources, 1959). Runoff in the watershed is now largely controlled by the Lake Hodges and Lake Sutherland dams. The mean seasonal natural runoff is 43,400 acre-feet (ac. ft.) at the mouth of the river and 41,200 ac. ft. at Lake Hodges.

Prior to the completion of Lake Sutherland in 1954 and the commencement of present-day trends of low seasonal rainfall, water in Lake Hodges used to overflow the dam periodically. However, no water has topped the dam

PLATE 6

SAN DIEGUITO & SAN MARCOS RIVER WATERSHEDS



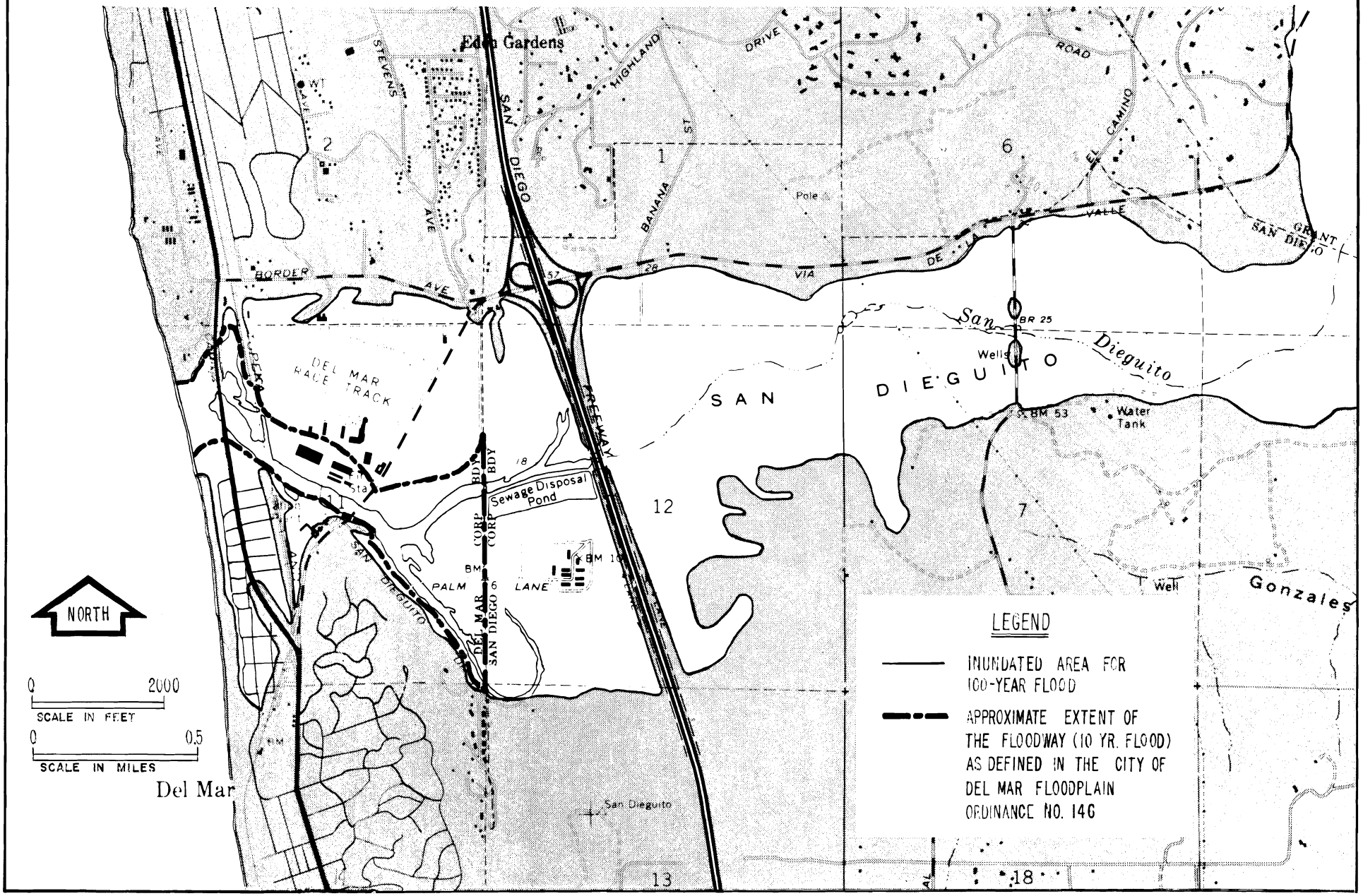
in recent years; hence, at present, the effective drainage basin for San Dieguito Lagoon is the 43 sq. mi. watershed downstream from Lake Hodges. Three major tributaries drain into the basin below the Lake: Gonzales Creek, the intermittent stream on the southern border of the flood plain, east of Interstate-5; La Zanja Creek, that originates along with Gonzales Creek on the undeveloped hilly terrace between Carmel Valley and the San Dieguito Valley; and Lusardi Creek, which originates inland near the rapidly-developing community of Rancho Bernardo. Two smaller water courses drain into the central lagoon basin from Crest Canyon on the south and Stevens Avenue Canyon on the north.

Although the upstream dams have greatly reduced the volume of surface water that entered the lower San Dieguito River basin and the lagoon during years of normal rainfall, they do not provide protection from major floods. The predicted peak discharge of a 100-year flood (Plate 7) below Lake Hodges is 75,000 c.f.s., and 20,000 c.f.s. for a 10-year flood (Moffat and Nichol, 1971). As early as 1940, an unlined flood control channel was excavated to contain the flood water of the San Dieguito River in the western valley (Purer, 1942). As development of the property in the lagoon area west and northeast of Interstate-5 has proceeded, increased attention has been given to the need to protect developed areas from flood damage. Two engineering studies have recently been completed which suggest several different flood control solutions (see Flood Control and Sedimentation section).

The 46 sq. mi. drainage basin of the San Marcos Creek system extends inland from the ocean to an elevation of about 1,700 ft. in the Merriam Mountain range, between the cities of San Marcos and Escondido (Plate 6). A major tributary, Encinitas Creek, drains the broad, sandy Green Valley

PLATE 7

SAN DIEGUITO RIVER AREAS OF POTENTIAL INUNDATION



Canyon, southeasterly of the lagoon. The San Marcos Creek stream channel is steep-walled and rocky (containing several attractive, rock-lined pools and waterfalls) between San Marcos Lake and La Costa, below which it spreads out into the broad flat basin of Batiquitos Lagoon (U. S. Army Corps of Engineers, 1971).

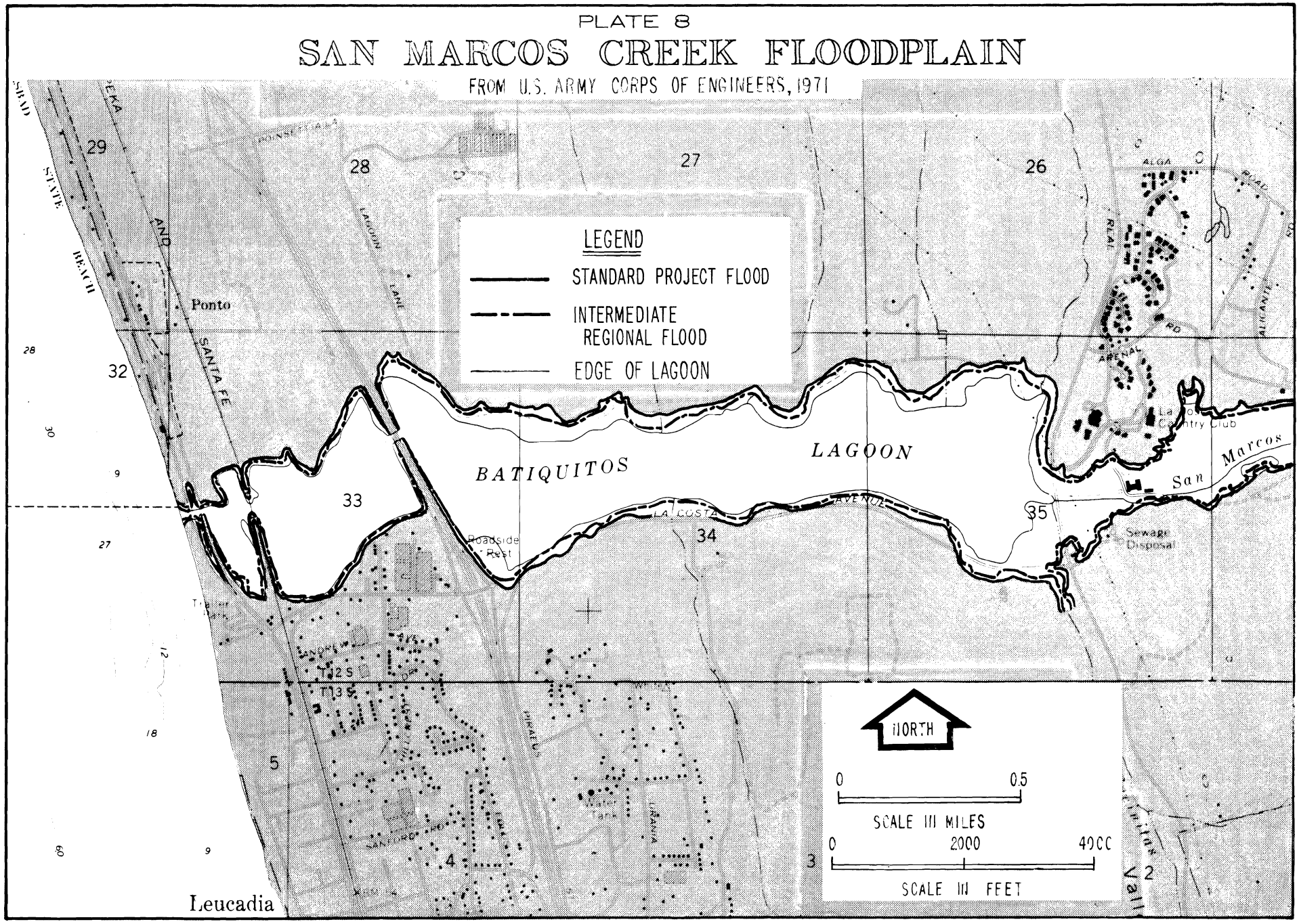
The mean seasonal precipitation for this drainage area ranges from about 10 inches near the coast to a maximum of 16 inches in the mountains. The dam at Lake Marcos was constructed in 1952. It is estimated that a 100-year flood would discharge 15,000 c.f.s. into the lagoon and a "Standard Project" flood (predicted for the most severe combination of meteorological conditions), 23,000 c.f.s. Either type of flood would inundate the entire lagoon area to an elevation of about +7 feet above mean sea level, as well as the southern portion of the La Costa Resort (Plate 8). Flooding in the San Marcos Creek basin is not presently considered a major problem and no plans have been made for flood control in this basin (U. S. Army Corps of Engineers, 1971). However, a flood damage problem may develop as the population expands within the watershed (see Flood Control and Sedimentation section).

The entrances of both San Dieguito and Batiquitos lagoons have long been blocked from tidal exchange by broad sand bars reaching elevations of over 8 feet above mean low low water at San Dieguito and over 11 feet at Batiquitos. Inland from these sand bars extend the shallow lagoon channels flanked by about 1 to 6 feet of clayey or organic-silt sediments, under which lie extensive deposits of sand or silty sand. These marine sands demarcate the former open-water basins and main tidal channels of the former deep-water lagoons which probably resembled the present day conditions in the

PLATE 8

SAN MARCOS CREEK FLOODPLAIN

FROM U.S. ARMY CORPS OF ENGINEERS, 1971



tidal lagoons at Agua Hedionda in Carlsbad, and at Mission Bay, San Diego. Both of the latter two lagoons have been dredged in recent years to remove their former surface layers of clayey salt marsh sediments. The sand in parts of Batiquitos Lagoon extends to depths of more than 100 feet and dredging to a depth of 20 feet is estimated to yield almost 15 million cubic yards of sand (Zatt, 1974a).

The erosion and progressive shrinkage of all the beach areas in San Diego County has become an issue of major concern. About 5,333 cubic yards of sand was lost from the Del Mar Beach alone, between November 1973 and 1974, according to a report by Zatt (1974b) who is presently making a similar study of the beach erosion at Batiquitos Lagoon. Considerable attention is being given to the possibility of dredging the sand from the San Dieguito and Batiquitos lagoons for beach sand replenishment purposes. Following the dredging the lagoon entrances would be kept open to allow for natural scouring of channels and transport of sand to the beaches during flood periods (Chang, 1974).

Water Characteristics

With no tidal waters allowed to enter either of the two lagoons, a pattern exists (Figure 1) of high water salinities in the summer and low salinity in the winter. This pattern is the result of waters within the lagoon evaporating (and concentrating the salts) during the summer, and being diluted by winter rainfall. These tremendous changes in salinity present a harsh environment for fish and wildlife. Most fish species can not survive. And, severe water surface changes (Plate 9), caused by the drying up in summer of areas flooded by winter rains, prevent successful nesting by resident wildlife species dependent upon this source of ponded water.

FIGURE 1

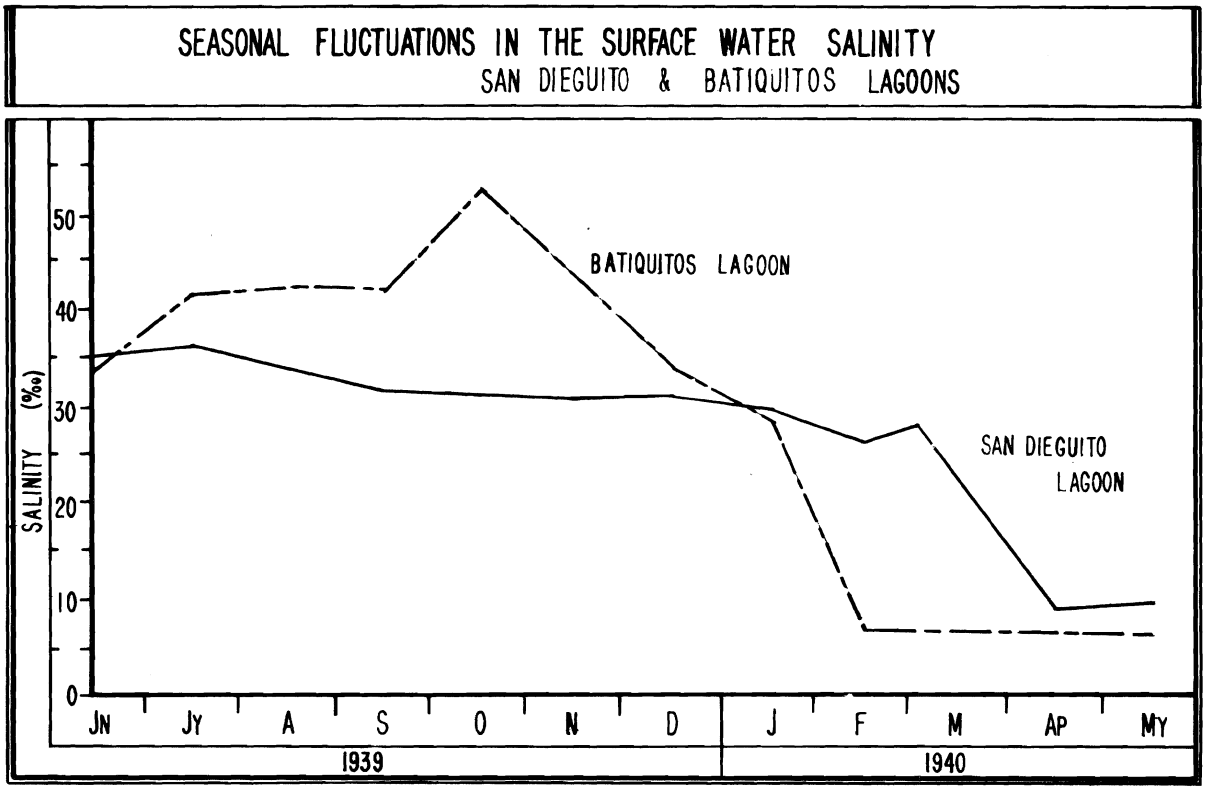
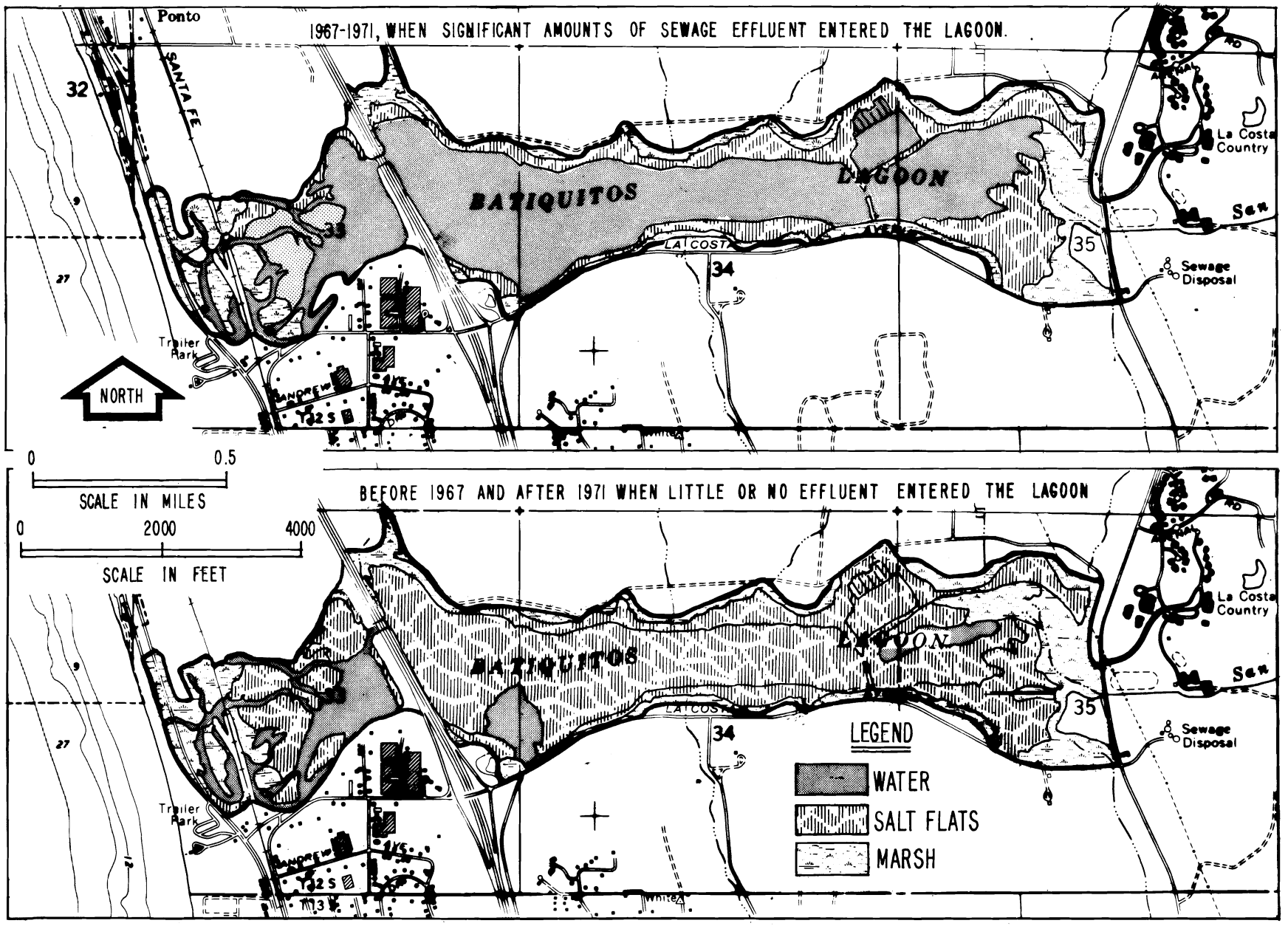

SEASONAL FLUCTUATIONS IN THE SURFACE WATER SALINITY
SAN DIEGUITO & BATIQUITOS LAGOONS
SALINITY (‰)
50
40
30
20
10
0
BATIQUITOS LAGOON
SAN DIEGUITO LAGOON
JN
JY
A
S
O
N
D
J
F
M
AP
MY
1939
1940

PLATE 9

SUMMER - FALL WATER SURFACE CHANGES



This pattern of changing salinity and water surface area caused by man's activities within the watersheds of the lagoons was stabilized by the addition of sewage effluent--in 1940 at San Dieguito Lagoon and 1967 at Batiquitos Lagoon. However, another set of problems evolved from this process--excess nutrients, decaying organic matter, oxygen depletion, sludge build-up, mosquitos, midges and foul odors. While waterfowl and certain shorebird species found this situation to their liking, fish could not thrive under depleted oxygen conditions which have occurred periodically.

The most noticeable result of adding sewage to Batiquitos Lagoon was the formation of extensive algae mats, offensive odors and high populations of mosquitos and midges. The mats of green algae continued to proliferate during the 7-year period sewage was discharged, despite heavy applications of herbicides. Until 1971, the source of sewage entering Batiquitos Lagoon was primarily overflow from a reservoir at La Costa. This reservoir received and stored secondarily-treated effluent for irrigating the golf course. During the winter and occasionally throughout the year, the reservoir overflowed into the lagoon. This situation continued until 1971, when a temporary sewer was constructed to carry sewage to the Encina facility in Carlsbad. This change resulted in the drying out of most of the eastern Batiquitos Lagoon basin. All sewage is now diverted to an ocean outfall. However, the Leucadia Water District facility at La Costa is being maintained in an operable condition. The future use of reclaimed water from this facility to irrigate the La Costa golf course has been considered.

San Dieguito Lagoon was used as a receptacle for sewage effluent for 35 years (1940-74). Until 1974, approximately 200,000-300,000 gallons per

day were discharged into ponds located within the lagoon. The nutrient-rich liquid was decanted from oxidation ponds into the lagoon channels. A layer of sludge 4" to 18" deep formed in the channel bottoms. This source will continue to supply the lagoon waters with nutrients for an undetermined length of time. In July 1974, however, sewage effluent was diverted to the San Diego Metropolitan sewer ocean outfall.

With the resolution of the "sewage problem" of both lagoons, the former regime of wide-ranging salinities and varying water surfaces once again characterizes the water conditions of both lagoons. These conditions will prevail until a permanent solution such as a permanent opening to the ocean, sufficient tidal prism, or inflow of fresh water, is provided.

Land Ownership and Access

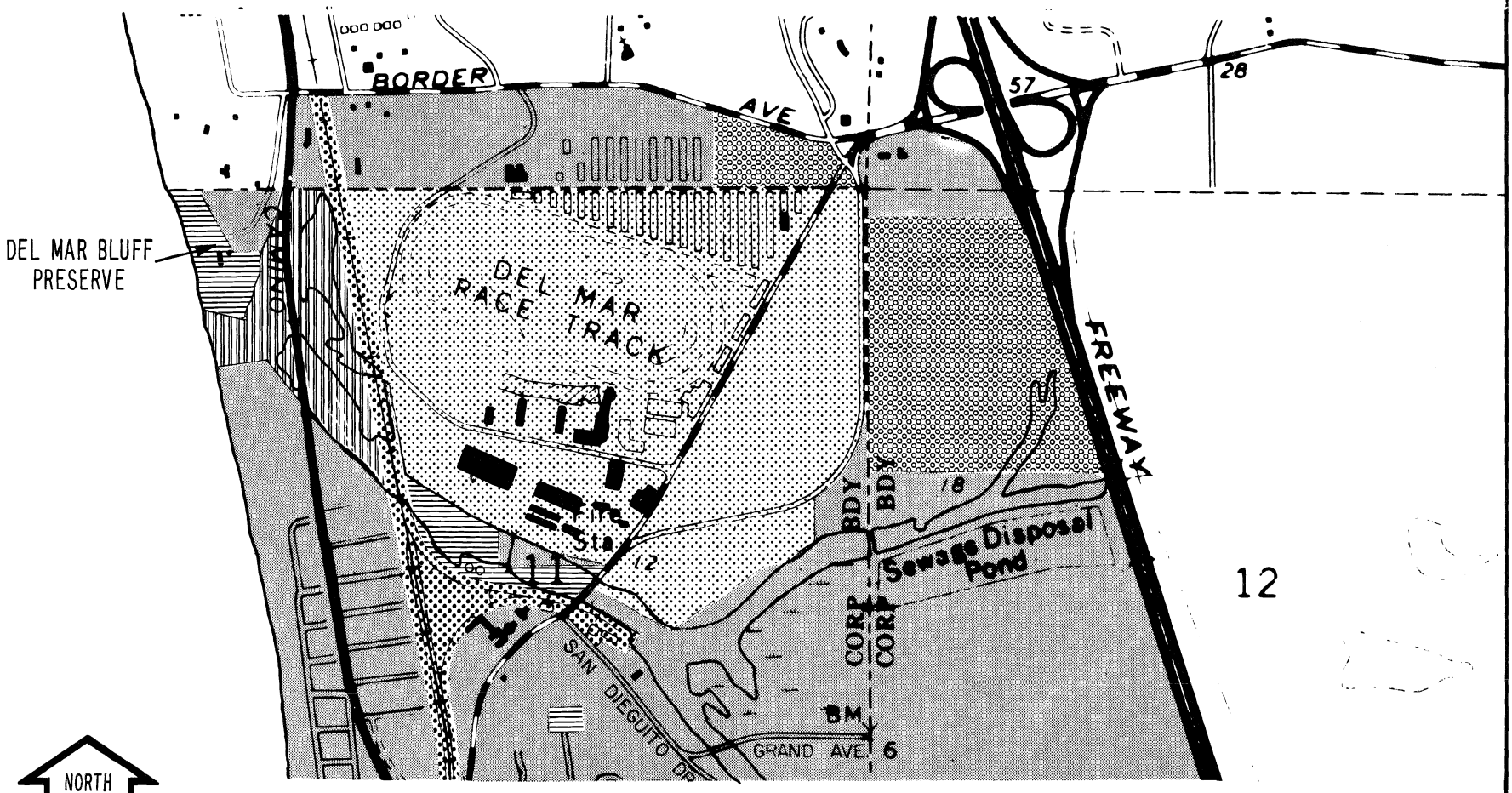
The ownership of the tide and submerged lands of both San Dieguito (Plate 10) and Batiquitos (Plate 11) lagoons is in question. The California State Lands Division is presently in the process of determining the State's historic and existing ownership interests in the submerged lands and the lands under tidal influence.

Most of the upland areas surrounding both lagoons are privately-owned. At Batiquitos Lagoon, however, the South Carlsbad State Beach is a public parcel, and at San Dieguito Lagoon, the State's 22nd Agricultural District owns the 313-acre Southern California Exposition fairgrounds. The 4-acre Del Mar Bluff Preserve located just north of the mouth of San Dieguito Lagoon is owned by the City of Del Mar.

The public has access to portions of both lagoons. While access has not been denied by private landowners, there are no roads or other facilities for public use of the areas. Present demand for access to the lagoons is

PLATE 10

LAND OWNERSHIP SAN DIEGUITO LAGOON



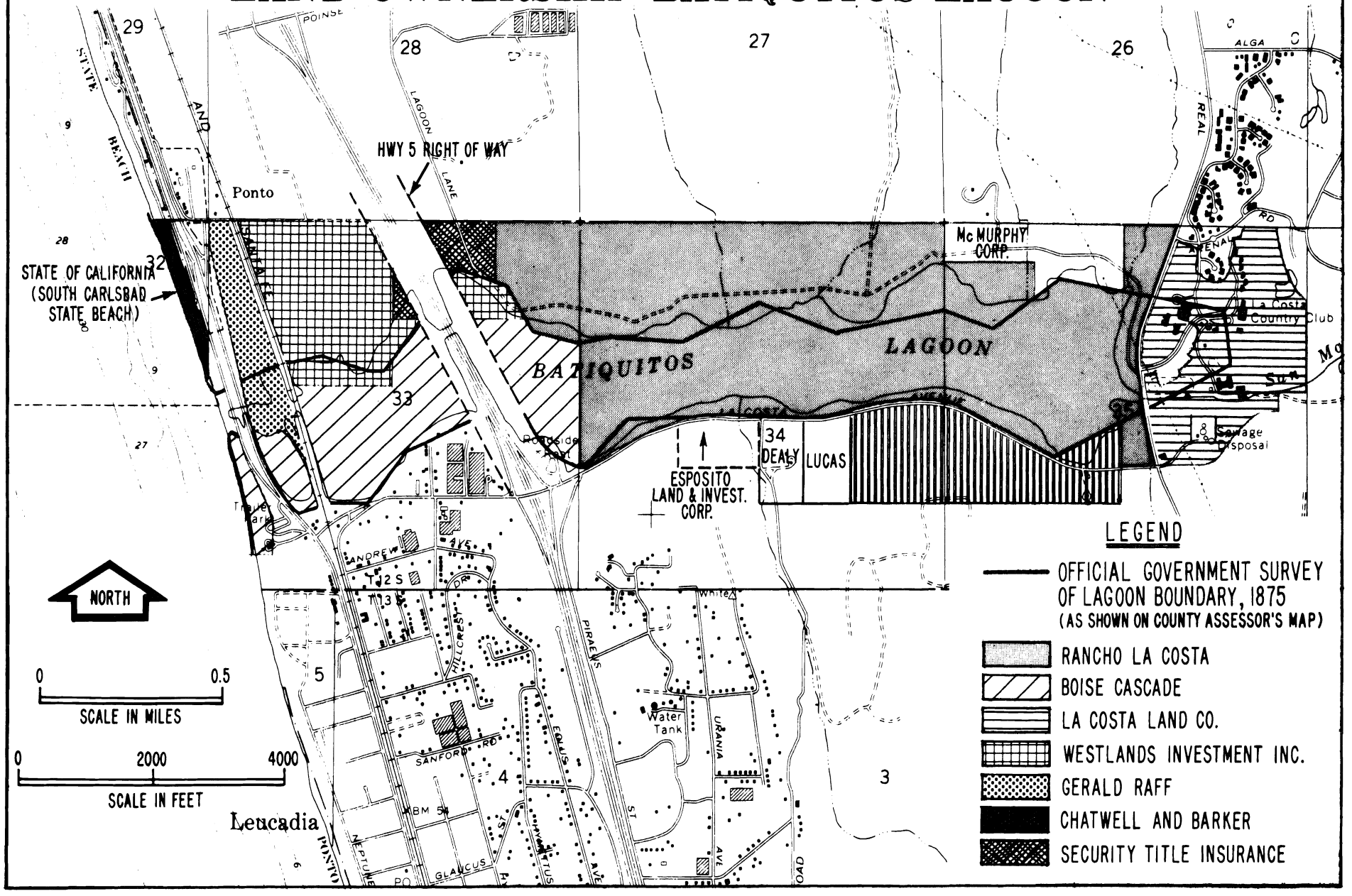
motivated primarily by the desire to observe wildlife. Neither lagoon has had other attractions, such as hunting, fishing or picnicking opportunities, to require improved access. Future access needs will depend upon improvement of aesthetic qualities which have been lacking.

Several proposals have been made for public acquisition of large areas in or adjacent to the lagoons. At San Dieguito Lagoon, the City of Del Mar has proposed securing the entire 100-year flood way for open space, preservation of natural environmental characteristics, and demarcation of the City from northern urban areas (City of Del Mar, 1974). The City of San Diego has proposed the acquisition of both the lower San Dieguito flood plain (from the Del Mar City boundary to about one mile east of El Camino Real) and Crest Canyon, which has been declared to be of regional significance by the San Diego Comprehensive Planning Organization (City of San Diego, 1973).

While San Dieguito Lagoon jurisdiction is divided between the cities of Del Mar and San Diego (Plate 12), Batiquitos Lagoon falls entirely within the jurisdiction of the County of San Diego (Plate 13). However, annexation of property on the southern boundary of the City of Carlsbad has proceeded at a rapid rate in recent years, and the Carlsbad general plan includes Batiquitos Lagoon within its boundaries. Unlike San Dieguito Lagoon in which upland ownership is very diversified, the upland area of Batiquitos is essentially held by only two land owners: the eastern basin and adjacent northern hill slopes belong to the Rancho La Costa Company and the western upland is mostly owned by Boise Cascade. The channel areas of both lagoons, below mean higher high water are designated as navigable and, hence, while not owned by the U.S. Army Corps of Engineers, fall under its jurisdiction.

PLATE 11

LAND OWNERSHIP BATIQUITOS LAGOON



The County of San Diego has proposed a program of attaining complete public ownership of the entire wetland area of Batiquitos Lagoon and also the adjacent northern hill slope and southeastern bluffs (San Diego County, 1972) (Plate 15). In addition, the California Department of Parks and Recreation is considering the acquisition of the beach area south of the present southern boundary of South Carlsbad State Beach.

Land Use, Existing and Planned

San Dieguito Lagoon

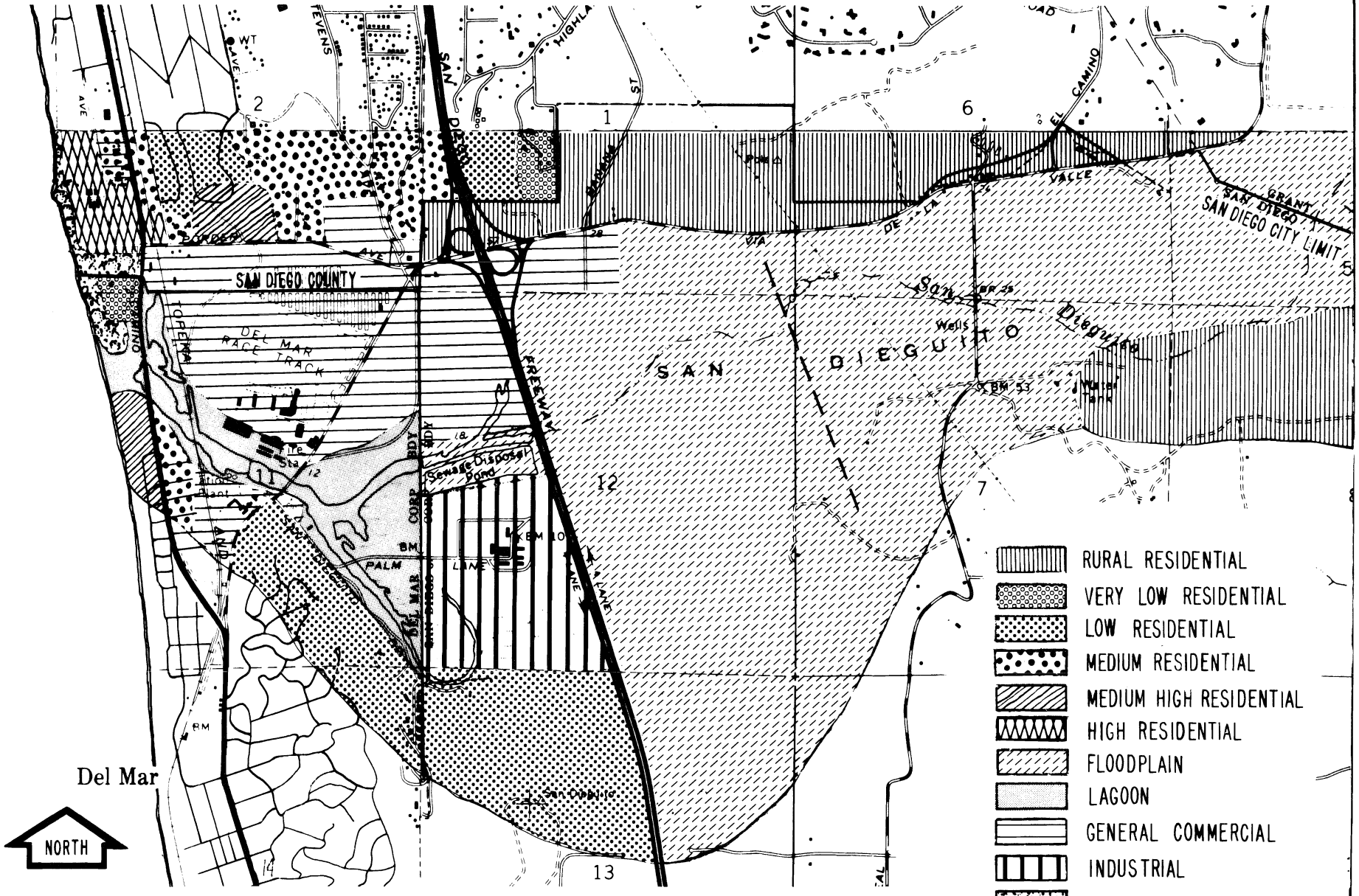
The most obvious land use and perhaps the most damaging to natural resources in the San Dieguito area are transportation facilities. Several local roads, two major highways and a railroad traverse the lagoon. Horse racing facilities, the fairgrounds and parking lots at the Southern California Exposition comprise the major land use at San Dieguito Lagoon. These facilities occupy approximately 313 acres of former marsh lands. Remnants of the old airport are still visible, but natural processes are slowly returning the site to its former condition. Levees forming sewage ponds just west of Interstate 5 testify to a former use of the lagoon. Unless these levees are maintained for water holding purposes, nature will also reclaim them. Lands east of the freeway are primarily devoted to agriculture or lie vacant. While lands in the San Dieguito area are only sparsely used, lands to the north, along the coast, and south of the lagoon are intensively developed, primarily to residences. These developments are mostly above the San Dieguito flood plain.

The San Dieguito Community Plan (Plate 12), adopted by the San Diego County Board of Supervisors on December 31, 1974, proposes the conservation of undeveloped lagoon within the limits of the City of Del Mar, flood plain

PLATE 12

SAN DIEGUITO COMMUNITY PLAN

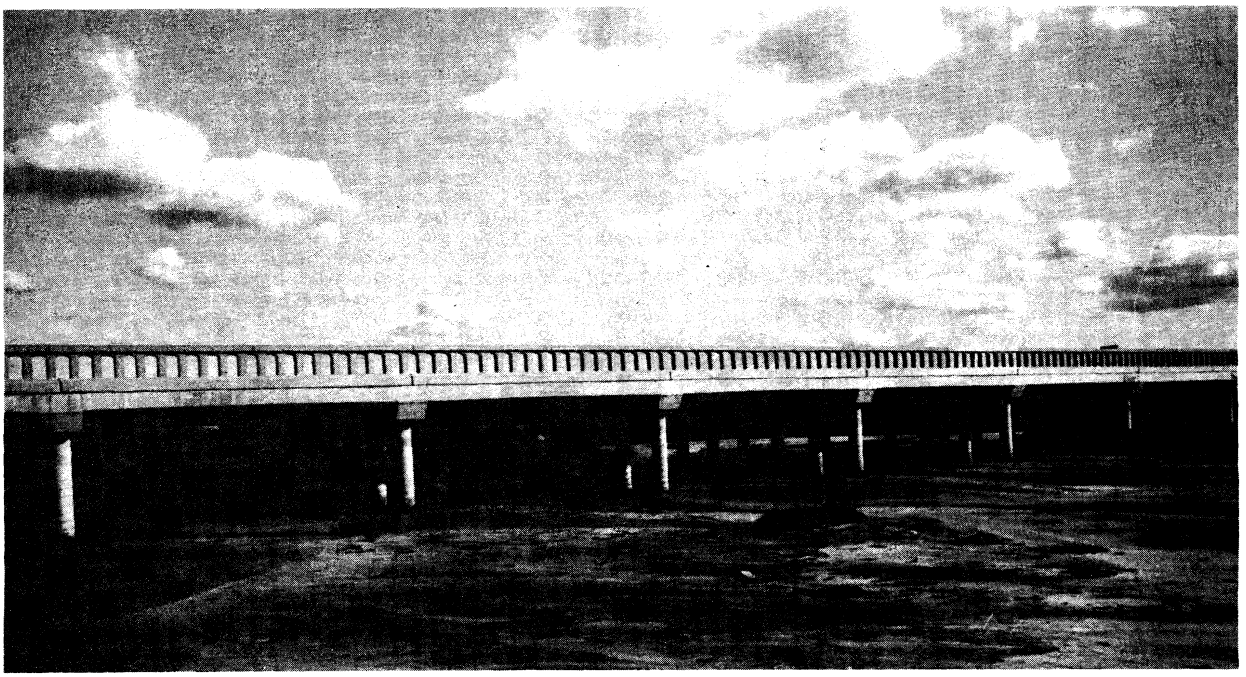
SAN DIEGUITO LAGOON & ENVIRONS



ADOPTED DEC. 31, 1974

SAN DIEGUITO LAGOON

BATIQUITOS LAGOON

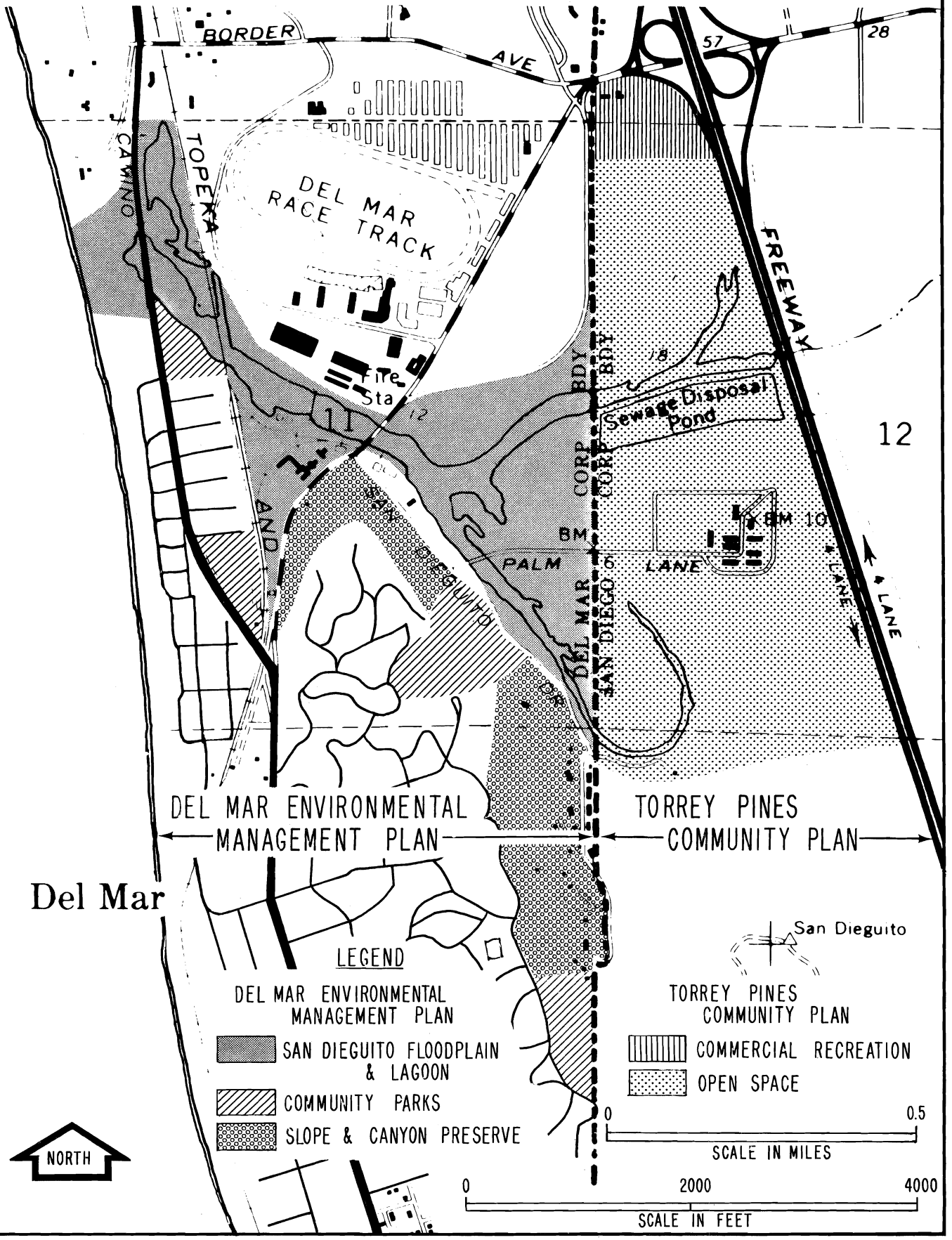


TWO MAJOR HIGHWAYS AND A RAILROAD TRAVERSE THE LAGOONS, AND, HENCE CONSTITUTE A MAJOR LAND USE OF BOTH WETLANDS.

PLATE 13

PROPOSED "OPEN SPACE"

AT SAN DIEGUITO LAGOON



zoning for a narrow flood way between the Del Mar City limit and the freeway, and flood plain zoning for all of the undeveloped lowland east of the freeway (Plate 12). General commercial and industrial development is proposed for the remainder of the flood plain west of Interstate-5. Though this community plan presents development proposals within the City of Del Mar, the city plan takes precedence over the county plan.

The Del Mar Environmental Management Plan (Plate 13) (City of Del Mar, 1974) is similar to the San Dieguito Community Plan in regard to the proposed future use of the flood plain and lagoon. One of the plan's objectives is to "retain and enhance natural benefits and ensure public safety within the San Dieguito River flood plain and lagoon." To accomplish this objective the plan proposes to:

1) Maintain and designate the lagoon, wetland areas, critical 100-year flood plain areas and any sensitive surrounding areas as permanent open space.

2) Coordinate legal interests and legal concerns of the multiple jurisdictions in the area.

3) Enhance and maintain appropriate sections of the total lagoon area as wildlife habitats.

4) Establish a comprehensive master plan and program for the management of the total lagoon area, its water supply, and the wildlife in the area.

5) Obtain maximum self-sufficiency in terms of water supply and energy output for the lagoon.

6) Maintain proper health and safety controls for the entire 100-year flood plain in the lagoon management program.

7) Establish a public relations program to develop and maintain public interest and support in lagoon management.

The Del Mar Environmental Plan has been endorsed by the Del Mar City Planning Department. Implementation of this plan is awaiting the completion

of a State Lands Division survey being made to substantiate state ownership of lagoon wetlands that lie under water and tidal influence.

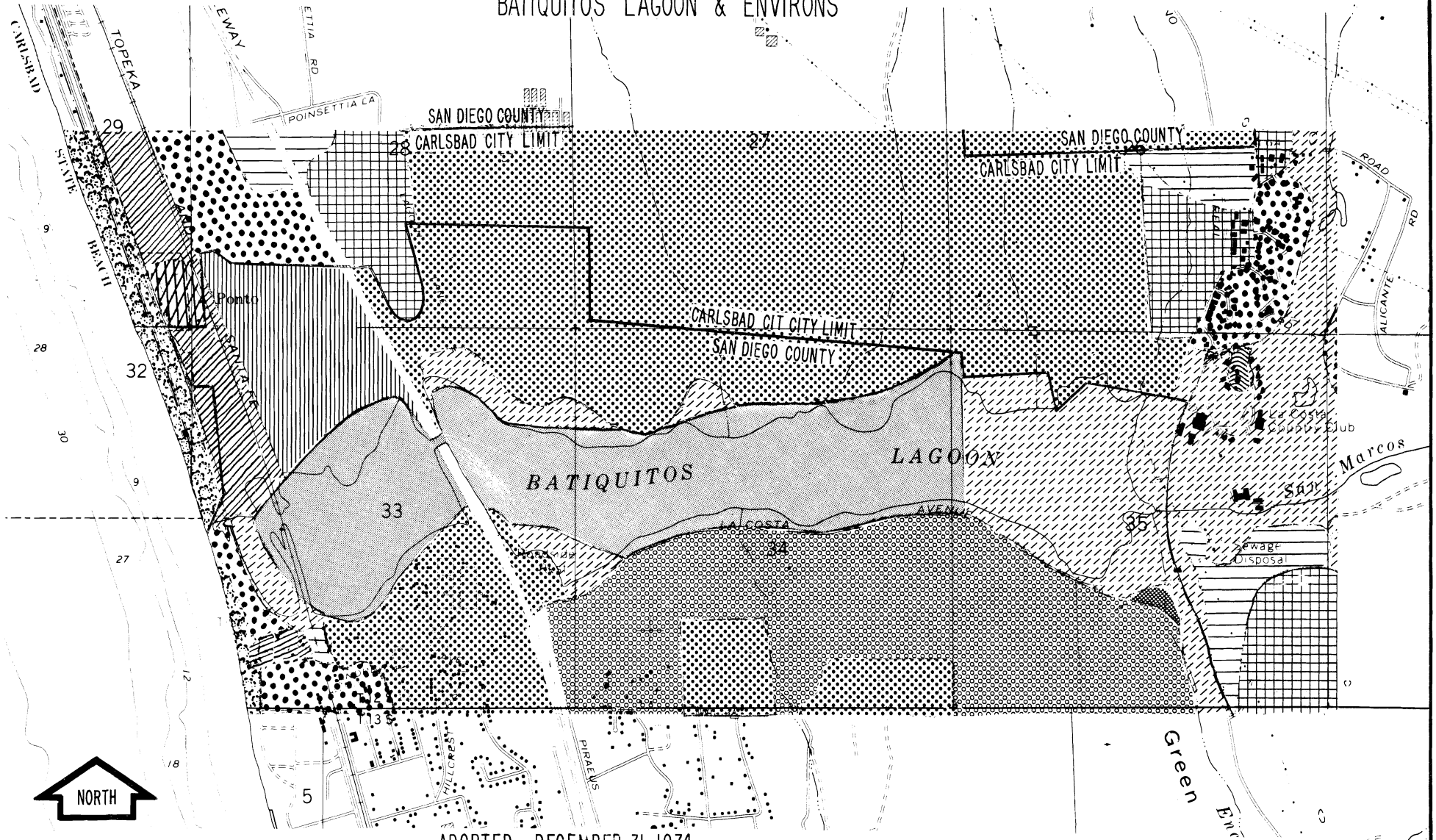
The Torrey Pines Community plan (Plate 13), adopted March 6, 1975, by the San Diego City Council, designates the majority of a wedge-shaped area, between Interstate-5 and the Del Mar City limit, as open space. The northern end of the parcel is designated commercial recreation.

In May 1975, a detailed proposal for use of San Dieguito Lagoon was presented to the Del Mar City Council by the San Dieguito Lagoon Preservation Committee (1975). The proposal, as implied by the name of its sponsoring organization, recommends the maintenance and enhancement of the lagoon to provide open space, fish and wildlife habitat and compatible recreation. The proposal also recommends regulation of land use "in buffer zone/borderland" areas, adjacent or near the lagoon, to prevent adverse impacts which might significantly degrade the quality of the lagoon area. The present plans of the County, the two cities and the Lagoon Preservation Committee for the flood plain and San Dieguito Lagoon are not compatible with most of the existing zoning. The City of Del Mar has most of this area zoned commercial and commercial service with small portions zoned residential and park-flood plain. The City of San Diego has its portion of the flood plain zoned for agriculture. In contrast to commercial and residential zoning, agricultural zoning is compatible with the natural function of a flood plain. To bring existing zoning in line with the proposed plan will require "down zoning," i.e., from commercial to agricultural.

PLATE 14

SAN DIEGUITO COMMUNITY PLAN

BATIQUITOS LAGOON & ENVIRONS



ADOPTED DECEMBER 31, 1974

- RURAL RESIDENTIAL
- VERY LOW RESIDENTIAL
- LOW RESIDENTIAL
- MEDIUM LOW RESIDENTIAL
- MEDIUM RESIDENTIAL
- MEDIUM HIGH RESIDENTIAL
- HIGH RESIDENTIAL
- NEIGHBORHOOD COMMERCIAL
- FLOOD PLAIN
- LAGOON
- GENERAL COMMERCIAL
- PARK

0 0.5
SCALE IN MILES

0 2000 4000
SCALE IN FEET

Batiquitos Lagoon

The entire wetland area of Batiquitos Lagoon is yet relatively undeveloped, except that it is traversed by two major highways, a local road and a railroad. Remnant dikes of a former salt production operation are still evident at the upper end. The eastern basin is bordered on the north and south by undeveloped, vacant land interspersed with pockets of agricultural lands (grain pasture, truck crops and flowers). At the east end, land use in the La Costa Resort includes single family residences and a quasi public recreation facility with a golf course and stables. Land use adjacent to the middle basin is primarily agricultural, with a few residences along the bluffs on the south side.

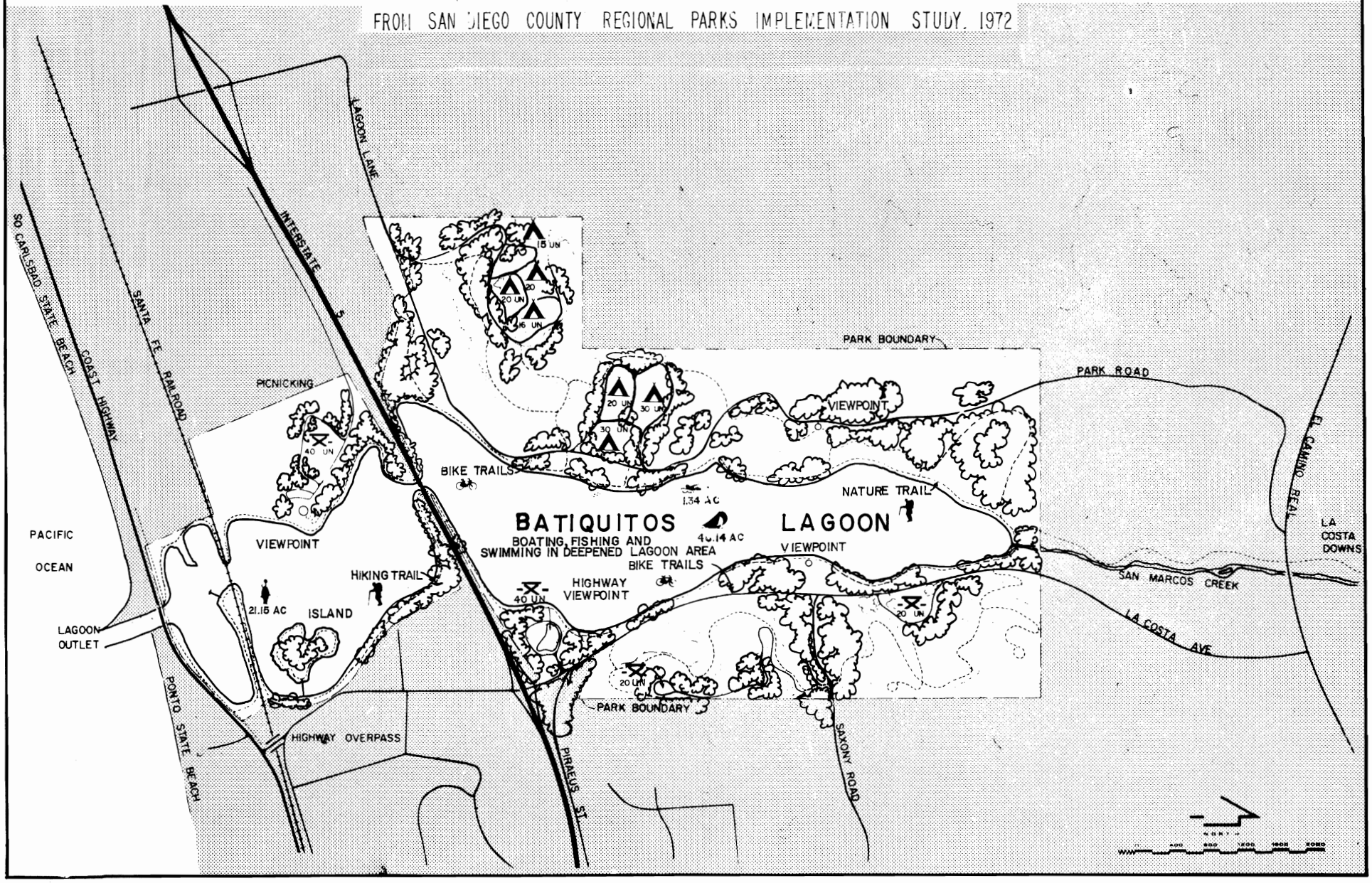
Proposed land uses, as depicted in the San Dieguito Community Plan leave the lagoon in a natural state, surrounded by a broken fringe of flood plain zoning (Plate 14). The lagoon designation calls for strict regulation or prohibition of development in order to preserve the natural ecosystem. Permissible uses would include recreation and natural terrain open space. Most of the adjacent hill slopes north and south of the lagoon are designated for low to very low residential development.

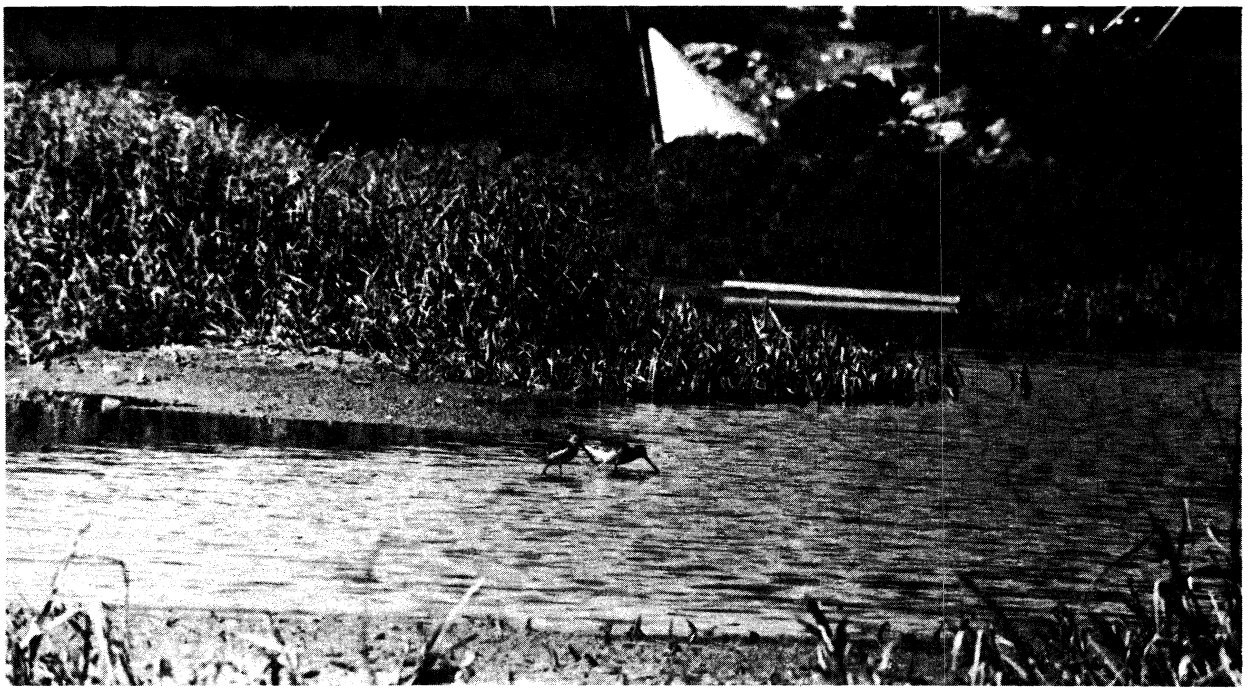
The undeveloped, attractive rural setting of Batiquitos Lagoon has promoted several plans for its future development as a regional park. The General plan of the City of Carlsbad designates the Lagoon as a proposed regional park, fringed by a greenbelt and watercourse border which extends up the tributary canyons north of the lagoon. The County of San Diego (1972) has prepared a conceptual plan for the development of a regional park covering the lagoon area from the coast inland to within about one-half mile of El Camino Real, and including much of the surrounding hillside and bluff slopes to the north and south of the lagoon (Plate 15).

PLATE 15

PROPOSED REGIONAL PARK

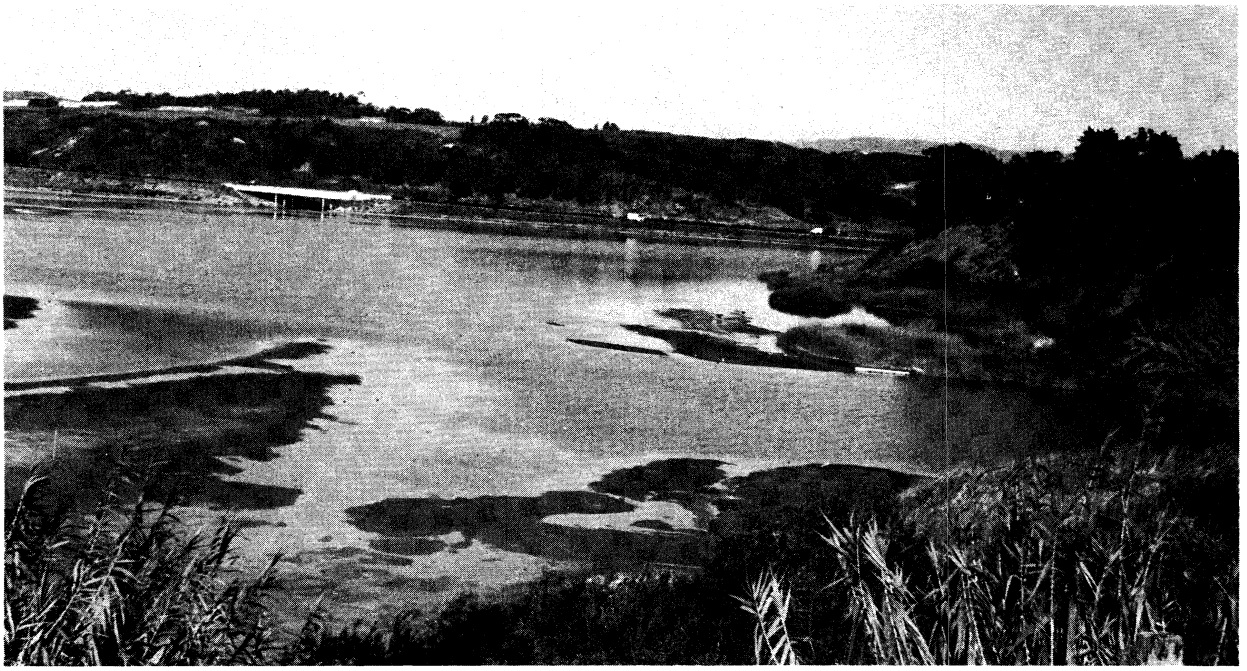
FROM SAN DIEGO COUNTY REGIONAL PARKS IMPLEMENTATION STUDY, 1972





SAN DIEGUITO LAGOON

BATIQUITOS LAGOON



BOTH LAGOONS HAVE A DIVERSITY OF AQUATIC AND UPLAND HABITATS THAT ATTRACT A DIVERSITY OF WILDLIFE.

RESOURCES

Habitats

The habitat types of coastal wetlands are traditionally grouped into three zones: the *marine* or *sublittoral* zone, which is continuously under water; the *littoral* zone, which is the intertidal area, including mudflats and tidal salt marsh; and the *maritime* zone, which is the area between the upper edge of the littoral zone and the upland vegetation, including non-tidal salt marsh and salt flats (Mudie, Browning and Speth, 1974). These zones, and the habitats within them, are essentially defined according to the degree of tidal influence to which they are subjected. Both San Dieguito and Batiquitos lagoons have long been cut off from regular tidal influence. And, they have long been subject to alternating cycles of freshwater inundation and dessication; hence their wetland habitat types do not conform with any traditional classification. They are more or less intermediate between a tidally-determined zonation and the type of zonation that characterizes a non-tidal, brackish-water coastal pond, such as described for San Elijo Lagoon (Carlberg, 1970; *Atlantis Scientific*, 1972).

In this report of San Dieguito and Batiquitos lagoons and their environs, the following classification of habitats is used:

A. Channels and ponds - areas either constantly submerged by water or covered by water for most of the year.

B. Mudflats and salt flats - extensive areas of bare soil, either permanently damp (mudflats), or dry and salt-encrusted during most of the year, but temporarily inundated during the rainy season (salt flats).

PLATE 16

SAN DIEGUITO HABITAT TYPES

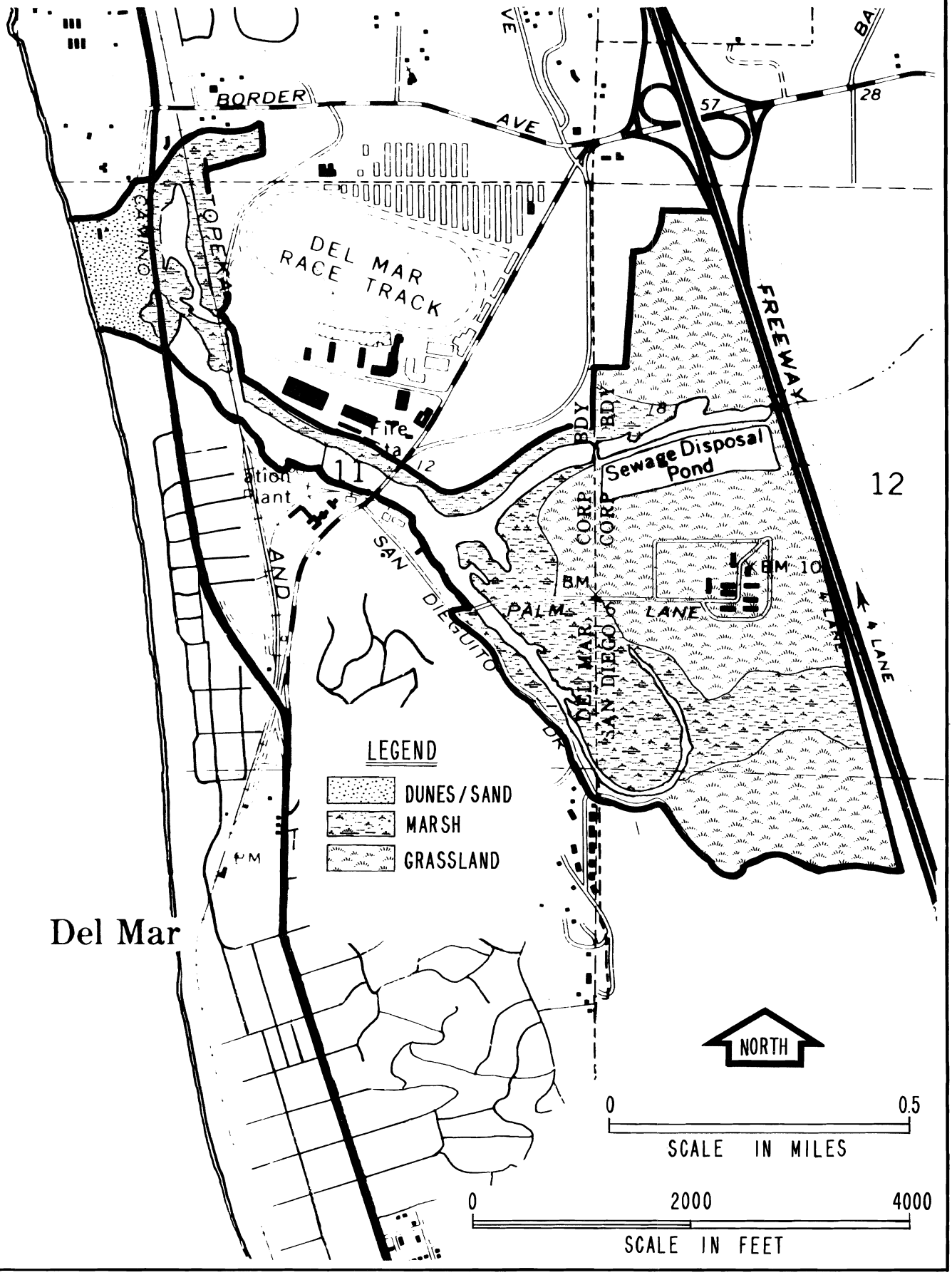
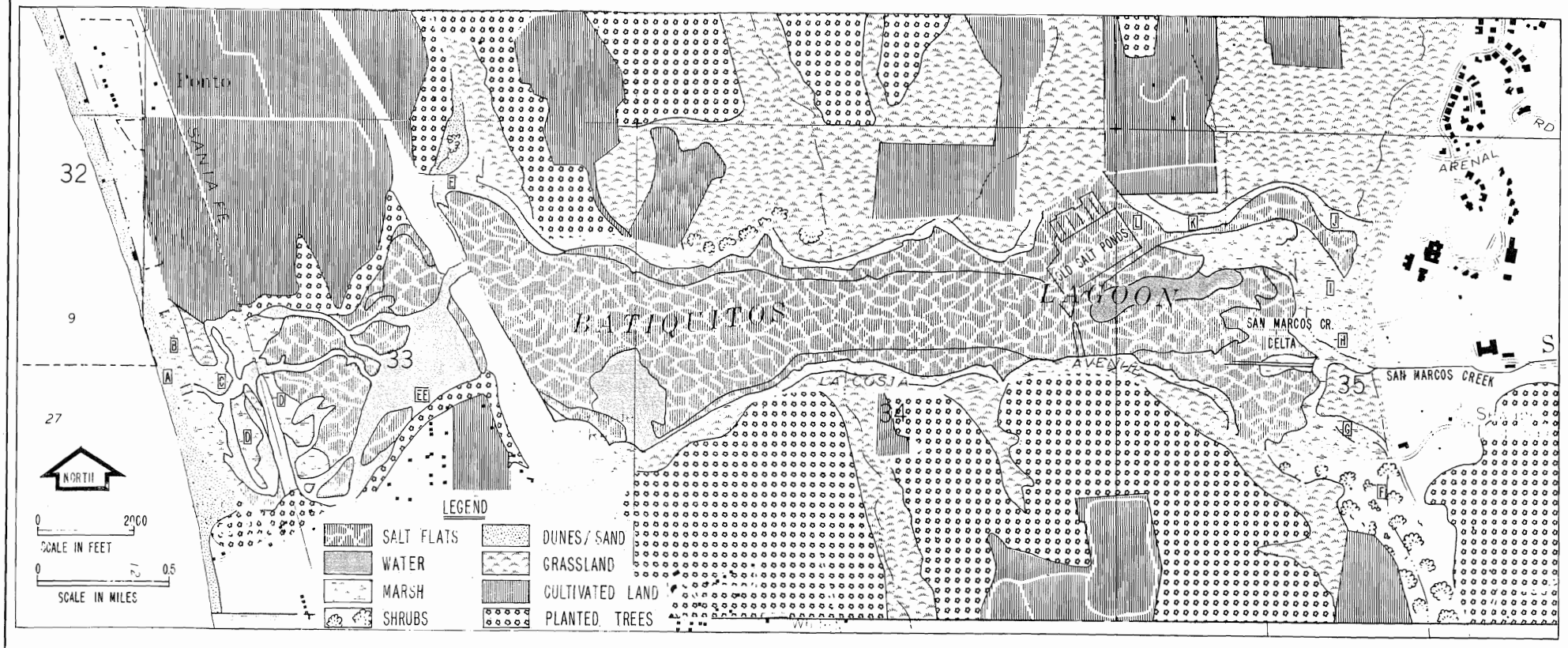


PLATE 17

BATIQUITOS LAGOON HABITAT TYPES



C. Marsh - areas covered by wetland vegetation, including salt marsh and brackish water marsh.

D. Upland transition grassland - grassland and low shrubs occupying the mildly saline soils of a transition area between the wetlands and the non-saline upland soils; corresponds with the maritime zone of some authors (Vogel, 1966; Purer, 1942), which is the tidal marsh border that is only occasionally inundated with tidal water (e.g., during tsunamis or on extreme high spring tides that are combined with storm surfs), or is merely subject to high concentrations of salt spray.

E. Riparian - vegetation occupying the watercourses and flood way borders of the intermittent rivers and creeks that drain into the lagoons.

The distribution of these habitats is shown in Plate 16 (San Dieguito Lagoon) and in Plate 17 (Batiquitos Lagoon), and the approximate habitat acreages are listed in Tables 1 and 2.

Channels and Ponds

The main channel system in San Dieguito Lagoon is uniformly shallow, ranging from 1-1/2 to 3 feet deep and extends inland for about 1-1/2 miles. The western end of the channel, however, is 3 to 6 ft. deep, with a hard, sandy bottom and steep sides, indicating an area of recent scouring by strong currents. Elsewhere, the base of the main lagoon channel is mostly fine micaceous sand, covered by 4 to 15 inches of organic sludge and large amounts of metal and glass refuse. The basement sediment becomes more silty towards the inland end of the main lagoon channel. The eastern end of this channel has become isolated from the rest of the channel system

TABLE I

HABITAT ACREAGES (APPROX.) SAN DIEGUITO LAGOON

HABITAT TYPE	ACREAGE
CHANNEL AND POND[1]	66 ACRES (16%)
MARSH[2]	125 ACRES (31%)
UPLAND TRANSITION GRASSLAND[3]	216 ACRES (53%)
TOTAL	407 ACRES (100%)

1 INCLUDES 26 ACRE FORMER OXIDATION POND.
2 INCLUDES MINOR ACREAGES OF MUD AND SALT FLATS INTERSPERSED BETWEEN VEGETATION.
3 INCLUDES ABANDONED FIELDS AND SAND DUNE-BEACH AREA AT MOUTH OF LAGOON.

TABLE 2

HABITAT ACREAGES (APPROX.) BATIQUITOS LAGOON

HABITAT TYPE	ACREAGES - IN BASINS[3]			
	WESTERN	CENTRAL	EASTERN	TOTAL LAGOON (%)
CHANNELS	10	40	20	70 (12%)
MUDFLAT-SALT FLAT	6	45	290	341 (57%)
MARSH[1]	11	10	90	111 (18%)
UPLAND TRANSITION GRASSLAND[2]	9	5	50	64 (11%)
RIPARIAN	-	-	14	14 (2%)
BASIN SUBTOTALS	36	100	464	600 (100%)

1 INCLUDES MIDDLE AND HIGH SALT MARSH AND BRACKISH WATER MARSH.
2 ALSO REFERRED TO AS MARITIME VEGETATION.
3 SEE PLATE 3.

by an alluvial fan formed at the foot of Crest Canyon with the water level on the east side being about one foot lower than in the rest of the channel system.

A large pond lies to the north of the present lagoon entrance area, west of the railroad. It is isolated from the main lagoon system by a sandy dike extending from the beach to the Del Mar racetrack. The southwestern corner of this pond has become filled by sand washed over the beach by high waves. The bottom of the northwestern section of this pond is covered by a thick layer of sludge. The pond at this location is deepest, almost 20 ft., strongly suggesting that this was formerly the main entrance channel area of San Dieguito Lagoon.

In Batiquitos Lagoon, well-defined channels are confined to the western end. These channels are uniformly shallow (5 ft. deep or less) and have a silty sand base except in the entrance channel area where coarser beach sand has been wave-washed into the channel. Outside of the entrance channel area, the sandy channel base is covered with a layer of organic sludge 1 to 6 inches deep.

Mudflats and Salt Flats

San Dieguito Lagoon does not possess a well-developed mud or salt flat habitat type. However, small acreages of mud and/or salt flat can be found interspersed between the vegetation-covered areas of the marsh habitat. On the other hand, mud and salt flats, mainly the latter, comprise 57% of the area of Batiquitos Lagoon. The further inland from the ocean the greater is the preponderance of salt flat, which makes about 17% of the western basin of the lagoon, 45% of the middle basin and 62% of the entire basin.

Marsh

There are three distinctive types of marsh habitat in both lagoons: brackish water marsh, "low" salt marsh and "high" salt marsh. The brackish water marsh occupies the shallow water areas of channels or ponds in which the water salinity is less than 10 parts per thousand (ppt), and the adjacent permanently wet mudflats. Characteristically, the water areas are dominated by alkali bulrush mixed with variable amounts of other bulrushes, sedges and rushes.[1] These relatively salt-tolerant, emergent marsh plant species may be joined or replaced in areas of very low water salinity by cattails. The damp open mudflats are usually colonized by fat-hen, goosefoot and, occasionally, by salt marsh fleabane. These colonizers may be replaced by dense stands of jaumea or saltgrass, both of which appear to be able to tolerate prolonged periods of inundation. The drier, more saline, upland fringe of the brackish water marsh is often demarcated by dense stands of pickleweed and patches of alkali heath, both of which are typical tidal marsh species and appear to be harmed by prolonged periods of inundation.

The salt marsh vegetation in both lagoons occupies the upper edges of the channels and ponds containing saline water (more than 25 ppt), or is found fringing the upper edges of the brackish marsh where soils have salinities greater than 10 ppt. Two distinctive types of salt marsh are evident:

(a) Low salt marsh - in low areas of permanently wet, saline soil, a closed vegetation cover is found comprising dense stands of pickleweed, alkali heath, saltgrass and salt cedar, and

[1] Scientific names of plants are found in the checklist of plants, Appendices A and B.

occasional patches of sea lavender or jaumea. This vegetation type has been designated as "low" marsh because, despite the fact that it also occurs at elevations which traditionally characterize the high marsh of tidal lagoons, this particular assemblage of plants characterizes the lowest areas of the marsh in both lagoons investigated (i.e., it occurred on the lower borders of saline channels, or in depressions within higher areas that appear to mark the former courses of tidal channels).

(b) High salt marsh - this marsh is characterized by dense stands of glasswort that fringe the upper borders of the "low" marsh (possibly designating the former position of the extreme high tide line) or forms slightly raised "islands" in, or low ridges between, open, salt-encrusted, clayey flats. The glasswort mounds are often colonized by annual grasses, while the edges of the salt pans may be colonized by salt-tolerant winter annuals, such as little iceplant, salt marsh daisy or salt marsh sand spurrey.

Upland Transition Grassland

This grassland largely comprises a mixture of moderately salt or alkali-tolerant annual grasses[1] and herbs, such as bassia and alkali weed. The grasses and herbs are interspersed with shrubs, including goldenbush, tree tobacco and tamarisk. Salt-tolerant forbs, including Australian salt bush, sea-blite and sea fig, are also found among the grasses.

[1]Most of these grasses could not be identified because they were only in the seedling stage at the time of study.

Riparian

In both lagoons this habitat is comprised typically of a variable assemblage of salt-sensitive trees, large shrubs and water-demanding perennial herbs. However, the inland portion of the San Dieguito River watercourse only supports low-growing herbs and annual grasses. The absence there of the larger riparian species is perhaps due to the inland movement of saline ground water during the dry season, which would prevent the successful establishment of the more deep-rooted, salt-sensitive, riparian trees and shrubs.

Vegetation

San Dieguito Lagoon

A total of 94 plant species (Appendix A) was recorded for San Dieguito Lagoon. However, more than half of the species listed from San Dieguito reflect the prolonged disturbance of the upland surrounding the lagoon. These disturbances include former agricultural practices, residential development, sewage pond construction, cattle-grazing and recreational vehicle activity. Over half of the total wetland acreage in the San Dieguito Lagoon Study area is occupied by this upland transition grassland. Marsh and salt flats occupy about 31.0% of the wetland area; most of the remainder (16.0%) is channels and ponds. Representative soil salinities in San Dieguito Lagoon are recorded (Table 3).

Batiquitos Lagoon

By far the largest portion of the Batiquitos wetland area is occupied by barren salt flats (57%). Channels and seepage ponds is another 12%. The wetlands vegetation is confined mostly to a narrow ribbon fringing

TABLE 3

SALINITY OF TOP SOIL IN SAN DIEGUITO LAGOON WETLANDS

A = SURFACE TO -3 INCHES
B = -3 INCHES TO -6 INCHES

SOIL TYPE, VEGETATION		EC_E (MMHOS/CM)*
SANDY FILL NEAR CHANNEL; *LIMONIUM*, *HAPLOPAPPUS*, *MESEMBRYANTHEMUM*	A	2.2
SANDY FILL CA 60 FT. BEHIND CHANNEL BERM; *HAPLOPAPPUS*, *LOTUS SCOPARIUS*, *ATRIPLEX SEMI-BACCATA*	A	1.6
	B	3.2
SANDY FILL ALONG SAN DIEGUITO DRIVE; *BRASSICA*, *CENTAUREA*, *HETEROTHECA*	A	1.9
	B	1.1
SANDY CHANNEL BANK; *FRANKENIA* AND *MESEMBRYANTHEMUM CHILENSE*	A	2.3
	B	2.2
SAND BAR IN CHANNEL; *JAUMEA* AND *MESEMBRYANTHEMUM CHILENSE*	A	11.1
	B	8.9
SAND BAR IN CHANNEL; *DISTICHLIS*, *SCIRPUS*, *ATRIPLEX*, *CHENOPODIUM*	A	18.9
	B	17.8
CLAY, HIGH MARSH; *SALICORNIA SUBTERMINALIS*, *MONANTHOCHLOE*	A	10.5
	B	7.8
CLAY OVER SAND, CHANNEL BERM; *BETA VULGARIS* AND *FRANKENIA*	A	9.1
	B	2.1
SILT, LOWER EDGE OF POND; *SCIRPUS*	A	19.3
	B	29.7
SILT OVER SAND; *JUNCUS ACUTUS*, *SALICORNIA VIRGINICA*, OAT	A	20.6
	B	17.0
CLAVEY SILT, LOW MARSH; *SALICORNIA VIRGINICA*, *DISTICHLIS*	A	22.0
	B	35.7
SALT ENCRUSTED SILT; *SALICORNIA VIRGINICA*	A	60.0
	B	81.3
CLAY IN DEPRESSION FORMED BY OLD LAGOON CHANNEL; *SALICORNIA VIRGINICA*	A	25.0
CLAY IN HIGH MARSH; *SALICORNIA SUBTERMINALIS*	A	70.0
	B	61.2
SANDY SILT; UPLAND TRANSITION GRASSLAND	A	1.1
	B	1.7
CLAY, SALT FALT; *SALICORNIA SUBTERMINALIS* AND *SUAEDA*	A	114.0
	B	85.0

*TO OBTAIN THE APPROXIMATE %SALT, MULTIPLY BY .064.

Batiquitos Lagoon and extending into it only as islands between channels at the western end, and to the San Marcos Creek delta at the eastern end. The total acreage of lagoon vegetation amounts to about 189 acres, of which about 58% is marsh; the remainder is upland transition grassland and riparian. Fifty-four plant species are recorded for Batiquitos Lagoon (Appendix B).

Wildlife

Birds

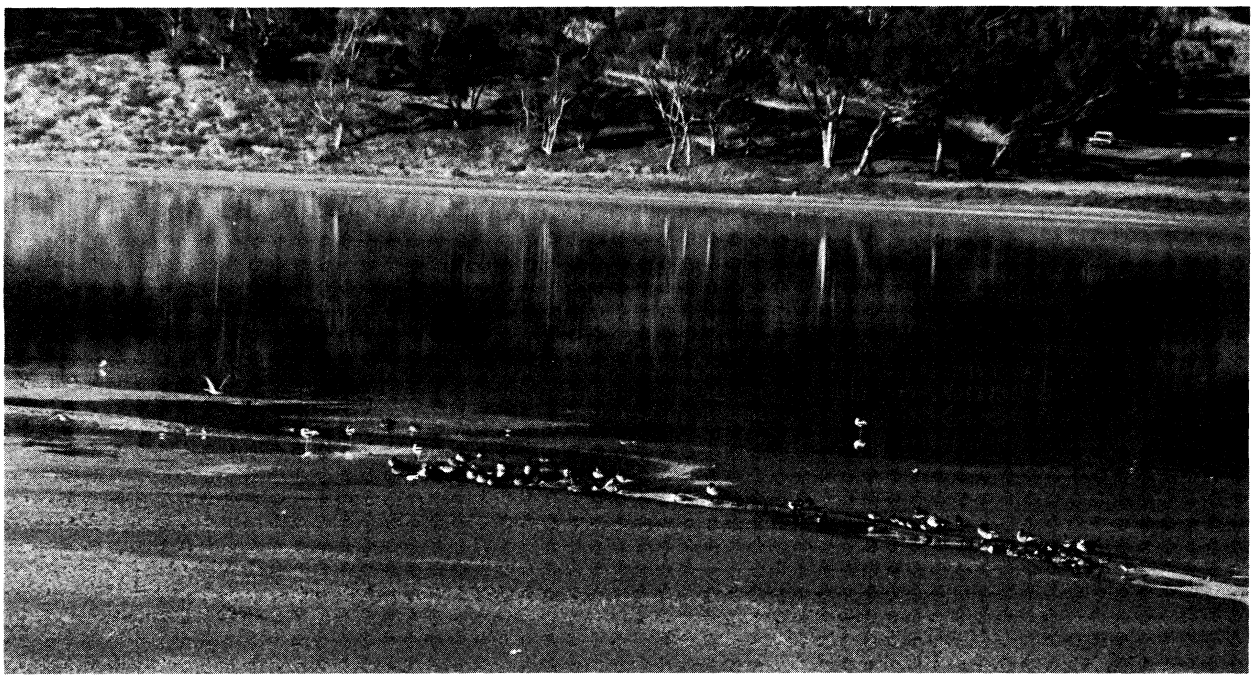
Despite the adverse environmental changes that have occurred in San Dieguito and Batiquitos lagoons over the past 3 decades, both lagoons continue to support waterfowl, shorebirds and many other water-associated species. The upland grassland and brush, and the bordering undeveloped, brushy hill slopes are important habitats for resident and migratory upland birds.

San Dieguito Lagoon

For its size and location this lagoon supports a relatively high population of resident and migratory water birds. Sixty-three species of water-associated birds were recorded by the San Diego Field Ornithologists at San Dieguito Lagoon from mid-January through December, 1974 (Appendix C) (Mike Evans, pers. comm.). An additional 42 species of upland birds have been noted for the San Dieguito wetlands and adjacent uplands. A total of about 14,500 birds was counted on 11 monthly censuses in 1974. The following 12 species accounted for about 85% of the total number seen (San Diego Field Ornithologist, 1974):

SAN DIEGUITO LAGOON

BATIQUITOS LAGOON



BOTH LAGOONS SUPPORT RELATIVELY HIGH POPULATIONS OF SHOREBIRDS AND WATERFOWL.

Water birds using moderate to shallow open water	Marsh birds, surface feeding ducks, grebes, phalaropes:	Number (all censuses)
	American coot	2,603
	Ruddy duck	2,272
	Northern shoveler	1,101
	Cinnamon teal	765
	Eared grebe	387
	Northern phalarope	1,059
		8,187
Water birds using shallow water and pond margins	Shorebirds:	
	Western phalarope	847
	American avocet	825
	Dowitcher species	738
	Black-necked stilt	617
		3,027
Land birds using bridges and shallow pond margins	Upland birds:	(all censuses)
	Cliff swallow	411
	Red-winged blackbirds	302
		713

San Dieguito Lagoon provides a varied aquatic habitat that is attractive to water-associated birds. Shorebirds, such as phalaropes, avocets, stilts, dowitchers, willets, curlews, various plovers and other sandpipers; and wading birds, like the great blue and black-crowned night herons, great and snowy egrets, are commonly seen in the western pond and in shallow areas of the inland channels. Also commonly observed are grebes and waterfowl. Some resident species of water-associated birds, including the cinnamon teal, avocets, killdeer, eared and pied-billed grebes and black-necked stilts, teal mallards, ruddy ducks and American coots nest in these same areas of the lagoon. The sewage oxidation pond is intensively used by both surface feeding and diving ducks, including pintails, mallards, shovelers, cinnamon and green-wing teals, and canvasbacks. An unusual, but attractive, sight in the western pond is one or two flamingos, believed to have become naturalized along the San Diego County coastline after escaping from a San Diego park.

The "low" marsh between the south lagoon channel and the San Dieguito River, as well as the area west of the Pacific Highway flood way, are reported to be a nesting site of the endangered Belding's savannah sparrow (M. Evans, pers. comm.). Thickets of tall shrubs in the old sewage oxidation pond (southwest of the present pond) are believed to be used by white-tailed kites for nesting (City of Del Mar, 1975). San Dieguito Lagoon also supports nesting populations of cliff swallows, loggerhead shrikes, red-winged blackbirds and song sparrows. Many other upland birds visit the area during winter migrations (Appendix C). A colony of the endangered California least tern nested successfully at San Dieguito Lagoon in 1969 (Craig, 1971). No successful nesting has been reported since then, but the terns regularly occur in the area each breeding season. San Dieguito Lagoon lacks a large amount of suitable, protected nest sites. In the 1973 breeding season 4 pairs of least terns used the lagoon, and 1 pair nested near the race track dirt parking lot; however, the clutch of eggs was destroyed by human disturbance (Bender, 1974a). Small fish are abundant in the lagoon, providing a good food supply for these endangered terns. After the nesting season in 1973, a flock of 100 or more adult and juvenile least terns from other nesting areas in the State stayed a month at the lagoon to feed before migrating south (Bender, 1974a). Suitable nesting sites for nesting terns could probably be developed at San Dieguito. But, controls on public use of the area would be required to protect the sites from disturbance.

Batiquitos Lagoon

From 1969 to 1970, 75 species of water-associated birds and 8 upland birds were recorded by the San Diego Field Ornithologists at Batiquitos Lagoon (Mike Evans, pers. comm.) (Appendix C). Twenty-three species

of shorebirds were recorded at Batiquitos Lagoon by members of the Buena Vista Audubon Society on shorebird surveys conducted for the Department of Fish and Game from December, 1969 to June, 1972 (Jurek, 1972). As many as 1,382 shorebirds were counted in the lagoon on one census. On individual censuses, maximum recorded populations of selected species include: 100 semi-palmated plovers, 102 snowy plovers, 115 willets, 1,100 sandpipers (Western, least, and dunlin), 500 sanderlings, 200 American avocets, 200 black-necked stilts and 1,050 northern phalaropes.

Several species of shorebirds nest at Batiquitos Lagoon. These include snowy plovers, killdeer, American avocets and black-necked stilts. In 1971, the lagoon contained a nesting population of at least 50 snowy plovers (Helmer, pers. comm.). Nesting colonies of California least terns have been recorded at Batiquitos Lagoon in the 1969, 1973, 1974 and 1975 breeding seasons. Flocks of these endangered terns were seen in the lagoon during the 1970 and 1971 breeding seasons, suggesting that nesting may have taken place those years. In 1973, at least 30 pairs nested on partially dried flats near the mouth of the lagoon between the railroad tracks and Interstate-5 (Bender, 1974a). In 1974, about 40 nesting pairs were found in this western area; at least 6 pairs nested on an island between Pacific Highway and the railroad tracks (M. Evans, pers. comm.); and, about 10 pairs nested on dry flats at the east end of the lagoon (Bender, 1974b). In 1969 a small tern colony was observed in the east end of the lagoon (Craig, 1971). In the spring of 1975, an unusually high water level in the lagoon flooded most flats, reducing the available nesting habitat for these terns. Only 9 pairs nested at Batiquitos in 1975 (Massey, pers. comm.). Fledging success each year has been good.

Batiquitos Lagoon also is important to least terns after the nesting seasons. Each year post-breeding flocks concentrate to feed at Batiquitos Lagoon and at other good feeding areas in the southern California coastal wetlands. In these areas young terns become proficient in catching their own food before the southward migration in the fall.

Totals of 1000 to 1500 ducks (about equal numbers of pintails and green-winged teal) were recorded during single-day counts at Batiquitos Lagoon during January and February, 1970 (Helmer, 1971). Most of the birds were seen in the eastern basin of the lagoon.

Far fewer species of upland birds have been recorded at Batiquitos Lagoon than at San Dieguito Lagoon (Appendix C). Wildlife studies at Batiquitos have focused mainly on aquatic birds. In addition, a much smaller amount of upland transition grassland and brush communities fringes Batiquitos Lagoon compared with the extensive upland habitats in the San Dieguito River basin. Fresh/brackish water marsh habitat on the south side of Batiquitos Lagoon, east of the railroad and east of highway Interstate-5, supports red-winged blackbirds, common yellowthroats and other marsh birds (M. Evans, pers. comm.).

Mammals and Reptiles

Accurate quantitative data are not available regarding the populations of mammals and reptiles found in the San Dieguito and Batiquitos wetlands and environs. Abundance estimates (Appendix D) are based largely on field observations of the frequency of tracks, scats and burrows, and on the number of animal sightings.

It appears that the types of mammals occupying the two wetland areas are similar, and more or less the same as those recorded for the less disturbed Los Penasquitos Lagoon wetlands and vicinity (Mudie et al., 1974). However, the total population numbers of mammals are probably greater in the San Dieguito than in the Batiquitos wetlands, simply because of the much larger acreage of upland transition grassland at San Dieguito. Conversely, it is of interest that more reptiles were observed in and around Batiquitos Lagoon than at San Dieguito Lagoon, possibly because of the lower numbers of predatory birds that frequent the latter area. It is noted, however, that San Dieguito Lagoon is one of three southern California coastal wetlands that has a resident population (at least 5-7 individuals) of the Pacific pond turtle, considered a locally-threatened species in southern California (M. Evans, pers. comm.).

In both wetlands, tracks and sightings indicated frequent invasion of the wetlands by domestic dogs and feral or domestic cats. In addition, in the San Dieguito area, there was abundant evidence of horseback riding in the vicinity of the western pond and the sewage oxidation pond. Herds of up to 50 cattle were observed grazing in both the flood way and flood plain areas of the eastern wetland area.

Fish, Shellfish, Other Aquatic Invertebrates

Very little marine life survives in these two environmentally unstable lagoons which are isolated from tidal flows during most of the year (Appendices E and F). Only 4 species of fish were found in San Dieguito Lagoon during the 1974 survey, namely killifish, mudsuckers, mullet and mosquito fish. However, in 1958-59, when channel water salinities were higher in this lagoon, it was reported that bay topsmelt were common

No living marine shellfish were found in San Dieguito Lagoon, although a variety of mollusk shells (Appendix G) lying on or just under the surface of the channel sediments indicates a former shallow water estuarine environment. Similarly, microscopic examination of shallow sediment cores (about 2 inches deep) taken from under the sludge layer in the channels, reveals the existence, in the recent past, of several common tidal lagoon species of foraminifera.

One species of a marine polychaete worm, *Polydora solcialis*, and an unidentified oligochaete worm were found in the relatively saline, isolated pond at the northern end of the western section of San Dieguito Lagoon. An abundance of empty worm tubes in this area indicates that a much larger marine worm population formerly existed. Similarly, dead specimens of a solitary coral, *Astrangia lajollensis*, that is commonly attached to fronds of kelp and eel grass, were found in the deepest part of this pond, along with living specimens of a tidal salt marsh protozoan, *Ammonia beccarii*, the presence of which suggests that oceanic conditions recently existed in this pond. In addition, large numbers of beach hoppers resembling the salt marsh genus, were found in the western lagoon area, as well as under damp logs further inland.

By far the largest number of aquatic invertebrates sampled in San Dieguito Lagoon was insects, including water boatmen, a very large (one inch long) green water beetle and larvae of biting midges. A small number of freshwater pillbugs and two species of freshwater snails also are common throughout the inner channel area, although not present in large numbers. An unidentified aquatic wolf-spider was occasionally observed darting over the surface of the water, on damp channel mudflats and under logs.

In Batiquitos Lagoon, large living populations of ghost shrimp and two marine polychaete worm species were found in the channel east of the lagoon entrance area. One of these worms, *Capitella capitata*, is regarded as a good indicator of polluted coastal waters. In addition, large numbers of unweathered, dead shells of Gould's bubble shell (the eggs of which are a source of food for fish) and of a small marine snail, *Assiminea californica*, indicate that in recent times there may have been large temporary populations of these mollusks in the western basin. The presence of large dead populations of a lagoon protozoan, *Quinqueloculina seminulum*, that prefers slightly diluted seawater conditions, suggests that seasonal increases in the salinity of channel water in Batiquitos Lagoon may be responsible for the elimination of some marine shellfish and invertebrate species.

Further inland, in the Batiquitos Lagoon channels, marine invertebrates are either absent or present only in small numbers, whereas large insect populations of water boatmen and midge larvae are common. At the extreme eastern end of the lagoon, remains of freshwater crayfish are often seen. The presence of many marine shellfish fragments in the surface sediments at the western end of the lagoon, however, again indicates that this lagoon has been tidal in relatively recent times (Appendix G).

Restoration of estuarine conditions in both lagoon systems would not only have a positive effect on native shellfish and aquatic invertebrates, but also raise the prospects of mariculture. Mariculture is the commercial production of marine organisms, principally shellfish.

RESOURCE USES

Both lagoons share a common non-appropriative use; they both function as broad bands of uncluttered open space, across which the ocean and scenic sandstone bluffs can be glimpsed by freeway and highway motorists. These distinctive bands of open space also serve to delimit the borders of separate coastal communities, namely Del Mar and Solana Beach, Leucadia and Carlsbad, which would otherwise be visually linked by the uniformity of road cuts or commercial roadside businesses. Other historical and contemporary appropriative and non-appropriative uses of the wetland resources differ from one lagoon to the other, and hence, are described separately.

San Dieguito Lagoon

Historically, the western end of San Dieguito Lagoon has been a favored fishing site for local fishermen, with halibut the most commonly reported catch. The lagoon channels also have been used for canoing in the past. In wet years, canoes used to be able to travel the length of the San Dieguito watercourse from Rancho Santa Fe to the ocean. The most recent record of canoing was after the flood of 1940-41, at which time it was reported that the lagoon channels were shallow and that in many areas, the bottom was covered by a layer of sludge into which an oar could be sunk for much of its length.

It is not precisely known how many persons now use the undeveloped wetlands for non-appropriative recreational and educational purposes, such as bird watching or nature study. However, during the course of the field work carried out for this report, bird watchers were regularly encountered. Other recreational uses of the San Dieguito Lagoon area

include exercising of horses and dogs on the sandbar at the lagoon mouth or in the grassland near the present sewage oxidation pond, and the frequent use of motorcycles in the central lagoon area.

The lagoon has been and continues to be the object of educational and scientific study. Completed and ongoing studies of the San Dieguito Lagoon, sponsored and directed by local colleges and universities, include:

a. Monitoring of changes in the lagoon water quality, 1970-75 (Bradshaw and Mudie, 1972);

b. Survey of the benthic organisms on the beach at the lagoon entrance, 1974-present (Dr. John Bradshaw and David Scott, Univ. San Diego);

c. Investigation of the recent geological history of the lagoon, 1975 (Environmental Studies Lab., Univ. San Diego);

d. Plans for an investigation of the possible biological removal of the sludge deposits in the lagoon by means of bacterial seeding, followed by aquaculture experiments (Dr. Alice Jokela and Dr. Richard Ford, Dept. Microbiology and Dept. Biology, San Diego State Univ.);

e. Plans for the development of experimental agricultural and horticultural field plots adjacent to the fairground parking area to demonstrate the feasibility of growing useful salt-tolerant plants (halophytes) in clayey or sandy soils irrigated with seawater, brackish water or sewage effluent (Mudie, 1974).

Groups of 25 to 50 local preschool and elementary school children use the lagoon area for nature study four or more times per year.

During the past two years, considerable attention has been directed towards the possible use of geological resources of San Dieguito Lagoon. It has been determined that there is enough sand underlying the lagoon and suitable for beach replenishment to warrant its dredging. The sand would be used for replenishment of the shrinking Del Mar Beach that annually is receiving more visitors (Zatt, 1974b). It also has been reported that the clayey surface sediments were used, in the late 1930's, for

SAN DIEGUITO LAGOON

BOTH LAGOONS RECEIVE MUCH RECREATIONAL, EDUCATIONAL AND SCIENTIFIC USE.

making adobe bricks (Purer, 1942); and, it is conceivable that this use might still be economically feasible if the soil salinity can be reduced in the inner lagoon area.

Batiquitos Lagoon

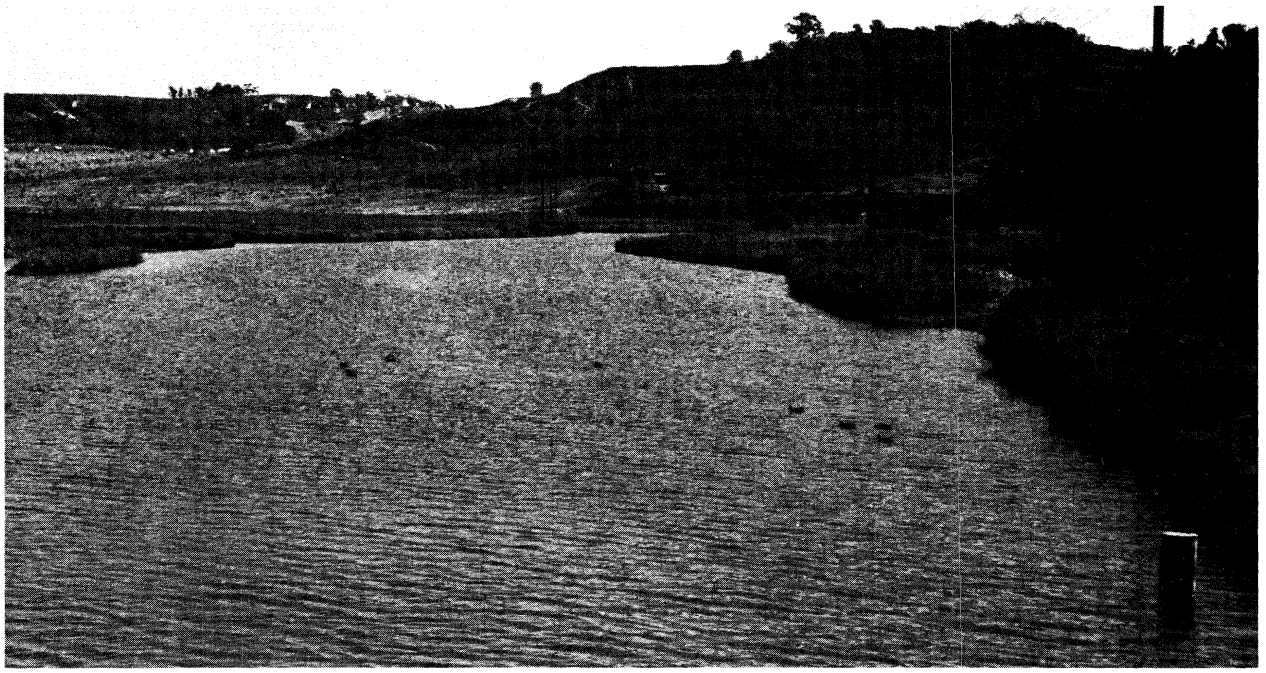
Although there are no records of line-fishing in Batiquitos Lagoon, bait-fishing for mudsuckers has periodically been practiced in this lagoon since at least 1960, and bait traps are still regularly set in the western channels. Duck-hunting in the lagoon was reported to be in practice in 1887 (S.D. Water Quality Control Board, 1967). Many old waterfowl nesting boxes still dot the shore although hunting is no longer practiced.

Little information is available concerning the current use of Batiquitos for aesthetic or natural history enjoyment or study. Between 1969 and 1971, the lagoon was frequently visited by ornithologists interested in observing the abundant shorebird life there, and undoubtedly many of the persons using the former freeway rest area also enjoyed the bird life. There are no records of use of the lagoon by local schools; however, Batiquitos was the site for a study of modern and prehistoric shellfish faunas, the subject of a UCLA Master's thesis in 1966 (Miller, 1966). And, the effect of herbicide application on the control of algal growth was the subject of an independent study project carried out by two biology students at San Diego State University in 1970 (Belt and Hom, 1970). The only known ongoing study is that of Bradshaw and Mudie (1972), who are monitoring the long-term changes in the water quality of the lagoon.

The primary contemporary use of Batiquitos Lagoon appears to be recreational. At the beach, in front of the lagoon entrance, there is an almost year-round use--which ranges from intensive use during warmer months

to light use during the cool season. The mudflats at the eastern end of the lagoon are regularly used by motor cyclists and recreation vehicle drivers. The eastern end also is used for model aircraft flying, and in one instance, for testing a home-constructed helicopter. The roadways bordering the eastern lagoon are frequently used as trails by local horsemen, and the parking area at the base of Lagoon Lane is usually occupied during the day by one or more cars. From here persons can enjoy the rural atmosphere of the eastern basin or take short walks along the north shore.

The only present commercial use of Batiquitos Lagoon (other than the bait fishing) is the regular use of the wide, undeveloped eastern basin as a test flight area for Palomar Airport helicopters, which are constructed locally by Hughes Aircraft Company, Oceanside. However, investigations have been made concerning the feasibility of another commercial use, that of exploiting the lagoon's superficial clay resources (Zatt, pers. comm.). And, it has been determined that at least five million cubic yards of sand in the beach-sand particle size range could be harvested from this lagoon and used to replenish the local beaches as far south as La Jolla (Zatt, 1974a).



SAN DIEGUITO LAGOON

BATIQUITOS LAGOON

THE LAGOONS CAN BE PRESERVED AS IS, RESTORED TO FORMER NATURAL CONDITIONS OR DEVELOPED FOR COMMERCIAL OR PUBLIC RECREATIONAL USE.

RESOURCE PROBLEMS

The natural resources of both San Dieguito and Batiquitos lagoons are presently in a degraded condition. Since the lagoons are centered in areas of burgeoning population growth, an increasing pressure is being exerted on planners to determine the future development and uses of these wetlands.

Planning can essentially be reduced to three basic possibilities: (a) preserve the lagoons and wetlands as they currently exist; (b) restore these areas to their former natural condition, as far as possible; or (c) develop the lagoon areas into artificial environments for commercial-recreational or public-recreational usage. The determination of what problems and conflicts in use will affect the wetland areas ultimately depends on which of these three basic possibilities is selected. Since a purpose of this report is to foster preservation and enhancement of coastal wetland resources, it is assumed that the underlying basis for the planning choice is to achieve optimum natural resource values for these presently degraded lagoons. This report, then, deals with the problems of resource maintenance and enhancement and conflicts in resource use from the point of view that the natural resource values of San Dieguito and Batiquitos lagoons will be improved.

Lagoon Entrance Maintenance

There is little question that the natural resource values of both lagoons are presently limited by the lack of regular ebb and flow of tides. For example, the major consequence of the long-term closure of the San Dieguito entrance channel coupled with the past history of that lagoon being used as a sewage receptacle, is that it is presently an unstable,

eutrophic, brackish water ecosystem, somewhat analogous to the purportedly dying Lake Erie.

A similar unstable situation characterizes Batiquitos Lagoon following the closure of its entrance channel. Although the underlying cause of productivity loss is the same as in San Dieguito, viz. the lack of tidal water exchange and the presence of nutrient-enriched surface sediments, the specific cause of the periodic decline in the natural resources of Batiquitos Lagoon appears to be principally related to the dramatic occilation between the steep summer increase in lagoon water salinity, and the steep downward plunge during the rainfall season. This range of salinity fluctuation appears to be tolerable to only a few fish species, and its harmful effects are undoubtedly exaggerated by the periodic inflow of nutrient-rich effluent which adds an additional burden to the already nutrient-overloaded lagoon waters.

Two options to the problem of the lack of tidal flows are available to planners, both of which would greatly increase the stability of the environments of both lagoons. One alternative is to stabilize the lagoons as brackish or freshwater ecosystems by providing a permanent input of fresh or slightly brackish ground water. The second alternative is to stabilize the lagoons as tidal ecosystems in which the regular flood and ebb of ocean water moderates changes in the salinity and temperature. Tidal flushing would also reduce the accumulation of organic and inorganic nutrients (Bradshaw and Mudie, 1972).

The problems that are likely to arise from the execution of the first alternative, i.e. the development of a stable brackish or freshwater lagoon, are: (a) existing nutrient excesses from the lagoons, and how

to prevent their future accumulations within an enclosed aquatic system; (b) how to secure sufficient volumes of fresh or slightly brackish water in order to maintain a more or less constant lagoon water level, and to counteract the tendency of the salinity to rise as the lagoon water evaporates and as seawater seeps in; (c) how to control sediment accumulation in the enclosed basins in order to prevent open water areas from becoming marshes, then upland areas; (d) how to control floodwaters in order to prevent periodic breaching of dams at the lagoon entrances, and the inundation of adjacent uplands; and (e) how to control the invasion and spread of emergent marsh plants, e.g. cattails and bulrushes, and the potential threat of severe insect problems. Engineering studies would be required to find solutions to these problems. Assuming that these problems can be overcome, the beneficiaries would be the many species of water-associated birds, such as are presently supported by nearby, fresh/brackish water Buena Vista Lagoon. With a constant inflow of fresh water, these coastal lagoons would not support ocean marine life, such as fish or shellfish, although they might possibly be stocked with fish that would thrive in fresh water; and, the natural resource diversity of the lagoons created by true estuarine conditions would be lowered.

Problems that would arise from attempting to restore tidal conditions in the lagoons center primarily around means of keeping the entrance channels from becoming blocked by the net deposition of wave and current-transported sand, i.e. more sand entering the entrance channel than transported out of it on each tidal cycle. In theory, sand will block an entrance channel unless the tidal prism[1] of a lagoon is sufficiently

[1]The volume of ocean water flowing in and out of a lagoon with each tide.

large to keep the entrance scoured. The minimum acceptable tidal prism for a self-maintaining lagoon entrance is probably about 27 million cubic feet; by comparison, the tidal prisms in San Dieguito and Batiquitos lagoons (when the entrance channels are open) are relatively small, being estimated at a mere 1/5 and 1/3 million cubic feet, respectively (Bradshaw and Mudie, 1972).

It is roughly calculated, however, that if the entrance channels of San Dieguito and Batiquitos lagoons were excavated down to a depth of 0 tidal datum (about -3.0 ft. below mean sea level), and if obstructing dikes (excluding the road and railroad embankments) were removed, then tidal prisms in the lagoons would be increased to about 2 and 13 million cubic feet in San Dieguito and Batiquitos lagoons, respectively (for comparison, the tidal prism of nearby Los Penasquitos Lagoon ranges between 3/4 and 2 million cubic feet). Dredging Batiquitos Lagoon to a depth of 2 feet below the present surface would increase the tidal prism of this lagoon to about 26 million cubic feet, whereas in San Dieguito Lagoon, it would require the dredging to 0 tidal datum of the entire channel system, plus the 50-acre parcel north of the flood way and east of the fairground parking area, to establish a tidal prism of 25-1/2 million cubic feet.

In addition to the natural self-flushing systems discussed above, several other methods of maintaining tidal conditions in coastal lagoons are at least potentially feasible (some are still in the experimental stage however). These channel maintenance methods have been described in some detail by Mudie, Browning and Speth (1974) and by the County of San Diego (1974). They include the fluidization of channel sediments by means of water forced through perforated pipes installed on or below the surface of the entrance channel sandbars; a crater-sink pumping system,

which removes sand from a crater excavated inside the entrance channel and pumps it out onto the beach (Inman and Harris, 1970); tidal gates to permit the build-up of a head of ocean water in the lagoon prior to its release on a low tide to scour the channel (U. S. Army Corps, 1966); and various jetty systems which are considered undesirable, however, because they tend to block natural sand transport to the beaches.

A decision regarding the most efficient and economical means of maintaining tidal flow in San Dieguito and Batiquitos lagoons should await the outcome of contemporary studies of the entrance maintenance problems in San Elijo Lagoon (County of San Diego, 1972), as well as the outcome of engineering studies of the wave and littoral drift regimes at the entrances of San Dieguito and Batiquitos lagoons. Regardless of the method used in restoring tidal conditions to these lagooons, it can be stated unequivocally that a stable, tidal regime in the lagoons will permit the rapid (e.g., within two to four years) establishment of large numbers of marine fish and shellfish, in addition to providing support for a wide diversity of aquatic birds; and, it would permit the restoration of salt marsh lands which play an important role in sustaining the productivity of lagoon ecosystems and nutritionally enrich near-shore coastal waters. Tidal lagoon systems would also reduce the pollution and insect problems that currently plague these wetland areas, alleviate flood control problems while allowing the natural transport of sand to adjacent beaches, and create the potential for mariculture, the commercial cultivation of marine organisms, in one or both lagoons.

Flood Control and Sedimentation

The flood hazards for the San Dieguito and Batiquitos Lagoon wetlands have been described previously in this report (Hydrology and Geology). Detailed engineering studies have been made of the flooding potentials in the western portions of both the San Dieguito River and the San Marcos Creek watersheds. However, more specific plans have been proposed for the control of flood waters in the San Dieguito than for Batiquitos lagoon and its environs.

San Dieguito Lagoon

Flood control proposals for the San Dieguito River range in magnitude from the construction of a concrete-lined channel extending from the ocean to the freeway (County of San Diego, 1965), to various lesser degrees of channel dredging and diking (Moffett and Nichol, 1971). The least intensive proposal suggests minor reinforcement of some portions of channel embankments combined with zoning-regulated restriction of flood plain ditches also are planned for the drainage from Eden Gardens Canyon (construction commenced in October, 1974), and that from San Andreas and Crest Canyons.

Moffatt and Nichol (1971) proposed a minimum protection plan involving construction of a riprap reinforcement to prevent scouring of the south bank of the lagoon near the entrance, and to limit overflow flooding of most of the residential area south of the lagoon and west of the railroad. This modification would not, however, prevent overflow inundation on the fairgrounds and the adjacent commercial developments. Full protection from overflow flooding would require the construction of a levee-lined, tidal channel extending from the ocean to the freeway, in addition to reconstruction of existing roads and bridges.

A final decision on the best method of flood control of the San Dieguito River has not yet been made. However, the City of Del Mar has expressed concern regarding the effects of channelization on the lagoon ecosystem, and has tentatively concluded (City of Del Mar, 1975) that the estimated property damages in the flood plain would not justify the costs of either the Moffatt-Nichol proposals or the earlier concrete-lined channel proposed by the County of San Diego (1965). Hence, in 1972, the City of Del Mar approved a flood plain over the zone ordinance which prohibits building, filling, dredging or diking of the river flood way (roughly the 10-year flood overflow limit, see Plate 7) unless prior approval of the City is obtained, and restricts construction in the surrounding flood plain fringe (roughly the 100-year flood overflow limit).

From a wildlife management viewpoint, the design and construction of flood-control works in the San Dieguito flood plain could be done in a manner to enhance the natural resource values of the lagoon. Earth-based tidal channels with sandbars and sloping sides could become colonized by productive low salt marsh vegetation. If such constructed channels included several deep ponds from which sediment accumulations were regularly removed, these ponds would provide temporary refuges for aquatic marine organisms on very low ebb tides. Deepening the river channel inland from Interstate-5, if properly planned, also could renovate the acreage of what formerly was brackish water marsh, riparian and freshwater pond habitats that are favored by many waterbirds.

On the other hand, the results of constructing a concrete-lined flood-control channel would be entirely detrimental to living resources. Such construction would remit development in the flood plain, but it also

would cause the complete destruction of existing wetland habitats and eliminate the possibilities of enhancing them for fish and wildlife.

Batiquitos Lagoon

Flood-control problems in the Batiquitos Lagoon wetlands differ significantly from those prevailing in the San Dieguito wetlands because of the smaller size of the San Marcos Creek drainage basin and the undeveloped state of the wetlands and their borders. Even the largest (i.e., 100-year) flood would barely overflow the dirt road on the north side of the eastern basin, and it would not reach La Costa Avenue. Although such a flood might wash out the El Camino Real Bridge and the waters overflow into the lower areas of the La Costa Resort, raising of the bridge and diking of the flood way through La Costa could eliminate these problems without adverse effect on the wetland resources.

Historical records of the expansion of the San Marcos Creek delta, the growth of minor alluvial fans at the bases of other tributary canyons, and the accumulation of sand deposits in the Encinitas Creek tributary strongly indicate that much of the eastern basin of Batiquitos Lagoon will become filled with fluvial sediments within the next century unless the formation and growth of the deltas is checked by restricting the inflow of large sediment loads. Sedimentation of the eastern basin of Batiquitos Lagoon could be controlled in several ways: 1) by the construction and regular maintenance of sediment traps at the bases of the main and tributary watercourses, 2) by control of upstream erosion, and 3) by restricting the development of creek flood ways so that minor depressions within them continue to act as natural sediment traps. Conversely, the construction of concrete-lined flood-control ditches, such as those presently planned for the arroyos on the south side of the eastern basin,

and channelization of the creek watercourses undoubtedly will promote the flow of sediment into the lagoon and accelerate its conversion to upland transition grassland.

Water Quality

The major water quality problem facing both lagoons is, quite simply, the lack of water. And, the possible solution to this problem is discussed in the section of this report on "lagoon entrance maintenance."

A good supply of sea water or freshwater would solve two existing conditions having an adverse impact on fish and wildlife. Sludge which has built up during the period when sewage effluent was discharged into the lagoons continues to supply nutrients to this water, resulting in eutrophic conditions. Dilution of these nutrient-rich waters with fresh or sea water would obviate this problem. The present regime of wide-ranging salinities would also be solved with a steady supply of water. The seasonal changes in water levels, another condition closely related to changing salinities, also would be cured with a continuous supply of water.

Development

Both lagoons lie within the boundaries set forth in several land-use plans that recently have been updated, *viz.*, the San Dieguito Community Plan, the Del Mar Community Plan and the Torrey Pines Community Plan. While some of the land use plans for the wetlands and adjacent slopes have been changed to reflect an increased awareness of the need to conserve wetland resources and to limit the development of flood lands, the underlying zoning of many land parcels has not yet been changed to reflect the new plans. Litigation may result from "down zoning" required to implement the new plans. Hence, the potential conflicts of use in the San Dieguito and

Batiquitos lagoon wetlands can only be discussed in concept at this stage, since the precise nature of the problems are subject to change.

Commercial-Recreational and Residential Development--San Dieguito Lagoon

In the San Dieguito wetlands area, land-filling is in progress east of Turf Road (approximately three acres) and east of the freeway interchange (16 acres), which, if unchecked, will culminate in filling approximately two acres of commercial service facilities in the high salt marsh areas both west and east of Jimmy Durante Road Bridge. The entire western pond and sand-dune area is zoned for similar use. Plans have been presented for the development of a 400-unit residential-commercial project, including a half-acre shopping center, in the wetlands and on the slopes bordering and east of the south lagoon channel. A 36-unit residential complex has been proposed for the vacant, filled area on the south side of the western pond. Ultimately, if all the land in the San Dieguito wetlands west of Interstate-5 was to be fully developed in accordance with current land zoning, the wetlands would be essentially reduced to about 70 acres of channels and ponds, plus 100 acres of upland transition grassland (currently zoned A-1-10).

In order to accommodate the predicted increase in traffic volume through the flood plain, it has been proposed to widen Turf Road and to construct a highway along the north bank of the flood way, thus connecting Jimmy Durante Road with a major interchange on the north side of the freeway bridge. This proposal would involve additional filling of the wetland area.

Encroachment is rapid on the hillslopes surrounding the San Dieguito wetlands: a 127-unit residential subdivision has been proposed for Crest

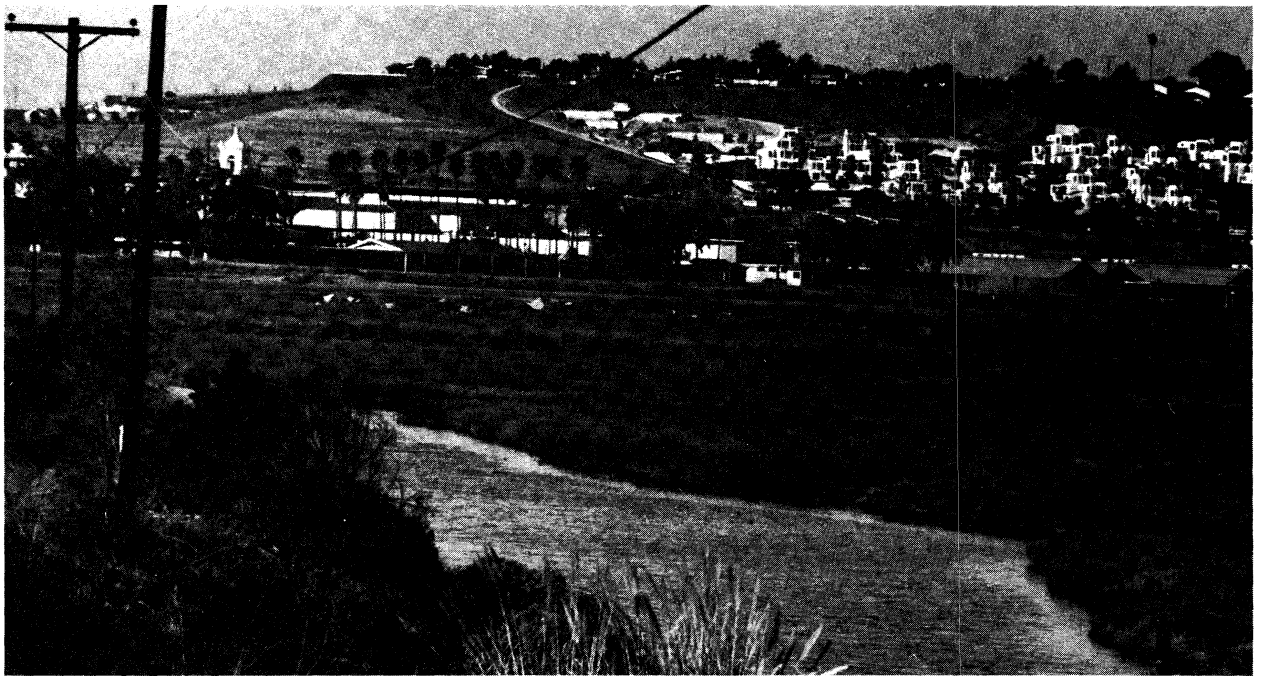
Canyon; residential development is progressively covering the mesa to the south and east of the canyon; and residential or commercial-recreational development is proceeding on the slopes north of Border Avenue. Southwest of the freeway, grading part of the mesa and its upper slopes has been completed as the first stage in the development of North City-West, a complex of "mini-cities" being planned by the City of San Diego. This project would ultimately support a population of about 1/3 million persons.

In addition to the obvious impact that filling would have on reducing the wetland acreage of San Dieguito Lagoon, development is likely to magnify the existing problems of disturbance in the wetlands by recreational vehicles and domestic animals. Further, the development of the adjacent uplands will undoubtedly exaggerate the existing problems of sedimentation, increase the volume of pollutants (fertilizer, oil, heavy metals, etc.) entering the lagoon from the watershed, and will probably increase the volume of storm and flood water runoff into the flood plain. The latter would probably necessitate an increase in the dimensions required for flood control devices in the wetlands.

Commercial-Recreational and Residential Development--Batiquitos Lagoon

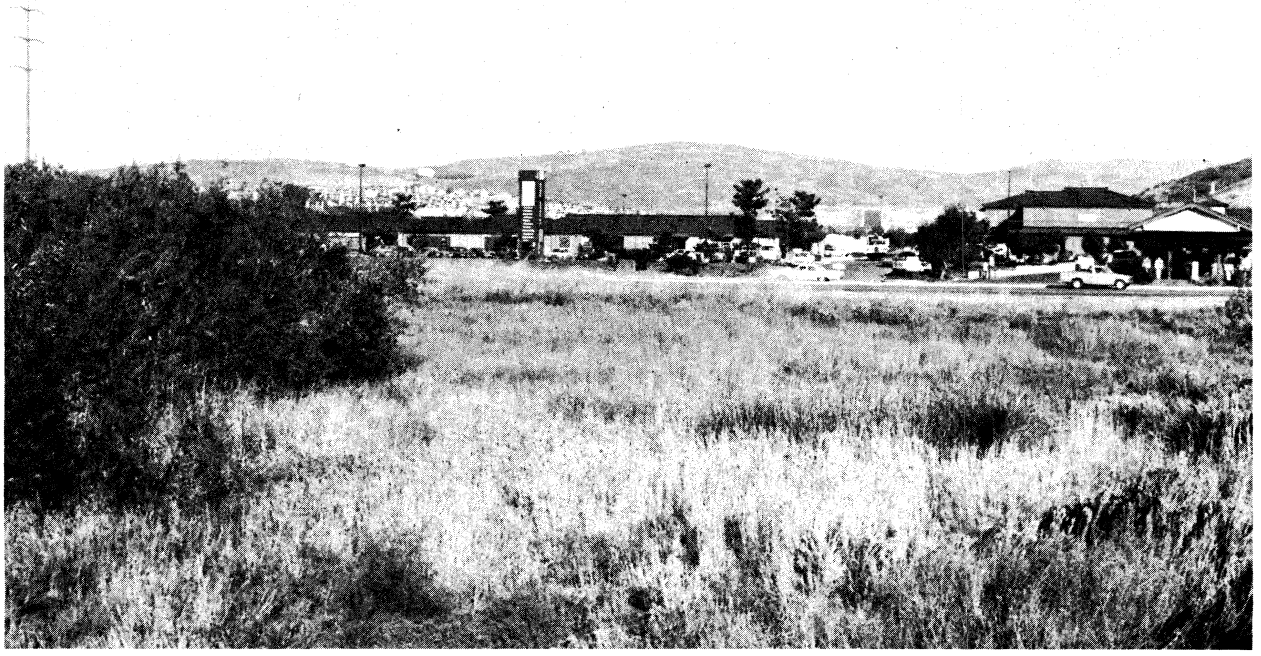
There are no immediate plans for commercial or residential development in the Batiquitos Lagoon wetlands other than a proposed marina development which is discussed in the next section of this report. However, several developments have been proposed for, or are under construction on, the slopes and bluffs surrounding the lagoon.

At the eastern end of the lagoon, development of the planned residential community of La Costa, which projects an ultimate population of 25,000 by 1980-85, has been more or less completed on the lower slopes; and,



SAN DIEGUITO LAGOON

BATIQUITOS LAGOON



INCREASED RESIDENTIAL DEVELOPMENT AT THE PERIPHERY OF THE LAGOONS WILL HAVE A SIGNIFICANT ECOLOGICAL IMPACT ON THE NATURAL RESOURCES.

grading prior to construction has progressed up the slopes of the San Marcos Creek watercourse as far as Rancho Santa Road (about 3.5 miles east of El Camino Real). Inland, the development of the City of San Marcos is also proceeding rapidly, with a predicted population increase from 9,000 in 1975 to 40,000 by 1990. To the southeast, the planned residential community of Village Park is rapidly expanding along Encinitas Boulevard.

South of the eastern basin of Batiquitos Lagoon, a large residential community, Saxony Highlands, has been proposed for the mesa top and slopes bordering Saxony Road canyon and the headwaters of a smaller canyon to the east; and, grading for other residential developments has been completed on the mesa to the west of Saxony Road canyon. To the north of the eastern lagoon, zoning has been approved for a planned community development on 370 acres surrounding the freeway interchange at Poinsettia Land (about one mile from the north shore of the lagoon) and a 112-acre development is proceeding immediately northwards (Noble Harbor Engineering, 1972). At the western end of the lagoon, plans have been approved for a nine-story condominium complex north of the lagoon entrance area, and a 250-unit condominium is being developed on the ocean front of the mesa to the south of the western lagoon. A 70-acre planned residential community, with commercial services and tourist resort amenities has been proposed for the hilltop north of the central lagoon basin.

These developments will obviously have an important impact on the natural resources of the Batiquitos Lagoon wetlands, and for the same reasons outlined in the discussion of San Dieguito Lagoon--namely, increased problems of disturbance by humans and domestic animals, accelerated sedimentation rates and increased runoff of urban wastes. The County of San Diego

has proposed a buffer zone fringing the lagoon to alleviate this type of problem. Sediment traps and adequate, enforced provisions for urban drainage and erosion control in the watershed would also present some of these potential problems.

Marinas and Sand Mining

Small craft harbors have been planned for both San Dieguito and Batiquitos lagoons. The San Dieguito Community Plan for the development of Del Mar Harbor proposed dredging a 400-foot wide tidal channel extending more than 3-1/2 miles inland and encompassing an area of over 2,000 acres, providing sites for 3,000 harbor-side homes, berthing for several thousand small craft, and including the development of commercial-recreational facilities (San Diego Regional WQCB, 1966).

The Batiquitos small craft marina plan (Noble Harbor Engineering, 1972) proposed dredging of this lagoon to a distance of at least 1/4-mile east of the freeway; and,for an unspecified distance further inland, development of the lagoon which would be controlled by a public harbor district and private development of adjacent lands. Along the shoreline of the marina, clusters of waterfront residences, as well as commercial-recreational developments which "complement the recreational and environmental features of the lagoon," would be constructed on dredge spoil. Limited dredging of Batiquitos Lagoon also is proposed by San Diego County's Regional Park plan (Plate 15), which, as a highest priority, recommends the public acquisition of 355 acres of the wetland area and 1,061 acres of adjacent shoreline (the County has contracted with John Sue and Associates to carry out necessary studies to develop detailed Park plans for Batiquitos area).

Other proposals requiring the dredging of both wetlands focus on the use of sand resources underlying the clayey lagoon surfaces for the replenishment of dwindling North County beach sand supplies (Zatt, 1974a; 1974b). The proposals recommend dredging down to a depth of about 20 feet in Batiquitos Lagoon and probably to a greater depth in San Dieguito, where the sand sediment fraction is smaller.

Dredging the lagoons for either marina development or sand mining would undoubtedly have a dramatic, short-term, adverse effect on the wildlife resources of the wetlands. However, studies of the shellfish populations in Agua Hedionda Lagoon, following its dredging to an average depth of about eight feet in 1954, indicate that large populations of a diversity of shellfish may rapidly colonize a shallow lagoon, despite the repeated dredging removal of sand from the lagoon basin (Miller, 1966; Ritter, 1972). Large populations of many species of nearshore fish were found in this shallow lagoon in 1973 (Bradshaw and Estberg, 1973). On the other hand, the dredging of Mission Bay to depths of ten feet or greater, resulted in a significant reduction of the formerly rich shellfish resources and caused a change in the composition of fish species from predominantly estuarine flatfish to mostly nearshore, open-ocean species (Chapman, 1962). Furthermore, significant reductions in the diversity of aquatic bird species found in both Agua Hedionda and Mission Bay are believed to have occurred, due to diminution of the acreage of inter-tidal mudflats and elimination of most of the salt marsh vegetation. Such negative impacts, however, could probably be avoided at Batiquitos and San Dieguito by judicious planning for a network of wide, deep-water tidal channels separated by islands of salt marsh bordered by gently-sloping mud or sandflats.

Industry

No significant industrial development has yet been proposed for either Batiquitos or San Dieguito lagoons. However, plans have been developed, or are being considered, for two industrial developments which would be located north of Batiquitos Lagoon and which might have a significant negative impact on that wetland resource. A major oil storage facility is being planned near Agua Hedionda Lagoon, about four miles north of Batiquitos Lagoon. This development would involve the near-shore berthing of oil tankers and the transfer of oil supplies to the storage areas, with the concomitant risks of major oil spills.

Any expansion of the helicopter construction industry based at Palomar Airport would undoubtedly exaggerate the already damaging effect on bird populations that results from the use of the eastern basin of Batiquitos Lagoon as a test flight area. This sort of flight testing should take place somewhere else than in coastal wetlands.

OVERVIEW

At the beginning of the present decade, approximately 85 percent of the State's 20 million people lived within 30 miles of the shores of California's coastline. Furthermore, over half of that total population presently live within a few hours drive of the coastline of three southern counties. Hence, there naturally is a great demand for the use of the coastal wetland resources. But, fortunately, there also is much concern about the status, and interest in the preservation, of these valuable and ecologically important wetland resources and open spaces.

At first the degradation and destruction of the California coastal wetlands was rampant, especially along the coast of the southern counties that include San Diego County. But gradually, through the arousal of public awareness and concern, the rate of reclamation and degradation of the coastal wetlands decreased. Finally, on November 7, 1972, under public referendum (Prop. 20), the California Coastal Zone Conservation Commission was established, and a moratorium placed on the indiscriminate destruction of California's coastal resources. The people of California officially made a stand, thereby, on how they feel about our coastal resources.

But, in southern California, and especially in San Diego County, the local people have long been sensitized to the problems and conflicts of resource use of their lagoons, bays and estuaries, and have been actively campaigning to preserve and wisely use their bloc of coastal resources. As has been stated in the text of this report, there is a multiple jurisdiction involved in the management of, and responsibility for, the natural resources of San Dieguito and Batiquitos lagoons. This jurisdiction involves principally the County of San Diego, and the cities of San Diego and Del Mar.

Each county and city judicatory has developed and prepared plans (viz., the County Regional Park Plan, the San Dieguito County Community Plan, the Del Mar Community Plan, the Del Mar Environmental Plan, the San Diego City Torrey Pines Community Plan, etc.), for the orderly development and management and wise use of the wetland resources of San Dieguito and Batiquitos lagoons. These plans vary in scope and biological feasibility, but the major thrust and philosophy of each plan is virtually the same: to preserve, enhance and maintain the natural resources and open spaces of these coastal wetlands. Furthermore, the San Diego Comprehensive Planning Organization, a kind of "umbrella" organization and "clearing house" for handling federal grant monies and environmental impact surveys pertaining to development in the southern coastal counties, has been established locally to ensure and facilitate cooperation and continuity in area planning. CPO, as it is referred to, also takes an active interest in the coastal wetland resources. And, local citizens groups such as the San Dieguito Lagoon Preservation Committee, San Elijo Alliance, San Diego Coastal Lagoon Committee, have played a major role in preserving San Diego County's wetlands.

The Department of Fish and Game both endorses and commends the splendid efforts of these private, city and county organizations, to preserve, enhance and maintain the natural wetlands of these southern California wetlands. For, in the final analysis, it is the people and their representatives who will weigh economic progress and development against the preservation and enhancement of natural amenities, and then decide whether we will have coastal wetlands or not.

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APPENDIX A

CHECK LIST OF FLOWERING PLANTS IN SAN DIEGUITO LAGOON

I. MARSH VEGETATION

A. BRACKISH WATER MARSH

FAMILY	SPECIES	FREQUENCY[1/]
Cyperaceae	Alkali bulrush, *Scirpus robustus*	c, la
Gramineae	Bermudagrass, *Cynodon dactylon*	lc
	Saltgrass, *Distichlis spicata*	o, la
Juncaceae	Spiny rush, *Juncus acutus*	r, lc
Boraginaceae	Chinese pusley, *Heliotropium curassavicum*	o
Caryophyllaceae	Sand spurrey, *Spergularia marina*	o
Chenopodiaceae	Fat-hen, *Atriplex patula* ssp. *hastata*	c, la
	Goosefoot, *Chenopodium macrospermum*	o, la
	Pickleweed, *Salicornia virginica* [2/]	o, c
Compositae	Jaumea, *Jaumea carnosa*	la
	Camphorweed, cf. *Pluchea purpurascens*	r
	Sow-thistle, *Sonchus oleraceus*	r
	Brass buttons, *Cotula coronopifolia*	o
Frankeniaceae	Alkali heath, *Frankenia grandifolia*	o
Malvaceae	Alkali-mallow, *Sida hederacea*	c
Polygonaceae	Curly dock, *Rumex crispus*	r

1/ Frequency symbols:
a = abundant, la = locally abundant, c = common, lc = locally common, o = occasional, r = rare (scarce)

2/ Plants often dead.

Solanaceae	Tree tobacco, *Nicotiana glauca*	o
	Nightshade, *Solanum* cf. *nodiflorum*	o

B. SALT MARSH - "LOW" MARSH

Gramineae	Saltgrass, *Distichlis spicata*	la
	Salt cedar, *Monanthochloe littoralis*	la
Chenopodiaceae	Fat-hen, *Atriplex patula* ssp. *hastata*	o
	Pickleweed, *Salicornia virginica*	c, a
Convolvulaceae	Alkali weed, *Cressa truxillensis*	o
Compositae	Jaumea, *Jaumea carnosa*	la
Frankeniaceae	Alkali heath, *Frankenia grandifolia*	lc
Plumbaginaceae	Marsh lavender, *Limonium californicum* ssp. *mexicanum*	

B. SALT MARSH - HIGH MARSH AND SALT PANS

Gramineae	Annual grasses, unidentifiable	la
	Soft chess, *Bromus* cf. *mollis*	lc
	Saltgrass, *Distichlis spicata*	o, lc
	Wild barley, *Hordeum* cf. *jubatum*	la
	Salt cedar, *Monanthochloe littoralis*	lc
	Rat-tailgrass, *Parafolis incurva*	lc
	Rabbit's-footgrass, *Polypogon monspeliensis*	la
Aizoaceae	Little ice-plant, *Mesembryanthemum nodiflorum*	la
Chenopodiaceae	Pickleweed, *Salicornia virginica*	o, lc

Chenopodiaceae (continued)	Glasswort, *Salicornia subterminalis*	a
	Sea blight, *Suaeda* cf. *californica*	lc
	Seep weed, *Suaeda ramosissima*	la
Convolvulaceae	Alkali weed, *Cressa truxillensis*	o, c
Compositae	Goldenbush, *Haplopappus venetus*	r
	Lasthenia glabrata ssp. *coulteri*	r
Frankeniaceae	Alkali heath, *Frankenia grandifolia*	r
Solanaceae	Coast box-thorn, *Lycium californicum*	r

II. DUNE VEGETATION (Including areas of unstabilized sandy soil)

Aizoaceae	Iceplant, *Mesembryanthemum crystallinum*	la
	New Zealand spinach, *Tetragonia expansa*	o
Chenopodiaceae	Russian thistle, *Salsola kali*	r, lc
Cruciferae	Wild stock, *Matthiola incana*	r
Compositae	Beach sandbur, *Ambrosia bipinnatisecta*	
	Tricolor chrysanthemum, *Chrysanthemum* cf. *carinatum*	o
	Goldenbush, *Haplopappus venetus*	o
	Telegraph weed, *Heterotheca grandiflora*	o, la
Geraniaceae	Red-stemmed filaree, *Erodium cicutarium*	lc
Leguminosae	Beach deerweed, *Lotus nuttalianus*	o, lc
	Deerweed, *Lotus scoparius*	r, la

Nyctaginaceae	Sand verbena, *Abronia maritima* 1/	o
	Beach sand verbena, *Abronia umbellata*	r
Onagraceae	Twisted suncup, *Camissonia bistorta*	c
	Beach evening primrose, *Camissonia cheiranthifolia*	lc
Polygonaceae	Little-leaf buckwheat, *Eriogonum parvifolium* 1/	r
Umbelliferae	Wild anise, *Anethum graveolens*	o

III. UPLAND TRANSITION (= MARITIME) GRASSLAND (Including vegetation in the old oxidation pond a Sample Area H, which is periodically inundated by shallow brackish water)

Cupressaceae 2/	Monterey cypress, *Cupressus* cf. *macrocarpa*	r
Gramineae	Annual grasses, unidentifiable	lc, la
	Giant reed, *Arundo donax*	
	Rip-gut brome, *Bromus rigidus*	
	Pampasgrass, *Cortaderia selloana* 3/	r, o
	Saltgrass, *Distichlis spicata*	la
	Wild barley, *Hordeum* cf. *jubatum*	o, a
Palmae	Date palm, *Phoenix dactylifera* 3/	r
	California fan palm, cf. *Washingtonia filifera* 3/	o
Aizoaceae	Ice plant/Sea fig, *Mesembryanthemum aequilaterale*	o, la
	Wild sea fig, *Mesembryanthemum chilense*	o, la
	Ice plant, *Mesembryanthemum crystallinum*	o, la

1/ Found only on the dunes.
2/ Cone-bearing, not Flowering Plant Order.
3/ Planted horticultural species.

Aizoaceae (continued)	Little ice-plant, *Mesembryanthemum nodiflorum*	lc, la
	Rosy ice-plant, *Mesembryanthemum rosea*	la
	Unidentified horticultural variety, *Mesembryanthemum* sp.	r
	New Zealand spinach, *Tetragonia expansa*	lc
Amaranthaceae	Amaranth, cf. *Amaranthus californicus*	lc
Apocynaceae	Oleander, *Nerium oleander* 1/	o
Chenopodiaceae	Australian salt bush, *Atriplex semibaccata*	o, la
	Bassia, *Bassia hyssopifolia*	o, lc, la
	Wild beet, *Beta vulgaris*	r, lc
	Mexican tea, *Chenopodium ambrosioides*	lc
	Russian thistle, *Salsola kali*	o, lc
	Sea blite, *Suaeda* cf. *californica*	r
	Seep blite, *Suaeda ramosissima*	c, a
Compositae	Western ragweed, *Ambrosia psilostachya*	r, lc
	California sagebrush, *Artemisia californica*	r, lc
	Chaparral broom, *Baccharis sarothroides*	
	Star thistle, *Centaurea melitensis*	lc
	Goldenbush, *Haplopappus venetus*	o, la
	Telegraph weed, *Heterotheca grandiflora*	o, lc
	Camphor weed, cf. *Pluchea purpurascens*	o
	Arrow-weed, *Pluchea sericea*	r
	Wire lettuce, *Stephanomeria virgata*	o, c
	Wild sunflower, *Helianthus* cf. *californicus*	lc

1/ Planted horticultural species.

Boraginaceae	Chinese pusley, *Heliotropium curassavicum*	o, c
Convolvulaceae	Alkali weed, *Cressa truxillensis*	o, lc
Cruciferae	Black mustard, *Brassica nigra*	o, a
	Tumble mustard, *Sisymbrium* cf. *officinale*	lc
	Wild radish, *Raphanus sativus*	lc
Euphorbiaceae	Castor-bean, *Ricinus communis*	r, lc
Geraniaceae	Herons-bill, *Erodium cicutarium*	r
Frankeniaceae	Alkali heath, *Frankenia grandifolia*	r, lc
Leguminosae	Acacia, *Acacia* cf. *longifolia*	r
	Deerweed, *Lotus scoparius*	o
	Sweet-clover, *Melilotus indicus*	lc
Malvaceae	Alkali mallow, *Sida hederacea*	o, c
Myoporaceae	Myoporum, *Myoporum laetum*	o, c
Plumbaginaceae	Statice, *Limonium perezii*	r
Polygonaceae	Flat-top buckwheat, *Eriogonum fasciculatum*	r
	Curly dock, *Rumex crispus*	r
Solanaceae	Jimson weed, *Datura stramonium*	r
	Tree tobacco, *Nicotiana glauca*	r, la
Tamaricaceae	Tamarisk, *Tamarix pentandra*	r, o
Umbelliferae	Wild anise, *Anethum graveolens*	lc

IV. RIPARIAN VEGETATION

Cyperaceae	Sedge, *Cyperus* sp.	o
Gramineae	Annual grasses, unidentifiable	c
	Bermudagrass, *Cynodon dactylon*	la
Typhaceae	Cat-tail, *Typha latifolia*	a
Boraginaceae	Heliotrope, *Heliotropium curassavicum*	o
Capparidaceae	Bladder-pod, *Isomeris arborea*	o
Caprifoliaceae	Elderberry, *Sambucus mexicanus*	c
Convolvulaceae	Alkali weed, *Cressa truxillensis*	c
Cruciferae	Black mustard, *Brassica nigra*	lc
Compositae	Goldenbush, *Haplopappus venetus*	r
Euphorbiaceae	Castor-bean, *Ricinus communis*	c
Labiatae	Horehound, *Marrubium vulgare*	o
Leguminosae	Sweet-clover, *Melilotus indicus*	o
Platanaceae	California sycamore, *Platanus racemosa* 1/	r
Polygonaceae	Curly dock, *Rumex crispus*	c
Rosaceae	Toyon, *Heteromeles arbutifolia*	o
	Wild rose, *Rosa californica*	lc

1/ Dead.

Salicaceae	Arroyo willow, *Salix lasiolepis*	c
Solanaceae	Tree tobacco, *Nicotiana glauca*	c
Umbelliferae	Hemlock, cf. *Conium maculatum*	c

APPENDIX B

CHECK LIST OF FLOWERING PLANTS IN BATIQUITOS LAGOON

I. MARSH VEGETATION

A. BRACKISH/FRESH WATER MARSH

FAMILY	SPECIES	FREQUENCY [1/]	SAMPLE AREAS
Cyperaceae	Sedge, *Cyperus* sp.	o	E
	California bulrush, *Scirpus californicus*	r, o	EE,H,K
	Bulrush, *Scirpus* cf. *fluviatilis*	o	G,H
	Olney's bulrush, *Scirpus olneyi*	o	H,I
	Alkali bulrush, *Scirpus robustus*	lc	H
Gramineae	Saltgrass, *Distichlis spicata*	la	F,G,K
	Rabbit's-footgrass, *Polypogon monspeliensis*	lc	H
	Dropseed, *Sporobolus* cf. *poiretii*	la	G
Juncaceae	*Juncus acutus* ssp. *sphaerocarpus*	lc, la	E,F,G,K
Typhaceae	Southern cat-tail, *Typha domingensis*	o	H,I
	Cat-tail, *Typha latifolia*	la	E,EE,G,H,K
Chenopodiaceae	Fat-hen, *Atriplex patula* spp. *hastata*	lc	H
	Pickleweed, *Salicornia virginica*	la	F,K
Compositae	Western ragweed, *Ambrosia psilostachya*	o	G
	Alkali aster, *Aster exilis*	o	H
	Brass buttons, *Cotula coronopifolia*	o, lc	E,F,G,H
	Jaumea, *Jaumea carnosa*	la	F,G,K

1/ Frequency symbols:
a = abundant, la = locally abundant, c = common, lc = locally common, o = occasional, r = rare (scarce)

Compositae (continued)	Salt marsh fleabane, *Pluchea purpurascens*	o, la	F,H
Frankeniaceae	Alkali heath, *Frankenia grandifolia*	la	G,K
Polygonaceae	Curly dock, *Rumex crispus*	lc	G
Salicaceae	Arroyo willow, *Salix lasiolepis*	r, la	G,H,I,K
Umbelliferae	Wild celery, *Apium graveolens*	o	F

B-1. SALT MARSH - "LOW MARSH"

Cyperaceae	Alkali bulrush, *Scirpus robustus*	o	E
Gramineae	Saltgrass, *Distichlis spicata*	c, la	B,C,E,I,K
	Salt cedar, *Monanthochloe littoralis*	r, la	B,D,K
Juncaceae	Spiny rush, *Juncus acutus*	c, la	B,C,I
Chenopodiaceae	Pickleweed, *Salicornia virginica*	a	B,D,E,G,I,K
Compositae	Jaumea, *Jaumea carnosa*	o, lc	B,E
	Salt marsh fleabane, *Pluchea purpurascens*		
Frankeniaceae	Alkali heath, *Frankenia grandifolia*	c, la	B,E,G,I

B-2. SALT MARSH - HIGH MARSH

Gramineae	Soft chess, *Bromus mollis*	lc	I
	Saltgrass, *Distichlis spicata*	o, la	E,G
	Salt cedar, *Mononanthochloe littoralis*	o	I
	Rat-tail grass, *Parafolis incurva*	o	I
Aizoaceae	Little ice plant, *Mesembryanthemum nodiflorum*	o	B,I,G,L

Boraginaceae	Chinese pusley, *Heliotropium curassavicum*	c	E
Caryophyllaceae	Salt marsh sand spurrey, *Spergularia marina*	r	G
Chenopodiaceae	Australian salt bush, *Atriplex semibaccata*	o	L
	Annual pickleweed, *Salicornia europaea*	o, a	G,H
	Glasswort, *Salicornia subterminalis*	r, a	B,G,I,L
	Pickleweed, *Salicornia virginica*	c	G,H
Compositae	Brass buttons, *Cotula coronopifolia*	o	I
	Salt marsh daisy, *Lasthenia glabrata* ssp. *coulteri*	r, lc	B,G
Convolvulaceae	Alkali weed, *Cressa truxillensis*	r	E,K
Plumbaginaceae	Marsh lavender, *Limonium californicum* ssp. *mexicanum*	r, la	G

II. DUNE VEGETATION

Gramineae	Saltgrass, *Distichlis spicata*	o	A
Aizoaceae	Wild ice plant, *Mesembryanthemum chilense*	la	A,B
Chenopodiaceae	Beach saltbush, *Atriplex* cf. *leucophylla*	r	A
Cruciferae	Sea rocket, *Cakile* cf. *maritima*	c	A
	Wild stock, *Matthiola incana*	lc	A
Nyctaginaceae	Beach sand verbena, *Abronia maritima*	o	A
	Sand verbena, *Abronia umbellata*	o	A

III. UPLAND TRANSITION GRASSLAND

Gramineae	Annual grasses, unidentifiable	lc	E,F
	Giant reed, *Arundo donax*	o	E

Gramineae (continued)	Salt grass, *Distichlis spicata*	lc	G,K
Palmae	Date palm, *Phoenix dactylifera* 1/	r	E
Chenopodiaceae	Australian salt bush, *Atriplex semibaccata*	c, la	E,G,I
	Bassia, *Bassia hyssopifolia*	lc	G
	Mexican tea, *Chenopodium ambrosioides*	r	E
	Russian thistle, *Salsola kali*	o	E
Compositae	Western ragweed, *Ambrosia psilostachya*	lc	E
	Chaparral broom, *Baccharis sarothroides*	la	F
	Goldenbush, *Haplopappus venetus*	c, la	E,F,G,I,K
	Tar weed, *Hemizonia fasciculata*	lc	L
	Cocklebur, *Xanthium strumarium*	o	E
Convolvulaceae	Alkali weed, *Cressa truxillensis*	la	G
Cruciferae	Black mustard, *Brassica nigra*	la	E,F,I
Frankeniaceae	Alkali heath, *Frankenia grandifolia*	o	G
Geraniaceae	Red-stemmed filaree, *Erodium cicutarium*	o	L
Leguminosae	Sweet clover, *Melilotus indicus*	o	L
Malvaceae	Alkali mallow, *Sida hederacea*	o	F
Solanaceae	Tree tobacco, *Nicotiana glauca*	o	E,F
Tamaricaceae	Tamarisk, *Tamarix* cf. *pentandra*	o	E
Umbelliferae	Wild anise, *Anethum graveolens*	r	F

1/ Horticultural.

IV. RIPARIAN VEGETATION

Compositae	Wormwood, *Artemisia douglasiana*	la	F
Juncaceae	Mexican rush, *Juncus* cf. *mexicanus*	a	F
Salicaceae	Arroyo willow, *Salix lasiolepis*	la	E,F
Platanaceae	California sycamore, *Platanus racemosa*	r	F
Umbelliferae	Hemlock, *Conium maculatum*	lc, la	E,F

APPENDIX C

BIRDS OF SAN DIEGUITO AND BATIQUITOS LAGOONS, 1970-74

		SAN DIEGUITO[1]		BATIQUITOS	
		No.	Season	Obs[2]	Season[3]
Grebes, Loons, Pelicans and Cormorants		W = winter visitor; S = spring migrant; R = Resident			
Red-throated loon	*Gavia stellata*	1	W	x[4]	
Horned grebe	*Podiceps auritus*	2	W	x	W
Eared grebe	*Podiceps nigricollis*	387	R(breeds)	x	W
Pied-billed grebe	*Podilymbus podiceps*	66	R(breeds)	x	R
Western grebe	*Aechmophorus occidentalis*				W
Double-crested cormorant	*Phalacrocorax auritus*	6	W		R,few
Brandt's cormorant	*Phalacrocorax penicillatus*				R,few
Pelagic cormorant	*Phalacrocorax pelagicus*				R,few
Brown pelican	*Pelecanus occidentalis*				few
Wading Birds					
Great blue heron	*Ardea herodias*	17	R	x	R

1/ San Diego Field Ornithologists, 1974 census.
2/ California Field Ornithologists census, 1970; and California Shorebird Survey, 1969-1974 (Jurek, 1974).
3/ Ford, 1973.
4/ John W. Rutherford, personal observation.

Wading Birds (continued)					
Green heron	*Butorides virescens*	43	R	x	R,few
Common egret	*Casmerodius albus*	12	W		R
Snowy egret	*Egretta thula*	14	W		R,abundant
Black-crowned night heron	*Nycticorax nycticorax*	74	R	x	
White-faced ibis	*Plegadis chihi*	14	Dec.,XII		S
Flamingo	*Phoenicopterus* sp.	x[4/]		x[4/]	
Sandhill crane	*Grus canadensis*			x[4/]	
Surface Feeding Ducks					
Mallard	*Anas platyrhynchos*	32	Apr.-Oct., IV-X	x	R
Pintail	*Anas acuta*	67	Sep.-Feb., Apr.,June	x	W
Green-winged teal	*Anas crecca carolinensis*	46	W	x	W
Cinnamon teal	*Anas crecca cyanoptera*	765	R(breeds)	x	R(breeds)
American widgeon	*Anas americana*	4	W	x	W
Northern shoveler	*Anas clypeata*	1101	R	x	W,abundant
Gadwall	*Anas strepera*			x	W
Blue-winged teal	*Anas crecca discors*			X	

Diving Ducks					
Redhead	*Aythya americana*	16	May-Dec.	x	W
Canvasback	*Aythya valisineria*	43	W,May,June		
Lesser scaup	*Aythya affinis*	24	W	x	W
Bufflehead	*Bucephala albeola*	7	W	x	W,few
Surf scoter	*Melanitta perspicillata*	3	Aug.		W
White-winged scoter	*Melanitta deglandi*				W,few
Common merganser	*Mergus merganser*			x[4/]	
Red-breasted merganser	*Mergus serrator*				W
Stiff-tailed Ducks					
Ruddy duck	*Oxyura jamaicensis*	2272	R(breeds)	x	R
Geese					
Domestic geese	*Branta*	2	Sept.		
Canada goose	*Branta canadensis*				W,few
Vultures					
Turkey vulture	*Cathartes aura*	1	June		

Appendix C - (continued)

Hawks and Kites					
White-tailed kite	*Elanus leucurus*	2	Sept.,Oct.	x[4/]	
Red-tailed hawk	*Buteo jamaicensis*	7	R	x	
Red-shouldered hawk	*Buteo lineatus*	2	Sept.,Nov., IX,XI		
American kestrel	*Falco sparverius*	4	Sept.-Dec.	x[4/]	
Marsh hawk	*Circus cyaneus*			x[4/]	
Marsh Birds					
Sora rail	*Porzana carolina*	1	May		R,few
American coot	*Fulica americana*	2603	R(breeds)	x	R,abundant
Common gallinule	*Gallinula chloropus*			x	
Virginia rail	*Rallus limicola*				R,few
Shorebirds					
Semipalmated plover	*Charadrius semipalmatus*	56	W	x	W,abundant
Snowy plover	*Charadrius alexandrinus*	9	Feb.(breeds)	x	R(breeds)
Killdeer	*Charadrius vociferus*	112	R(breeds)	x	R(breeds)
Black-bellied plover	*Pluvialis squatarola*	27	July-Nov.,	x	W
Ruddy turnstone	*Arenaria interpres*		Apr.;VII-XI,IV	x	W,few
Common snipe	*Capella gallinago*	1	Feb.		
Long-billed curlew	*Numenius americanus*	4	Sept.	x	W

Shorebirds (continued)					
Whimbrel	*Numenius phaeopus*	10	Jan.,Apr., Aug.	x	W,few
Spotted sandpiper	*Actitus macularia*	44	W	x	W,few
Willet	*Catoptrophorus semipalmatus*	88	W	x	W,few
Greater yellowlegs	*Tringa melanoleuca*	16	July-Dec.	x	W
Lesser yellowlegs	*Tringa flavipes*	10	W	x	W
Baird's sandpiper	*Calidris bairdii*	6	Sept.,Oct.		
Least sandpiper	*Calidris minutilla*	115	Oct.-Jan.	x	W
Dunlin	*Calidris alpina*	25	W	x	W
Western sandpiper	*Calidris mauri*	897	R	x	W,common
Sanderling	*Calidris alba*	30	W	x	W
Short-billed dowitcher	*Limnodromus griseus*			x	W
Long-billed dowitcher	*Limnodromus scolopaceus*			x	W,few
Marbled godwit	*Limosa fedoa*	130	W	x	W
American avocet	*Recurvirostra americana*	825	R(probably breeds)	x	R(breeds)
Black-necked stilt	*Himantopus mexicanus*	617	R(breeds)	x	R(breeds)
Wilson's phalarope	*Steganopus tricolor*	191	Apr.-Sept.	x	W
Northern phalarope	*Lobipes lobatus*	1059	July-Sept.	x	W
Knot	*Calidris canutus*	4	Sept.		

Gulls and Terns					
Western gull	*Larus occidentalis*	6	Jan.,May, June,Nov.	x	R
Herring gull	*Larus argentatus*	1	Jan.		W,few
California gull	*Larus californicus*				W,abundant
Ring-billed gull	*Larus delawarensis*	94	W	x	W,abundant
Heermann's gull	*Larus heermanni*				S,few
Bonaparte's gull	*Larus philadelphia*	11	W		
Forster's tern	*Sterna forsteri*	54	W	x	W,abundant
Least tern	*Sterna albifrons*	108	May-Aug. (has bred)	x	S(breeds)
Caspian tern	*Hydroprogne caspia*	3	Aug.-Sept.	x	R
Black tern	*Chlidonias niger*	1	Aug		
Royal tern	*Thalasseus maximus*			x	
Common tern	*Sterna hirundo*			x	W
Elegant tern	*Thalasseus elegans*			x	S
Upland Birds					
California quail	*Lophortyx californicus*	15	May,Dec.	4/	
Rock dove	*Columbia livia*	62	R		
Mourning dove	*Zenaida macroura*	26	R		
Band-tailed pigeon	*Columba fasciata*			x4/	

Upland Birds
(continued)

White-throated swift	*Aeronautes saxatalis*	1	May	
Vaux's swift	*Chaetura vauxi*	15	May	
Anna's hummingbird	*Calypte anna*	3	Jan.,May,June	
Rufous hummingbird	*Selasphorus rufus*	1	Apr.	
Burrowing owl	*Speotyto cunicularia*			x[4/]
Short-eared owl	*Asio flammeus*			x[4/]
Belted kingfisher	*Megaceryle alcyon*	8	Aug.-Feb.	x
Common flicker	*Colaptes auratus*	1	Jan.	
Western kingbird	*Tyrannus verticalis*	2	May,Sept.	
Cassin's kingbird	*Tyrannus vociferans*	3	Apr.,July	
Black phoebe	*Sayornis nigricans*	34	R	
Say's phoebe	*Sayornis saya*	5	W	
Western wood peewee	*Contopus sordidulus*	1	May	
Tree swallow	*Iridoprocne bicolor*	1	Oct.	
Rough-winged swallow	*Stelgidopteryx ruficollis*	16		
Barn swallow	*Hirundo rustica*	4	May,Oct.	
Cliff swallow	*Petrochelidon pyrrhonota*	411	Apr.-Aug.	
Violet-green swallow	*Tachycineta thalassina*	2	Oct.,Dec.	
Scrub jay	*Aphelocoma coerulescens*	1	Aug.	

Upland Birds
(continued)

Bushtit	*Psaltriparus minimus*	4	Sept.	
Bewick's wren	*Thryomanes bewickii*	2	Jan,Sept.	
Mockingbird	*Mimus polyglottos*	21	R	
Water pipit	*Anthus spinoletta*	20	W	
Loggerhead shrike	*Lanius ludovicianus*	14	R	
Starling	*Sturnus vulgaris*	30	May-Aug.,Nov.	
Warbling vireo	*Vireo gilvus*	1	Sept.	
Yellow-rumped warbler	*Dendroica coronata auduboni*	26	W	
Orange-crowned warbler	*Vermivora celata*	2	Sept.	
Yellowthroat	*Geothlypis trichas*	2	Sept.	x
Wilson's warbler	*Wilsonia pusilla*	1	Sept.	
Western meadowlark	*Sturnella neglecta*	18	R	
Red-winged blackbird	*Agelaius phoeniceus*	302	R(breeds)	x[4/]
Bullock's oriole	*Icterus bullockii*	4	Apr.-Jun.	
Brewer's blackbird	*Euphagus cyanocephalus*	103	Apr.-Jul.	
Yellow-headed blackbird	*Xanthocephalus xanthocephalus*	5	May	
House finch	*Carpodacus mexicanus*	170	R	
Brown towhee	*Pipilo fuscus*	7	Apr.-May, Oct.-Nov.	

Upland Birds
(continued)

Savannah sparrow	*Passerculus sandwichensis*	45	R	x
Sparrow species	Unidentified	10	Sept.	
White-crowned sparrow	*Zonotrichia leucophrys*	54	W	
Song sparrow	*Melospiza melodia*	166	R	

APPENDIX D

PARTIAL CHECKLIST OF MAMMALS AND REPTILES IN SAN DIEGUITO AND BATIQUITOS LAGOONS

1. Mammals (or their tracks, scats or burrows) observed during this study
2. Cited in County of San Diego (1973)
3. Cited in City of Del Mar (1975)

MAMMALS

		SAN DIEGUITO[1/]			BATIQUITOS	
ORDER	SPECIES	1	2	3	1	2
Marsupiala	Virginia opossum, *Didelphis marsupialis*	o	x	x	1	2
Insectivora	Ornate shrew, *Sorex ornatus*		x			x
	Broad-handed mole, *Scapanus latimanus*	o	x	x		
Lagomorpha	Black-tailed jackrabbit, *Lepus californicus*	o	x	x	c	x
	Desert cottontail, *Sylvilagus auduboni*	a	x	x	c	x
	Brush rabbit, *Sylvilagus auduboni*		x		o	x
Rodentia	Ground squirrel, *Otospermophilus beecheyi*	a	x		c	x
	California vole, *Microtus californicus*		x	x		x
	House mouse, *Mus musculus*	a		x	c	
	Little pocket mouse, *Perognathus longimembris*	o				
	Deer mouse, *Peromyscus maniculatus*		x			x
	Norway rat, *Rattus norvegicus*	c		x	o	
	Wood rat, *Neotoma* sp.	c*			c*	
Carnivora	Coyote, *Canis latrans*	c	x	x	c	x
	Dog, *Canis canis*	c		x	c	
	Feral cat, *Felix domesticus*	o			o	
	Gray fox, *Urocyon cinereoargenteus*					x

1/ Symbols: a = abundant, o = occasional, c = common, lc = locally common, * = observed on adjacent hillsides
hillsides only

Appendix D - (continued)

		SAN DIEGUITO			BATIQUITOS	
Carnivora (continued)	Striped skunk, *Mephitis mephitis*	c	x	x	c	x
	Long-tailed weasel, *Mustela frenata*	o			o	
	Raccoon, *Procyon lotor*	c	x		c	x
Artiodactyla	Mule deer, *Odocoileus hemionus*	o	x		o	
	REPTILES					
Chelonia	Western pond turtle, *Clemmys marmorata*	c		x	o	
Squamata	Aquatic garter snake, *Thamnophis couchi*				o	
	Common garter snake, *Thamnophis sirtalis*			x		
	Gopher snake, *Pituophis melanoleucus*	c			c	
	Diamond-back rattle snake, *Crotalus atrox*	o*			o*	
	Kingsnake, *Lampropeltis* sp.				o*	
	Coast horned lizard, *Phrynosoma coronatum*				o*	
	Western fence lizard, *Sceloporus occidentalis*				c*	
	Southern alligator lizard, *Gerrhonotus multicarinatus*				o*	
	Western skink, *Eumeces skittonianus*				o*	
	Side-blotched lizard, *Uta stansburiana*				c*	

APPENDIX E

FISH IN SAN DIEGUITO AND BATIQUITOS LAGOONS

COMMON NAME	SCIENTIFIC NAME	SAN DIEGUITO	BATIQUITOS
Mosquito fish[1/]	*Gambusia affinis*	common	
Mullet	*Mugil cephalus*	common	occasional
Killifish	*Fundulus parvipinnus*	abundant	abundant nr. mouth
Mudsucker	*Gillichthys mirabilis*	common	common nr. mouth
Bay topsmelt	*Atherinops affinis*	common[1/]	abundant[2/], W. basin
Checkspot goby	*Ilyphus gilberti*		occasional[2/], W. basin
Opaleye	*Girella nigracans*		occasional nr. mouth

1/ Observed 1958, 1959 (Carpelan, 1960) and reported in City of Del Mar (1975).
2/ Reported in Ford (1973).

APPENDIX F

AQUATIC INVERTEBRATES OF SAN DIEGUITO AND BATIQUITOS LAGOONS

ORDER	COMMON NAME	SCIENTIFIC NAME	SAN DIEGUITO[1]	BATIQUITOS
Arthropods				
Crustaceans	Striped shore crab	*Pachygrapsus crassipes*		c(nr. mouth)
	Ghost shrimp	*Callianassa californiensis*		c(nr. mouth)
	Crayfish	*Procambarus* sp.		o(sta. 6)
Amphipods	Beach hoppers		a	
Isopods	Pill bugs	unidentified Ligiidae	o	
Ostracods	Ostracods		a(throughout)	o
Insects	Waterboatmen		a(low salinity areas)	a[2](throughout[3])
	Water beetles		o	
	Biting midges		a[2](low salinity areas)	a[2](outer basin[3])
Spiders	Wolf spider		c(throughout)	
Annelid Worms				
Polychaetes	Spionid polychaete	*Polydora socialis*	o	c(mouth)
	Capitellid polychaete	*Capitella capitata*		a(mouth)
Oligochaetes	Worm	unidentified Oligochaete	o	
Mollusks	Assimineid snail	*Assiminea californica*		a[2](outer basin)
	Gould's bubble shell	*Haminoea vesicula*		a[2](outer basin)
	Freshwater snail	*Physa* sp.	a[2]	a[2]
	Freshwater snail	*Bythinea* sp.	a[2]	o[2]
Protozoans				
Foraminifera	Forams	*Ammonia beccarii*	o	c(outer lagoon
		Quinqueloculina seminulum		a[2](outer lagoon)

1/ Symbols: a = abundant, o = occasional, c = common.
2/ Periodically abundant.
3/ Ford, 1973.

APPENDIX G

NON-LIVING MOLLUSCS OBSERVED IN THE SAN DIEGUITO AND BATIQUITOS LAGOONS

COMMON NAME	SCIENTIFIC NAME	BATIQUITOS	SAN DIEGUITO
Razor clam	*Tagelus subteres*		x
California razor clam	*Tagelus californicus*	x	x
Limpet	*Acmaea* sp.	x	
California cone shell	*Conus californicus*	x	
Slipper shell	*Crepidula onyx*	x	
Myid clam	*Cryptomya californica*	x	
Bean clan	*Donax gouldii*	x	
Gould's paper bubble	*Haminoea vesicula*	x	
Egg cockle	*Laevicardium substriatum*	x	x
Periwinkle	*Littorina cautulata*	x	
Bent-nosed clam	*Macoma nasuta*	x	x
Tellinid clam	*Tellina carperenteri*		x
Petricolid clam	*Petricola* cf. *tellimaulis*		x
Cooperellid clam	*Cooperella subdiaphana*		x
California hornshell	*Cerithidea californica*		x
Cockle	*Chione* sp.	x	