

**25th ANNUAL
SURVEYING AND
MAPPING CONFERENCE**

February 5-9, 1990

**RIPARIAN RIGHTS:
WATER BOUNDARIES FOR LAND SURVEYORS**

Instructor: Roy Minnick

**WATER BOUNDARIES
For
LAND SURVEYORS**

Roy Minnick, Instructor

A short course given at the
Alaska Surveying and Mapping Conference

Anchorage, Alaska
February 5 & 6, 1990

**Admission of the State of Alaska
Into the Union**

**By the President of the United States of America
A Proclamation**

WHEREAS the Congress of the United States by the act approved on July 7, 1958 (72 Stat. 339), accepted, ratified, and confirmed the constitution adopted by a vote of the people of Alaska in an election held on April 24, 1956, and provided for the admission of the State of Alaska into the Union on an equal footing with the other States of the Union upon compliance with certain procedural requirements specified in that act; and

WHEREAS it appears from information before me that a majority of the legal votes cast at an election held on August 26, 1958, were in favor of each of the propositions required to be submitted to the people of Alaska by section 8 (b) of the act of July 7, 1958; and

WHEREAS it further appears from information before me that a general election was held on November 25, 1958, and that the returns of the general election were made and certified as provided in the act of July 7, 1958; and

WHEREAS the Acting Governor of Alaska has certified to me the results of the submission to the people of Alaska of the three propositions set forth in section 8 (b) of the act of July 7, 1958, and the results of the general election; and

WHEREAS I find and announce that the people of Alaska have duly adopted the propositions required to be submitted to them by the act of July 7, 1958, and have duly elected the officers required to be elected by that act;

NOW, THEREFORE, I Dwight D. Eisenhower, President of the United States of America, do hereby declare and proclaim that the procedural requirements imposed by the Congress on the State of Alaska to entitle that State to admission into the Union have been complied with in all respects and that admission of the State of Alaska into the Union on an equal footing with the other States of the Union is now accomplished.

IN WITNESS WHEREOF, I have hereunto set my hand and caused the Seal of the United States of America to be affixed.

DONE at the City of Washington at one minute past noon on this third day of January in the year of our Lord nineteen hundred and fifty-nine, and of the Independence of the United States of America the one hundred and eighty-third.

/s/ Dwight D. Eisenhower
3 January 1959
Washington, D. C.

By the President:
/s/ Christian A. Herter
Acting Secretary of State

WATER BOUNDARIES FOR SURVEYORS

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Experience Summary for Roy Minnick

Roy Minnick is a property boundary location specialist in both public and private practice. In his public practice is responsible for the boundary location section in the California State Lands Commission.

He has been a surveyor since 1955, in both office and field, and during the last 20 years has specialized in land title and boundary location problems.

Mr. Minnick was founder and chairman of the Survey Technology Program at Sacramento City College and in that capacity developed courses in boundary location principles, land description interpretation, and water boundaries.

In private practice he serves clients with property boundary problems relating to retracement of public lands surveys, land description and document interpretation, and other property boundary problems.

The American Congress on Surveying and Mapping has accepted papers from him and he has taught seminars nationwide.

Mr Minnick has authored articles for professional journals, and was the founding chairman of the editorial review board for the American Congress on Surveying and Mapping and a past member of the editorial review board for *The American Cartographer*, the journal of the American Cartographic Society. He has also authored and coauthored several books, is co-editor of *The Surveying Handbook*, and is an active member of numerous professional and historical societies.

*Note AS 9.25.040
Ambiguities - tidal boundary
is to mean low water*

ALASKA STATUTES

Chapter 03. Sovereignty of State.

Sec. 44.03.010. Offshore waters and lands. The jurisdiction of the state extends to waters offshore from the coast of the State as follows:

(1) The marginal sea to its outermost limits as those limits are from time to time defined or recognized by the United States of America by international treaty or otherwise.

(2) The high seas to the extent that jurisdiction is claimed by the United States of America, or to the extent recognized by the usages and customs of international law or by agreements to which the United States of America or the State is a party.

(3) Submerged lands including the subsurface of submerged lands, lying under the waters mentioned in this section. (Art. 1 ch 89 SLA 1959).

Sec. 44.03.020 Ownership of waters and submerged lands. The ownership of the waters and submerged lands described in Article 10 of this chapter is in the State unless ownership of a parcel or area is held by a person or entity by a valid and effective instrument of conveyance or by operation of law. (Art. 2 ch 89 SLA 1959)

ARKANSAS STATUTES 1976

10.206. Deeds to land in lakes to be issued to land owner. -- The Commissioner of State Lands is hereby empowered and authorized to execute deeds to such lands to riparian owners upon application and the filing of proof of record ownership of adjacent lands and proof of proper survey of said lands, conveying all the right, title and interest of the State of Arkansas to such lands as have emerged or may hereafter emerge to the mean high-water mark of any such stream or lake. (Acts 1945, No. 203, Art. 3, p. 470.)

10.609. Confirmation of prior sales - Restriction on title - Lands below highwater reserved to state - Prior law not repealed. All sales heretofore made by the Commissioner of State lands under the provisions of said Act 282 of the General Assembly of the State of Arkansas for the year 1917, approved March 21, 1917 (repealed), are hereby confirmed and the title of all purchases under such deeds from the Commissioner of State Lands are hereby quieted, established and confirmed; provided, the area described in any such deeds as being conveyed shall extend only to the line of ordinary highwater, and shall not extend to the bed or channels of the chutes or adjoining area which lies below the line of ordinary highwater, the title to which formations below the line of ordinary highwater is reserved in the

INTRODUCTION

This presentation covers what is probably the most complex of all boundary locations, that of riparian or water boundaries. Water lines naturally fluctuate and so any boundary dependent on a fluctuating line must change. This is a natural breeding ground for litigation among littoral owners^{1/} since a changing line causes one man to lose and another to gain. As a result courts rooted in common law have often established precedents for riparian boundary location based upon equity rather than upon more precise and scientific location principles. In recent years courts have modified some viewpoints and reversed itself on others. As a result, the law is in a state of confusion. To make matters worse, riparian specialists are an obstinate group who seldom agree among themselves.

What does all of this mean to the surveyor? How does the surveyor begin to understand riparian boundary location? Most importantly, what does the surveyor need to know to perform his duties and discharge his responsibilities?

Fortunately some basic principles are available to all, and with these, the surveyor need not be greatly concerned even though the legal situation may appear confusing. Generally speaking, the law defines the boundary, and the surveyor locates the boundary. When the boundary is not defined, the surveyor can be a key investigator and finder of fact to aid the property owners and the court arrive at a definition of the boundary, and then locate the boundary by map and description.

Before the discussion of boundary can begin, some aspects of ownership and title must be considered.

^{1/}Littoral owners have riparian rights to the adjacent waterway; riparian boundaries mark the waterward extent of littoral ownership. Littoral ownership adjacent to navigable waters are bound by the water lines at various levels or stages.

SOVEREIGN LANDS

The first aspect to consider in water boundary situations is the ownership of the body of water, whether it is a lake, pond, bayou, estuary, river, tide and submerged lands, swamps, or man-made reservoir lakes.

Reservoir lakes are usually of small importance, from a water boundary standpoint. The beds of the reservoir are usually purchased from individual owners prior to dam construction and the resulting inundation.

The beds, and usually the immediately adjacent shoreline are owned by the purchaser, and the usual problems about water boundaries do not exist. Hence, no further comment is made here.

The remaining water bodies exist naturally and it is the ownership and boundaries of these that pose problems and create uncertainties for both the owners of the beds of the water bodies and the immediately adjacent shoreline.

The extent of upland ownership, that is the littoral ownership, is limited to the shoreline, and does not include the bed of the water body, if the water body is navigable.

The beds of navigable water bodies, are owned by the various states, as a result of the so-called equal footing doctrine. At the close of the American Revolution, the original thirteen colonies became successors to the rights of the sovereign Kings of England with regards to the ownership of the beds of navigable waterways. Later, the original states agreed to admit new states on an "equal footing" with the original States. In this fashion the "sovereign" basis for ownership in the beds of navigable waterways has its roots in English common law.

The sovereign traditionally held the lands in trust for the general public who could use the water bodies for "commerce, navigation and fisheries." Sovereign navigable waterways are inseparable from the public trust doctrine. Each State, upon admission to the Union, became the Trustee. The states have discharged these trusts in various ways, and since the public trust question is basically a matter of state law, a number of approaches have been used, and the law from state to state is inconsistent.

United States Chief Justice Taney, speaking for the Court, explained the ownership of such lands as follows:

For when the Revolution took place, the people of each state became themselves sovereign, and in that character hold the absolute right to all their navigable waters and the soils under them for their own common use, subject only to the rights since surrendered by the Constitution to the general government. (Martin v. Waddel 41U.S.349 - 1842)

Even within a state, public trust law may be confused and uncertain. California public trust law is no exception, and the courts seem to take a case-by-case approach within broad principles of law. The legal results in a given situation, therefore, are hard to predict. In California, a large body of case, Constitutional and statutory law concerning public trust issues exists.

The public trust doctrine for sovereign lands has several elements: (1) the physical character of the land. (2) Source of title to the land. (3) Changes of the character or boundaries of the land. Other elements can be considered, such as revocation of the trust, or estoppel, but these are beyond the scope of this presentation.

THE PHYSICAL CHARACTER OF THE LAND

In general, the public trust doctrine applies to tidelands, submerged lands, and the beds of navigable streams, rivers and lakes. In contrast, under English law, the trust extended only to lands subject to the ebb and flow of the tides which, in the small island, included in essence all navigable waters. With its long rivers and large interior lakes, however, America expanded the trust definition to include all navigable waters even if non-tidal.

By virtue of its admission to the Union as a sovereign state, California acquired title to all the ungranted trust lands within the boundaries of the new state. One important consequence is that the status of land as sovereign trust land is determined by its character on the date of admission to the Union, September 9, 1850, not by its character at a later date. Hence, considerable difficulty surrounds proving the actual character of the land in 1850 inasmuch as accurate surveys of much of California's coastal land as it

existed in 1850 are lacking. However, evidence of its character at a later date is admissible in a court of law to show its character in 1850, and scientific studies usually try to shed light on the issue.

There are various classes of lands involved in water boundary situations. There are tidelands, submerged lands, navigable lakes, streams, and rivers, and swamp and overflowed land.

Tidelands are lands subject to the public trust lying between the lines of mean high and low tide covered and uncovered successively by the ebb and flow of the tides including the shores of every bay, inlet, estuary, and navigable stream as far up as tide water goes and until it meets the lands made swampy by the overflow and seepage of fresh water streams. Tidelands do not, however, include ...

... those lands which were affected occasionally by the tide, but only those over which tidewater flowed so continuously as to prevent their use and occupation... there must have been such continuity of the flow of tide water over them, or such regularity of the flow within every twenty-four hours, as to render them unfit for cultivation, the growth of grasses, or the uses to which up-land is applied. (San Francisco v LeRoy, 138 US 656, 671-2 [1890])

Submerged lands are also subject to the public trust. Submerged lands are those covered by water at any stage of the tide, and would include the bed of the sea and of bays and inlets. Ownership of the submerged lands between the low water mark and the three-mile ^(3000' mile¹¹) limit became important when oil was discovered in this area and the necessary technical advances made extraction feasible. In 1947 the U.S. Supreme Court decided that these lands were held by the Federal Government in trust for the people. In 1953, however, Congress passed the Submerged Lands Act which conveyed whatever interest the Federal Government had in these lands to the states with the exception of those lawfully held by the Federal Government. Congress also specifically reserved its paramount regulatory power under the Commerce Clause of the United States Constitution.

A third category of lands subject to the common law public trust is "navigable waters," technically distinguished from tidelands and submerged lands although the latter may also be navigable. Again, the "navigability" of waters for determining whether the public trust doctrine applies is ascertained by reference to the state of nature in 1850. The Federal test of navigability is used, and the basic question is whether the waters were navigable in fact at that time. The standard is whether ...

... they are used, or are susceptible of being used, in their natural and ordinary condition, as highways for commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water ... navigability does not depend on the particular mode in which such use is or may be had ... nor on an absence of occasional difficulties in navigation, but on the fact, if it be a fact, that the stream in its natural and ordinary condition affords a channel for useful commerce. (U.S. v Utah 283 U.S. 64 [1931] Utah v U.S. 403 U.S. 9 [1971])

Unlike tidelands, submerged lands, and navigable waters, "swamp and overflowed" lands are not generally considered to be subject to the public trust. In 1850 Congress passed the Swamp Lands Act which granted to each state all of the unsold swamp and overflowed lands within their borders. Swamp and overflowed lands are those which were "... unfit for cultivation by reason of their swampy character and requiring drainage or reclamation to make them available for beneficial use," (Black's Law Dictionary) and could be sold by the states to private persons without restraint as to ownership or use.

Thus, the lands belonging to the state may be divided into two categories: those which it received from the Federal Government by grant, the swamp and overflowed lands, which are not subject to the common trust, and those which it received by virtue of its sovereignty, the tidelands and lands under navigable waters, which are subject to the public trust. The all-important distinction to be made between the two is, in practice, not an easy one. For example, coastal lagoons are difficult to specifically state, as of September 9, 1850. whether the land was properly

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characterized as swamp and overflowed lands, or as tidelands. One consideration is how these lands were surveyed, classified and conveyed by the State and Federal Governments, a subject that can be discussed ad nauseum by everyone with any viewpoint or interest.

TITLE

The applicability of the public trust doctrine to a particular parcel of land has been explored only insofar as the physical character of the land is concerned. If the particular piece of land is tidal, submerged or navigable, it may be subject to the trust depending on how title is held and what the source of that title is.

Prior to the Treaty of Guadalupe Hidalgo in 1848, California had been owned by Spain and then Mexico. Upon cession from Mexico, the Federal Government acquired title to all ungranted land in the territories which later became the State of California, and tidelands and navigable waters were held in trust for the new state. In order to fulfill the obligation imposed by the Treaty of Guadalupe Hidalgo that all prior Mexican land grants be respected, the Federal Government established the Federal Land Commission in 1851. Mexican land grants were to be presented to and confirmed by the Commission and, if not confirmed or claimed, became part of the public domain. Although the new state acquired title to its sovereign trust lands upon joining the Union in 1850, the argument can be made that state's title to lands is subject to the title claimed under a confirmed Mexican land grant.

Even if the state could not assert fee title to lands, within a Mexican grant, many feel that such lands may be impressed with the public trust burdens, including those which Mexican law, at the time of the grant, would have recognized. Mexican land grants were examined and confirmed according to Mexican law, and the Mexican law at that time apparently recognized the existence of public use rights in the seashore, rivers and ports roughly analagous to those recognized under the American common law public trust doctrine. In some respects, Mexican public use rights were broader in that they extended to the extraordinary high

tideline rather than to the mean high tideline, they conferred the right to use privately owned river banks, and they may have conferred a right of access over privately owned littoral land. These public rights would not have required confirmation by the Federal Land Commission and arguably devolved to the Federal Government as part of the public domain and thence to the state as public trust property in the same way as sovereign trust lands. Present litigation may have settled this question.

Trust Lands Held by the State. Subject to the foregoing exceptions, the State acquired title to all tidelands and navigable waters in 1850 in trust for the people and as an attribute of its sovereignty. The State's title to the submerged lands from low water mark to the three mile limit was confirmed in 1953 by the Submerged Lands Act, and these lands also are held in trust. Undisposed trust lands, of course, are held in trust by the state for the people.

Trust Land Held by Private Persons. Disposition of these lands was subject to state law, and the state immediately began conveying tidelands and sometimes adjoining submerged lands into private hands. Special Sales Acts concerning the sale of certain tidelands were passed in 1851, 1853, 1863, 1870, and 1874. General Sales Acts were enacted in 1855, 1858, and 1868. The wholesale disposal of tidelands under these statutes was slowed somewhat by the constitutional prohibition in 1879 against sales of tidelands located within two miles of an incorporated municipality. In 1909 a law prohibiting any sale of tidelands was enacted to counter the alleged abuses inherent in private ownership of tidelands.

Since tidelands were held by the state in trust for the people, there was always some who doubted the validity of sales to private individuals. Some early law cases held that such sales were void or voidable. In 1892, however, the United States Supreme Court decided the landmark Federal public trust case, *Illinois Central R. R. v. Illinois*, (146 U.S. 387),

which involved a grant of waterfront on Lake Michigan to a corporation, which the Illinois legislature now wishes to revoke. The Court, in speaking about the status of the title, described it as:

... a title held in trust for the people of the State that they may enjoy the navigation of the waters, carry on commerce over them, and have the liberty of fishing therein free from the obstruction or interference of private parties. The interest of the people in the navigation of the waters and in commerce over them may be improved ... for which purpose the State may grant parcels of the submerged lands ...

The Court then went on to say that the state could not abdicate its duty and control over the trust, nor could the trust be extinguished or impaired by a transfer of title. However, the trust could be revoked if the state relinquished title to particular parcels without any substantial impairment of the public interest in the lands and waters remaining.

Taking this cue, the California courts resolved the some uncertainty about sales of tidelands by holding that, although the state could convey tidelands to private persons, the title so conveyed was subject to the public trust rights and powers of the state and of the public.

Exceptions to the general statement that a private tidelands' owner holds subject to the public trust are found where the sale was made under a special statute clearly evidencing the legislative intent to alienate tidelands free of the public trust and where the state has otherwise revoked the trust or would be precluded from asserting it. In general, however, privately owned tideland is subject to the public trust.

No statutory authorization to sell submerged lands and lands under navigable waters appears to have ever existed, in contrast with the statutes authorizing the sale of tidelands. Such sales likewise may be subject to attack, and if void, title would remain with the state as trustee.

The State has also granted tidelands to local governmental entities in trust. The statutes by which these grants are made ordinarily set out the permissible uses which can be made of such lands, and the state has a residual interest to be certain we are consistent with the terms of the granting statute.

What does all of this mean to the surveyor? How does the surveyor begin to understand riparian boundary location without being a specialist or an attorney? Fortunately, there are some basic principles available to all of us. There are two major circumstances that govern riparian boundary location. One is related to non-navigable waterways where the littoral ownership includes the waterway. In this case, the submerged portions are divided proportionately among the littoral owners by agreeable and sensible means. Several methods are covered in Chapter 10 of "Boundary Control and Legal Principles" by Curtis M. Brown. The most common, and generally pictured in all of the general survey text books are "pie method" for dividing round lakes and the "long lake method" for dividing long lakes. Thread of stream is customary along rivers and other methods are used in bays and coves. In situations where the surveyor is called upon to proportionately divide non-navigable waterways, any method that is agreeable to the parties concerned and is within the surveyor's authority are acceptable. The classical methods detailed in the books have the advantage of being established by precedent, and, hence, more readily acceptable by others and more supportable by the surveyor.

A surveyor attempting to proportionately divide a lake, for example, should attempt to obtain agreement from all parties, preferably by acknowledgment on a record map, even if some parties are not clients.

Navigability determination is a difficult assignment. Navigability means different things to different people and, in all cases, it lacks precise definition. Generally, waters are navigable, in fact when they are used or are susceptible for being used in their ordinary conditions as highways of commerce of which trade and travel are conducted in the customary modes of trade and travel on water. Some states have passed laws declaring the factors necessary to constitute navigability. Others totally ignore the situation. Section 100 of the California Harbors and Navigation Code attempted to explain what constitutes navigability. Subsequent sections define the limits of navigability on some bodies of water. In Minnesota, a stream capable of floating a canoe may

be considered navigable. In many states, including California, the ability of a stream to carry logs may be a factor in declaring a stream to be navigable.

State laws and courts, when they address the issue, generally consider a water body navigable when it is suitable for use as a public way. The State, as "sovereign," has a duty to protect the rights of the public from abuse or infringement unless a law to the contrary has been enacted and upheld. The State as the owner of the bed of navigable waterways is generally a co-equal and, in some instances, superior to adjacent upland owners.^{1/} The upland owners themselves are co-equal and have certain property rights entitled to protection. These rights are usually called riparian rights and accrue to an adjacent upland owner in addition to other normally accruing rights. Riparian rights may include such things as the right to "wharf-out" into the water body to construct bulkheads, and to enjoy the fruits of accretion, and to suffer the flipside - erosion. An upland owner, in order to have riparian rights, must share a common boundary with the owner of the bed of the waterway. Any intervening ownership, no matter how infinitesimally small, can deprive a person of these riparian rights.

Surveyors must carefully examine chain of title histories of property to be certain that no intervening interest exists. It is common to find that even though an original deed was riparian, the present vesting document does not include riparian rights. These usually occur when a strip of land lies between a meander line or a private subdivision meandered line. The strip is "dropped out" by uninformed scriveners, or perhaps inadvertently.

^{1/}An instance of superior title - the State, in its sovereign capacity, is generally safe from adverse possession claims.

There are two broad categories of law governing navigability; State and Federal law. State law considers navigable waterways to be generally a public highway. The public may use the waterway as well as the adjacent upland owner. In some jurisdictions, navigability is based on limited tests such as commerce, navigation and commercial fishing. In other states such as California, this narrow traditional definition of navigability has been broadened to include whatever uses the general public may wish to make of the waterway. This includes recreational fishing, water skiing, and other such "non-commercial" uses. A landmark case in California that resulted in this broadening of public uses was the so-called Marks v. Whitney case that resulted in a State Supreme Court decision in 1970.^{1/}

Federal law is based on the commerce clause in the United States Constitution which defines the authority of the Federal Government to control the use of navigation on interstate waterways. Although the Federal Government is expanding its control of navigable waterways, and even includes some waterways that were not naturally navigable, by and large their efforts relate to land use regulation and navigation on the water surface. From the surveyor's standpoint their management activities are not as often related to water boundaries. From a title standpoint and the resulting boundary of navigable waters, State laws are generally more directly related because of the equal footing doctrine discussed earlier. Generally water boundary disputes are settled in State courts. The usual exception to this occurs when the Federal Government is an adjacent upland owner in either proprietary or sovereign capacity and a dispute arises between the Federal Government and the State. Federal courts are also used to settle water boundary disputes between the various states.

^{1/}Marks v. Whitney, 6 C, 3d 251 (1971)

From many different standpoints such as water use, property ownership, title and boundaries, the determination of navigability perhaps is the most important distinction that must be made. While navigability disputes are usually settled in courts or by law, the surveyor often finds himself gathering facts and evidence that will support the contention of either navigability or non-navigability. In fact, the surveyor may well be instrumental in the determination of navigability provided the surveyor is aware of the implications and impact of his actions.

Navigability is generally determined in three cases; by law, in fact and whether or not a waterway is susceptible to use by the public. As mentioned earlier, some states have laws that indicate navigable waterways. In California, our Harbors and Navigation Code fulfills this purpose. Section 100 defines what constitutes public way and then, by statutory declarations, portions of approximately 60 waterways are declared navigable.

In California we regard these statutory declarations as being presumptive; that is, we presume that waterways are navigable at least as far as the points declared in the statute. Often times navigability in fact has been proven to be considerably greater than defined in the statute.

For example, in Section 102 "Deer Creek between its mouth and the house of Peter Lassen" is declared navigable. In another instance, Neuces Creek is declared navigable from its mouth in Suisun Bay to a point 1/2 mile above the warehouse of George P. Loucks.

The two above instances provide interesting starting points for surveyors who are asked to map property adjacent to one of the waterways. It is incumbent upon the surveyor who is preparing a survey for someone owning property on Neuces Creek to determine where the head of navigability happened to be. Obviously, this may not be as easy as it may appear since the statute was enacted in 1872 and warehouse of George Loucks long since disappeared. Peter Lassen had two different houses on Deer Creek during the course of his lifetime. Locating the statutory head of navigation is a research project not normally associated with surveyors but, nonetheless, it is an integral part of the work. Many in California have not yet been located.

One pitfall to avoid is the tendency to rely on the Harbors and Navigation Code to determine navigability for title purposes. In reality the Code is police power. Those bodies listed are protected against activities that would restrict navigation.

The second method for determining navigability is to determine in fact that the waterway was used as a public highway for commerce, navigation and fisheries or other purposes allowed under State law. Sometimes several months are spent attempting to locate historical evidence of use in an effort to determine the navigability of water bodies.

In some of the western states, water bodies that were navigable in fact at time of entry into the Union and for years thereafter in their natural condition are now dry as a result of irrigation diversion, or some other artificial course. One such case is the San Joaquin River in the central valley of California. It once carried steamboats up into the foothills, but now it is dry most of the year. It is hard for land-owners to understand that the river, in a land title sense, is navigable.

Studies show that navigation existed on the river as far as Fort Millerton in the foothills of the Sierras. In fact, the Army shipped goods to supply the garrison by boat until the Southern Pacific Railroad cut off navigation by building a low bridge across the river. Although the river remained deep enough for years afterward, little use was made for navigation. In 1944 Friant Dam was built and the water diverted from the channel. As a result downstream owners felt the riverbed was theirs and, occasionally, sellers added a strip of land to the deed description they purchased. Unfortunately, the general rule is that artificial influences do not affect riparian property lines; they are "frozen" in their last natural position.

Property surveyors surveying from a deed in this area had best beware, particularly if they wish to avoid a liability suit from a disgruntled landowner. Naturally, the surveyor can note that the deed was merely translated onto the ground, but most clients expect their property to be surveyed correctly and a professional surveyor is presumed to know that such situations exist and to act accordingly.

The third method for determining navigability involves water bodies in existence at time of statehood, still in existence, and large enough to be susceptible to navigational uses as may be defined by the state in which the water body is located. Water bodies that fall into this category may be relatively small mountain lakes that are only now becoming valuable because of the public's unquenchable thirst for recreational land.

Generally, water bodies, in order to be navigable, had to exist as a natural body of water either navigable in fact or susceptible to navigability

under its ordinary condition at the time the State entered the Union. The mere fact that the body of water dried up periodically or will be dry for periods of time each year does not in itself prevent declaration of navigability. For example, in 1908 a Supreme Court case in Florida considered a case involving title to the bed of Lake Jackson in Leon County. Most of the bed during ordinary water levels could be navigable only by flat bottomed boats drawing no more than six inches of water. Large portions of the lake bottom were dried out for such long periods of time that crops were harvested on the lake beds. The court held Lake Jackson to be navigable. The fact that the lake went dry at times did not strip it of navigability since in its ordinary state it was navigable.

A surveyor who attempts to solve the question of navigability must be a finder of fact. A surveyor will have to collect evidence that might range from diaries, to photographs, to maps, to charts and the collection of parole testimony. As is so often the situation in civil lawsuits, the court's decision rests upon the preponderance of evidence. The surveyor as the research investigator gathers pieces of evidence and assesses the material in a manner that enables him to render an opinion that hopefully will be sustained by a court. Once the question of navigability and, hence, ownership of the water boundary has been settled, the still knottier question of boundaries may be addressed.

Boundaries along tidal waterways are usually tide lines. For example, along the western coast of the United States the ordinary high water mark is normally considered to be the boundary between the State and the upland owner. In areas where the shoreline is natural, the ordinary high water mark may be defined as the mean high tide line averaged over a substantial period of time. Tidal riparian boundaries, where possible, rely on tidal observations over an 18.6 year period. The 18.6 period is a full cycle of the varying relationship among the positions of the earth, sun and moon. Various methods have been described over the years for locating mean high water line boundaries.

From the surveyor's standpoint, it is necessary to first ascertain what the boundary may be between the bed of the water and the upland owner. This is generally a matter of law and for attorneys. Where the boundary may ultimately be located is normally within the province of the surveyor. For example, the court may determine that the boundary between two points on a shore is the mean high tide line. In the event the court doesn't define the elevation of the boundary, it is the surveyor's task to determine the elevation of the mean high tide line in a manner acceptable to the parties concerned and then to locate this line on the ground. For example, the mean high water line in the given stretch may be determined by observation to be 2.5 feet above mean lower water. The surveyor locates this contour line with reference to mean lower low water by the usual methods of survey. In other cases, as in the State of Washington, the vegetation line may be the boundary established by law. On non-tidal water boundaries, a variety of techniques may be used to determine the legal boundary. For example, in Clear Lake, the largest lake in California with over 100 miles of shoreline, had a low water mark boundary definition of zero on the Rumsey gauge. The gauge was established by a man named Rumsey in the late part of the 19th century and daily observations on a water level staff have been made ever since. As a result, the surveyors interested in mapping the line between the thousand or so upland property owners and the State of California can use this contour line which was defined by survey leveling to be a contour elevation of 1318.26 feet above sea level.

After defining the boundary, by law and fact, it is necessary to consider some other factors before location of the line can be commenced. Notably, accretion, erosion, avulsion and sundry acts of humans in building dams, bulkheads, carving cutoffs and building groins and jetties.

Accretion is the gradual imperceptible deposit of buildup of land along the shore of a water body.

Erosion is the gradual and imperceptible washing away or reduction of land along the water boundary. Avulsion is the sudden and perceptible

separation of land by the violent action of water. In this last case, property boundary lines usually remain fixed in place, just prior to the avulsive action. For example, a stream that during a flood stage, suddenly adopts a new channel does not alter the ownership of the abandoned river bed. If the waterway is navigable it so happens that the State will end up owning the abandoned bed of the river that now cuts the parcel in two parts. Accretion and erosion on the other hand result from natural causes and the property lines shift as the shoreline shifts. In the case of accretion, the surveyor is called upon to first of all identify the amount of accretion and then apportion that accretion as necessary and in a manner which recognizes the co-equity of the upland owners. It is much easier to divide surplusage among people than it is to show boundary lines resulting from erosion where property owners have less land than previously.

Other factors to be considered in locating boundary lines along waterways are the physical and legal effects of artificial changes. Examples of artificial changes are dams, groins, piers and other shoreline structures that prevent the body of water from moving naturally. For example, in California, landfill and bulkheading of a natural mean high tide line causes the boundary between the State and the upland owner to be frozen in its last natural condition prior to the landfill. In other states this is not true. A person may add on to his property by landfilling, since the landfill does no more than push the boundary line waterward.

In all of the above cases, the words "suddenly," "generally" and other operative words are subjective. For example, in the definition of avulsion we used the word "suddenly". Various contenders in litigation will argue over the definition of suddenly. Many persons consider "suddenly" as spanning a period of time overnight to as long as seven years.

On the Colorado River, Boulder Dam has been generally construed by several Federal courts to have no effect upon downstream property boundaries. Although it is clearly an artificial influence, the court has held that it has acted primarily as a control to prevent both floods and drought and the resultant regulation of the flow does not inhibit the gradual erosion

and accretion of the river. Other problems arise when considering situations where entire parcels have been eroded away and then natural processes have reversed themselves and accretion occurs. In this situation, is the title extinguished and the accretion divided between the adjacent upland owners at the time the process reversed or does the title reemerge. Surveyors may face other situations involving islands in waterways. The ownership of an island may depend upon whether the island grew from the bed of the river since statehood or whether it existed prior to statehood. In California according to Civil Code Section 1016, "Islands formed in beds of streams which are navigable belong to the State. Islands formed in non-navigable streams belong to adjacent upland owners."

Certainly someone intending to work with water boundary locations must be able to conduct thorough research and to assemble facts that relate to the case at hand. The surveyor must be able to ask questions of himself and others, and to understand, through reading and study, the classical precedents in water boundary cases.

WATER BOUNDARY DETERMINATION

A variety of legally acceptable evidence may be utilized to establish water boundaries. At the outset, please keep in mind that the boundary is the last natural condition. Therefore, as to each of the following tests, you must add the caveat that the appropriate test is to be applied as to the last natural condition of the water body.

In order to understand the legal test of a tidal water boundary, it is first necessary to understand certain terms or words of art. The definitions here are those adopted by the U. S. Coast & Geodetic Survey (now the National Ocean Survey)^{1/}

high water - the maximum height reached by a rising tide. The height may be due solely to the periodic tidal forces or it may have superimposed upon it the effects of prevailing meteorological conditions.

^{1/} "Tide and Current Glossary", Special Pub. 228, U.S. Department of Commerce. Part of "Glossaries for Surveyors" #721.

high water line - the intersection of the plane of mean high water with the shore. The shoreline delineated on the nautical charts of the Coast & Geodetic Survey is an approximation to the high water line.

higher high water - the higher of the two high waters of any tidal day.

mean high water - the average height of the high waters over a 19 year period. For shorter periods of observations, corrections are applied to eliminate known variations and reduce the result to the equivalent of a mean 19 year value. All high water heights are included in the average where the type of tide is either semidiurnal or mixed. Only the higher high water heights are included in the average where the type of tide is diurnal. So determined, mean high water in the latter case is the same as mean higher high water.

mean higher high water - the average height of higher high waters over a 19 year period. For shorter periods of observations, corrections are applied to eliminate known variations and reduce the result to the equivalent of a mean 19 year value.

low water - the minimum height reached by a falling tide. The height may be due solely to the periodic tidal forces or it may have superimposed upon it the effects of meteorological conditions.

lower low water - the lower of the two low waters of any tidal day.

mean low water - the average height of low waters over a 19 year period. For shorter periods of observations, corrections are applied to eliminate known variations and reduce the result to the equivalent of a mean 19 year value. All low water heights are included in the average where the type of tide is either semidiurnal or mixed. Only the lower low water heights are included in the average where the type of tide is diurnal. So determined, mean low water in the latter case is the same as mean lower low water.

mean lower low water, frequently abbreviated lower low water on Coast & Geodetic Survey charts - the average height of lower low waters over a 19 year period. For shorter periods of observations, corrections are applied to eliminate known variations and reduce the result to the equivalent of a mean 19 year value.

Generally speaking, state law applies to the location of water boundaries. However, federal law does apply if the boundary is determined by a federal patent or for locating the boundaries of navigable waters of the United States under federal law. The Federal rules also may apply in certain instances involving artificial accretions.

A water boundary for the purposes of federal law is the ordinary high water mark, or mean high water. This has been defined in Borax Consolidated, Ltd. v. Los Angeles, 296 U.S. 10 (1935) as the average of all the high waters occurring over a tidal epoch of 18.6 years. This includes averaging both high waters that occur daily on the Pacific Coast.

STATE LAW

For the purposes of state law, a tidal water boundary is the ordinary high water mark which is the same as the line of mean high water. However, California cases would appear to adopt a different method than the federal rule for determining mean high water. The California cases use the "average" of the "neap tides" over an 18.6 year period. The neap tides are the tides

that occur during the first and third stages of the moon, which are lower than those that occur during the second and fourth quarters.

NON TIDAL WATER BODIES

Water boundaries on non-tidal water bodies are generally determined by state law. In California, section 830 of the Civil Code defines the boundary as the low water mark on navigable non-tidal water bodies. On non-tidal non-navigable bodies, the upland owners take to the middle, whatever that may be.

How is the low water mark, and high water mark determined on non-tidal navigable water bodies? Although at first glance this question seems to have an easy answer, it does not, in fact. Non-tidal water bodies are not subject to any sort of regular fluctuation. Substantial seasonal changes occur, and they differ from year to year depending on many factors such as rainfall. Hence, there is no mean water mark in the same sense as that found along tidal bodies of water. In addition, a great majority of the water bodies in this category have been subjected to artificial influences, such as dams, diversion for irrigation, or even hydraulic mining.

California has not specifically defined the appropriate test for determining the high or low water mark on non-tidal navigable water bodies. Case law seems to suggest the levels reached during a season not affected by droughts or floods. This is obviously little guidance, since there are almost as many viewpoints about what may constitute a drought or flood as there are persons interested in the boundary.

A 1964 California Attorney General's Opinion described a definition of low water mark as:

"The elevation of water in the non-tidal navigable lake or stream at its low point during a normal year, not affected by floods, droughts, or other special circumstances."(430ps. Atty.Gen. 296)

The Opinion further advised that any competent evidence may be used to establish the low water mark on a non-tidal navigable lake, including but not limited to maps, historical data, testimony, and physical characteristics of the lakebed, streambed, or adjacent terrain. This approach has generally been confirmed in case law.

Investigators seldom are able to determine precisely where the last natural boundary was. The information that you will find dealing with the last natural condition of the water boundary, if any substantial period of time has elapsed, does not include data that will permit you to precisely define that boundary in accordance with appropriate legal definitions.

Coupled with the fact that available data is not precise, is the fact that in most instances you will be called upon to locate the water boundary as per its last natural condition in areas that have been subject to not only natural changes but also many artificial changes. Generally speaking, areas still in their natural condition are few, located in remote areas, and therefore not the subject of a great deal of dispute. Water boundaries along cliffs don't change much over the years and the location of boundaries in these areas is, perhaps, quite simple. The difficult areas - the beaches, waterfront areas, recreational lakes, and rivers- will not only pose a challenge, but may even prove impossible to locate from the facts alone. Boundary agreements and exchanges are sometimes the only solutions other than quiet title action.

Some of the sources that provide the information needed are listed in the appendix.

In summary, water boundary location is difficult because of the wide variety of interests in land, types of land, and inconsistent law. For those very reason- working with water boundaries poses a challenge that never seems to diminish, even as experience increases.

- FLATS The area covered with water too shallow for navigation with vessels ordinarily used for commercial purposes. The space between high and low water mark along the edge of an arm of the sea, bay, tidal river, etc. Black's Law Dictionary.
- GREAT POND An inland body of water which, in its natural state, contains more than 10 acres. Flood v. Earle, 145 Me. 24.
- HIGH-WATER MARK The line which the water impresses on the soil by covering it for sufficient periods of time to deprive it of vegetation. Brown, 1969.
- LITTORAL Belonging to the shore, as of seas and great lakes. Corresponding to riparian proprietors on a stream or small pond are littoral proprietors on a sea or lake. Black's Law Dictionary.
- LOW-WATER MARK The line to which a body of water receded, under ordinary conditions, at its lowest stage. Brown, 1969.
- NAVIGABLE Capable of being navigated; that may be navigated or passed over in ships or vessels.
- At common law, a river or stream in which the tide ebbs and flows, or as far as the tide ebbs and flows. Black's Law Dictionary.
- In fact, streams which, in their ordinary condition, are capable of floating vessels, rafts or logs, unaided by artificial means. Charles C. Wilson & Son v. Harrisburg, 107 Me. 207.
- RELICTION An increase of the land by the permanent withdrawal of the sea, river or lake. Brown, 1969.
- RIPARIAN Of or on the bank; related to or belonging to the bank of a river. Brown, 1969.
- SHORE Land lying between high-water and low-water marks. Dunton v. Parker, 97 Me. 461.
- THREAD Also called thweat, the line midway between banks or the line equidistant from the edge of the water on the two sides of the stream at the ordinary stage of the water. Brown, 1969.

B. WATERS AND WATERCOURSES

1. IN GENERAL

§ 12. Generally.

There is much apparent confusion and uncertainty as to the proper location of boundaries of land bordering on waters and watercourses arising in a large measure from conflicting views as to the ownership, as between the state and the individual, of the land between the high and low-water mark, and of the land underlying a body of water or a watercourse. This question of ownership as between the individual and the sovereign or the state may turn upon whether the waters are tidal or nontidal, and if they are nontidal, whether they are in fact navigable. The doctrines of accretion and avulsion also have a direct bearing on the location, and the shifting of the location, of boundaries on watercourses and on bodies of water. These questions are discussed in another title in this work,¹⁶ although to the extent that a private owner when conveying land bounded by waters cannot confer title upon nor fix the boundaries of his grantee beyond that point to which he owns title, the question of title and ownership of a grantor to land underlying a body of water or watercourse is involved in the discussion of boundaries herein.¹⁷

Once the question of the extent of a grantor's ownership is disposed of, the location of boundary lines under his conveyance becomes fairly definite. In the last analysis the question whether a grant of land bounded by a watercourse or a body of water conveys land of the grantor lying under the water or below the high water line is controlled by the intention of the parties,¹⁸ and that intention, if expressed in terms, will determine the boundaries of the grantee; where that intention is not expressed, the courts have from very early times indulged in the presumption that unless a contrary intention appears or is clearly inferable from the terms of the deed of conveyance, the grantee acquires whatever land his grantor owned under the water and his boundary will be deemed to be fixed by, and located upon, the boundary line of his grantor.¹⁹ In other words, a grant bounded on a stream or on tide waters will be held to convey all the land owned by the grantor, in the absence of anything showing an intention not to do so, subject, however, to the public easement.²⁰ This presumption that the grantor intends to convey all the land he owns under the water is a very strong one and there are many expressions of opinion which are substantially to the effect that nothing short of an express reservation will overcome its force.¹ This general principle applies to a conveyance by reference to a map representing the land as fronting upon a stream of water. In such cases the presumption may arise that the purchaser becomes the owner of the fee to the center of the stream.²

Am Jur 2d; Boundaries

§ 14. Tidal waters; arms of the sea.

The variant rules in different jurisdictions as to whether the title to soil between the high and low-water mark is vested in the private riparian owner¹¹ or in the public make it difficult to lay down general rules for determination of the boundary lines under conveyances by the owners of uplands bordering on tidal waters. Generally, the law will, in the absence of any contrary intention appearing in, or inferable from, the conveyance, presume an intention to convey all the land owned by the grantor under the water;¹² much, however, depends upon the circumstances of the case and the particular description used.¹³ Where the common law prevails, and the sea or bay is named as a boundary, the line of ordinary high-water mark is intended.¹⁴ If, however, the grantor in a grant of private lands owns to the low-water mark on tidelands, his grantee is presumed to take to the low-water mark.¹⁵

When the word "shore" is used as a boundary, unexplained by circumstances, it may be doubtful whether the sea side or the land side of the shore is intended. However, a boundary running "to the shore" is generally deemed to run to the high-water mark, the word "to" being one of exclusion rather than inclusion and the accompanying description "thence along the shore" indicating similar intention.¹⁶ When both the "sea" and the "shore" are used to designate one boundary, the presumption appears to be that they are intended to describe that side of the beach on which the sea lies and therefore to include the beach to low-water mark.¹⁷ In any case, the express condition of the deed or other circumstances may indicate the intention of the parties. A description "to the shore to a heap of stones" will fix the boundary at the actual location of the stones, and if this is at low-water mark, the shore is included in the description.¹⁸ A description "to the water" makes the low-water mark the boundary, and an accompanying phrase "thence along the shore" indicates an intention that the low-water mark of the shore should be followed.¹⁹

Am Jur 2d; Boundaries

§ 15. Inland lakes and natural ponds.

As in the case of lands bounded by tidal waters, the determination of the boundary line of land bordering on inland lakes and natural ponds depends to a considerable extent upon the ownership of the bed of the lake or pond as between the public and the private owners of the upland, which in turn may be dependent upon whether the waters are navigable or nonnavigable. In this country, however, according to the generally accepted doctrine, the boundaries of owners of land abutting upon the navigable lakes extend only to the low-water mark, the title to the bed of the lake being in the state, while the bed of a nonnavigable lake or natural pond is generally deemed to be property of the adjoining landowners.²⁰ When the bed of an inland water is subject to private ownership, the question whether the title to any part thereof passes by a conveyance of lands bordering upon the water depends upon the intention of the parties as manifested in the words of conveyance.¹

There is, however, a very strong presumption that the grantor intends to convey all the land he owns under the water.² If he owns to the center of the water and the boundary as described in the conveyance touches the water or is along by the water, the presumption is that the title carries to the center,³ unless a contrary intention clearly appears.⁴ This presumption holds even where the line is otherwise described in courses and distances,⁵ and regardless of the fact that a description of acreage is fulfilled by grant of the upland without any part of the lake bed.⁶ This presumption may, however, be negated by express words or by other words of description which clearly exclude the lake bed from the land conveyed.⁷ If, for example, the description of property conveyed runs the boundary along dry land, such as the bank, shore, or margin of a pond or lake, land under water is excluded from the conveyance.⁸ Furthermore, an intention not to carry title to the center may be manifested by the use of words "by the shore" in designating a boundary; in such case the title will extend only to low-water mark.⁹ A description of land by metes and bounds, without reference to a lake on which it abuts as being a boundary, ordinarily has the effect of limiting the grantee's title to the lines mentioned in the deed,¹⁰ even where a part of the lake bed is actually included in the description by metes and bounds in the deed.¹¹

In some jurisdictions, notably those subject to the Colonial Ordinance Rule,¹² the presumptive boundary of lands bordering on a fresh-water pond is considered as being the low-water mark.¹³

Am Jur 2d; Boundaries

§ 46. —Great ponds.

In several New England states by virtue of the Ordinance of 1647, the title to the great ponds, which may be defined as ponds covering over 10 acres, is vested in the state.⁷² These ponds the state owns as public property in trust for public uses. It has not only the *jus privatum*, the ownership of the soil, but also the *jus publicum* and the right to control and regulate the public uses to which the ponds shall be applied. The littoral proprietors of land on the ponds have no peculiar rights in the soil or in the waters, unless it is by grant from the legislature.⁷³ It has been declared that explicit legislative authority is necessary to the alienation to an individual of the public rights in the beds of large ponds.⁷⁴ However, the rights in a great pond which had been appropriated to private persons, and were held by them as private property at the time the ordinance became operative, were not affected thereby.⁷⁵ The title to great ponds passed under deeds from Plymouth Colony, which plainly intended to convey them, although the intention appears only from the *habendum* clauses of the deeds, no mention of them being found in the granting clauses.⁷⁶ If a pond had previously been granted to a town, and had not passed to a private person, the legal title remains in the town, but the beneficial right is in the public.⁷⁷

Where a statute of limitations is made applicable to suits by the commonwealth, a prescriptive title can be acquired to a great pond.⁷⁸ However, mere use of the water for mill privileges is not so adverse to the rights of the public to the water that it will ripen into a title which cannot be interfered with by a state grant to a city of the right to use the water for the domestic purposes of its inhabitants.⁷⁹

78 Am Jur 2d; Waters

§ 17. Artificial ponds and watercourses.

The problems which arise in reference to natural streams and lakes which serve as boundaries between lands of adjacent owners have their counterpart when artificial watercourses and ponds are used as boundaries.² In the absence of special circumstances, an artificial body of water or watercourse is, for the purpose of boundary, treated like natural waters and watercourses so that the mere mention of it as a boundary will carry title to the center if the grantor owns that far,³ while on the other hand, the boundary line may be limited to the edge in the same manner as in the case of ordinary watercourses.⁴ In the case of a canal the fee of which is not in the public the same rule applies as in the case of watercourses generally, so that a boundary on it will carry title to the center if the grantor owns to that extent.⁵

Some courts have taken the view that a deed bounding lands by an artificial pond which has been in existence long enough to become a permanent body of water and is being kept and maintained as such fixes the line of the land conveyed at the low-water mark of the pond at the date of deed.⁶

A description of the boundary line of land bordering on an artificial pond as commencing at "a stake near the high-water mark of the pond" and running thence "along the high-water mark of said pond to the upper end of said pond" makes the boundary line a fixed and permanent one, giving the grantee no right to any accretions or land left dry by the pond receding, through the gradual and imperceptible result of natural causes.⁷

§ 18. Bodies of water created by damming of stream or lake.

In determining the boundary under a conveyance of land bounded by an artificial pond created by the expanding of a stream by means of a dam, the tendency is to apply the rule applicable to natural streams, and to presume that the thread of the stream will continue to serve as the boundary,⁸ at least if the pond has not been maintained in its artificial condition so long that it has become permanent and has acquired new well-defined boundaries.⁹

In the case of the artificial raising of a natural lake or pond, the rule applicable to ponds and lakes will be applied.¹⁰ In a jurisdiction where the state holds title to submerged lands under lakes, its title will be extended to include lands covered by the artificial raising of the level of the lakes when such condition is continued so long as to become a natural condition.¹¹ Where waters are raised by a dam built pending litigation, no change will result in the boundaries of land conveyed as bounded on the pond.¹²

§ 19. Swamps and marshes.

The common-law presumption that where land is bounded by a nonnavigable creek or stream the grantee takes to the middle of the stream is not applicable to the case of a grant of land adjoining a swamp, describing the land as bounded by a line running to the swamp and thence along it.¹³ Thus,

patents for fractional sections of land facing on a marsh, which recite the number of acres granted and refer to the official plat of the survey by which the marsh is shown as the boundary, while the computed areas conform to the area included within the surveyed lines without including any part of the marsh, must be limited by the surveyed boundaries without including any land which is a part of the marsh.¹⁴

§ 410. Natural or artificial causation.

It has been stated as a general rule that it is immaterial, as respects the effect of accretion, reliction, or erosion, whether it results from natural or from artificial causes, in whole or in part.²⁰ This rule has frequently been applied in cases where the accretion, reliction, or erosion is indirectly induced by artificial conditions created by third persons.²¹ It has been held that, for the line of ownership to follow a waterline changed by accretion, such accumulations need not be due entirely to natural causes, provided they are not caused by the riparian or littoral owner himself.²¹ The fact that the building of breakwaters by public authority may have aided the operation of natural causes in the deposit of accretions has been held not to modify the general rule that the riparian or littoral proprietor is entitled to his proportionate share of such accretions.²² It is said that the rule as to accretions is designed to protect the riparian owner's access to the water,²³ and that this reason is just as valid when the area adjacent to the upland is filled in or pumped up by acts of strangers to the upland title, as it is when the accretion is from natural causes.²⁴ According to some authorities, however, a riparian proprietor is not entitled to accretions to his land resulting from artificial causes, or, at least, from an artificial condition produced by a wrongful or unauthorized act.²⁵ It is generally agreed that the riparian owner will not be permitted to increase his estate himself by creating an artificial condition for the purpose of effecting such an increase,²⁶ and that the doctrine of accretion does not apply to land claimed by man through filling in land once under water and making it dry.²⁷

In at least one state, a statute has been enacted which purports to vest title to accretions caused by public works in the state.²⁸

Since title to land under water is not lost by avulsion,²⁹ it is clear that title to such land is not lost where a river shifts to a new location as a result of unnatural forces.³⁰ It has also been held that there may be accretions after an avulsion, and that it does not matter that the accretions are caused by an artificial process or means over which the riparian owner has no control, and which he has no part in creating or causing.⁴¹

78 Am Jur 2d; Waters

4. APPORTIONMENT

§ 422. Generally.

In considering the proper mode of division between adjoining riparian or littoral proprietors of additions to their lands by accretion ~~or reliction~~, it should be observed that by reason of the many varying conditions, it is practically impossible to formulate a general rule by which all of the cases may be governed.⁴³ It undoubtedly is true, however, that accretions formed in front of and contiguous to the land of several owners belong to them all, and cannot be claimed by one with whose land the first point of contact was made.⁴⁴ The inevitable consequence of a contrary rule would be that if it could be shown that the point of contact was first made to lands of one of the riparian owners, he would be entitled thereby to the whole accretion subsequently made to the lands of other riparian owners on either side of him and thus would cut off their water boundaries and privileges.⁴⁵

According to a number of authorities, such additions should be divided equitably among the riparian or littoral proprietors.⁴⁶ The two principal objects to be kept in view in making such an apportionment are: (1) that the parties shall have an equal share, in proportion to their lands, of the area of the newly formed land, regarding it as land useful for the purposes of cultivation or otherwise, in which the value will be in proportion to the quantity;⁴⁷ and (2) to secure to each an access to the water and an equal share of the waterline in proportion to his share on the original line of the water,⁴⁸ regarding such waterline in many situations as principally useful for forming landing places, docks, quays, and other accommodations with a view to the benefits of navigation, and as such constituting an important ingredient in the value of the land.⁴⁹

A rule or mode approved in many cases, unless it results in such inequalities as to make it inequitable, is to give the several riparian proprietors a frontage on the new shore, proportional to their frontage on the old one, connecting the respective points by straight lines.⁵⁰ In such case, the lines by which the new frontage is reached will be parallel, or converge or diverge, according as the new waterline is equal to and parallel with, or is longer or shorter than, the original shoreline.⁵¹ In determining the extent of the original shoreline of the respective proprietors, the general line ought to be taken, and not the

actual length of the line on the water margin if it happens to be elongated by deep indentations or sharp projections. In such case, it should be reduced, by an equitable and judicious estimate, to the general available line of the land upon the water.⁵² The rule sometimes adopted, however, is to extend the original frontage of the respective lots as nearly as practicable at right angles with the course of the river to the thread of the stream.⁵³ Another method or rule which has been applied in some jurisdictions in the case of additions to land bordering on nonnavigable streams is to extend the side lines of each tract to the water at the nearest point.⁵⁴

One common principle which pervades all modes of division is that no regard is necessarily to be paid to the direction of the side lines between contiguous proprietors; the reference ordinarily is entirely to the shoreline.⁵⁵ Under some circumstances, however, a division according to the projection of the side lines may be equitable and proper.⁵⁶

The foregoing rules or methods are generally applicable to land formed by accretion or uncovered by reliction on or along the seashore as well as along the margin of rivers.⁵⁷ The rules or methods herein stated, however, are necessarily general in character, and it should be borne in mind that the circumstances of the particular case may require a modification of any of these doctrines.⁵⁸ It is also to be noted that accretions may be divided between adjacent riparian owners by agreement as well as by actual survey,⁵⁹ and regardless of their exact legal rights.⁶⁰

§ 432. Ownership of land filled in by owner of shore or bed.

The owner of the shore or bed of a navigable stream or other body of water is ordinarily entitled to reclaim the submerged land by filling out to the line of navigability,²⁸ and an upland proprietor has generally been held to be the owner of made land which he created by filling tidal or submerged lands to which he held title, at least as against all persons except the state or federal government acting in aid of navigation or commerce.²⁴

Filled land created by the owner of the shore or submerged soil, held under separate title from the adjacent upland, has generally been held to belong to such owner and not to the upland proprietor.²⁵ It has been held or recognized that the state or its grantee is the owner, as against the abutting riparian proprietor, of filled land at the edge of navigable water where such land is created by the former as owner of the shore or submerged soil, at least where the filling is in aid of navigation or commerce.²⁶ The riparian proprietor's right of access to navigable water has been expressly denied across filled land which was created in aid of navigation or commerce by or on behalf of the public owner of tidal or submerged soil.²⁷ The separate owner of the bed of nonnavigable waters, rather than the riparian proprietor, has been held to be the owner of land at the water's edge which the former created by filling the submerged soil.²⁸ Under some circumstances, however, the adjacent upland proprietor has been held to be the owner of land which the public owner of submerged or tidal soils created by filling or dredging.²⁹

§ 433. Land created by filling or dredging by third person.

Land created at the water's edge as the result of filling or dredging by a third person has been held or recognized to be the property of the adjacent upland owner, as in the case of a natural accretion, as between those parties.³⁰ Also, as against other riparian proprietors, it has been held that the upland owner has the right to filled land created by a third person.³¹ But land which a third party created at the water's edge by filling the publicly owned shore or submerged soil has been held to be the property of the state or its grantee as against both the filler and the upland proprietor.³²

§ 435. Apportionment between adjacent proprietors.

In cases concerning the apportionment of filled land between adjacent riparian or littoral proprietors, the rights of the state or of third parties not being involved, the courts have applied the rules governing the division of natural accretion,³³ and upland owners have usually been awarded a frontage on the new waterline proportionate to that which they had on the original shore, in the absence of peculiarities in the formation of the shore or other circumstances making that course inequitable.³⁴

XVII. ISLANDS

§ 436. Generally.

An island is defined generally as a piece or body of land surrounded by water.³⁸ To constitute an island in a river, the formation or body must be of a permanent character, not merely surrounded by water when the river is high, but permanently surrounded by a channel of the river, and not a sand bar, subject to overflow by the rise of the river and connected with the mainland when the river is low.³⁹ But it is not necessary that the formation on the bed of the river and extending above its surface be suitable for agricultural purposes in order to constitute it an island.⁴⁰

§ 437. Title and rights.

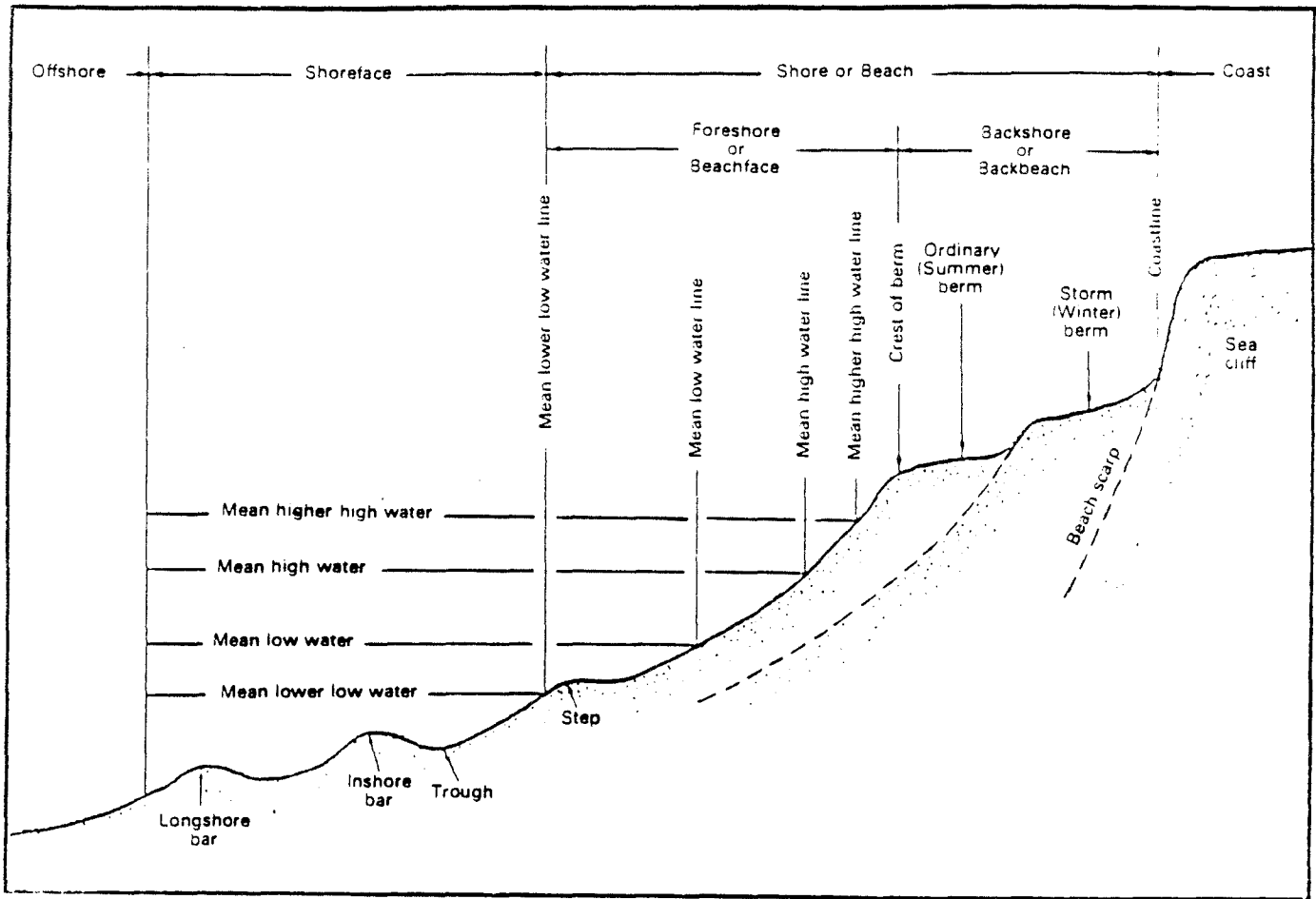
The title to islands is ordinarily vested in the owner of the bed of the waters out of which they arise, provided there has been no separation of such ownership by grant, reservation, or otherwise.⁴¹ Consequently, where the riparian or littoral proprietors have title to the bed of the waters,⁴² each is ordinarily the owner of such islands or portions thereof as arise on his side of the thread of the stream or channel,⁴³ and within his side lines.⁴⁴ Where the

title to an island has become vested in a riparian proprietor by virtue of its formation on his side of the channel of the stream, his title is not divested by a subsequent change in the channel, at least where such change results from artificial causes.⁴⁵ In case an island is so formed in the bed of a river as to divide the channel and form partly on each side of the thread of the river, if the land on the opposite sides of the river belongs to different proprietors, the island will be divided between them according to the original thread of the river.⁴⁶ But where the boundary line of riparian proprietors extends only to the water margin,⁴⁷ the title to islands arising out of the adjacent waters is ordinarily vested in the state or its grantee.⁴⁸

The admission of a state into the Union does not necessarily operate to transfer to such state the title of the United States to islands resting on the bed of navigable waters within the state,⁴⁹ although the act of admission has been held in some instances to pass such title.⁵⁰

The ownership of an island carries with it the usual riparian rights.⁴¹ Where, under the rule prevailing in the particular jurisdiction, the riparian proprietor takes title to the thread of the stream,⁴² the title of the owner of an island extends to the center of the channel between the island and the opposite tract on either side.⁴³

78 Am Jur 2d; Waters



ZONES OF A COASTAL BEACH

From: Thompson, Morris M. 1979.
Maps For America. Washington:
 U.S. Government Printing Office.
 265 pp.

General Information About
Meandering and Navigable Waterways Found in
U.S. Manuals of Instruction Used in California

1. All manuals have a section on meandering.
2. Two manuals are listed for the year 1851. One written for the Office of the Surveyor General of Wisconsin and Iowa; the other written for the Surveyor General of Oregon. The Oregon Manual was the manual used for the survey of California Public Lands until the 1855 manual was issued.
3. The Manual of 1930 defines a meander line as "the traverse of the margin of a permanent, natural body of water."
4. All manuals call for meander corners to be established at all those points where the lines of the public surveys intersect the "banks" of bodies of water, waterways or islands that are to be separated from the public lands for acreage.
5. All manuals refer to the position of the banks of a river or stream as, facing downstream, the bank on the left-hand side is the "left bank." and the bank on the right-hand side is the "right bank."
6. Tide waters are not mentioned in the Manuals of 1851 to 1881 but are mentioned after 1881.
7. The Manual of 1902 states that lands bounded by waters are to be meandered at mean high water mark (Sec. 154).
8. Manual of 1902 states that unless an irregular or sinuous line closely follows a stream or body of water, it is not entitled to be called a meander line (Sec. 153). (See also Section 108 and 151).
9. "The manual of United States Surveying", by J. H. Hawes, 1868, adds:
 - A. Large lakes, navigable rivers and bayous, are by Law of Congress made public highways, and as the Government surveys progress, they are mentioned and segregated from the public lands.
 - B. Wide "Flats" - where wide, irregular expansions occur in rivers that are not navigable, and such expansions are permanent bodies of water, the area of which is more than forty acres, and embraces more than one-half of a legal subdivision of forty acres, they should be meandered on both banks.

MANUAL	LAKES, PONDS, BAYOUS	STREAMS, RIVERS	ISLANDS	TIDE WATERS	MISCELLANEOUS
1890	<p>1) All lakes & deep ponds of the area of 25 acres & upward.</p> <p>2) Navigable bayous.</p> <p>3) Shallow ponds readily to be drained or likely to dry up are not to be meandered.</p>	<p>1) Both banks of "navigable" rivers.</p> <p>2) All rivers not classed "navigable"; the right angle width of which is three chains & upward-both banks.</p> <p>3) River not classed "navigable", will not be meandered above the point where the average right angle width is less than three chains (F).</p>	1) Same as (D) 1871	1) Meanders are to follow the <u>high water line</u> of lands bordering on <u>tide water</u> (G).	<p>1) Same as (E) 1881</p> <p>2) Closure: Within each fractional section, between any two meander posts or of an island in the interior of section: 5/8 of a link for each chain when less than 80 chains, error must not exceed 150 links (L).</p>
1894	1) All lakes, navigable bayous & deep ponds of the area of 25 acres & upwards (J).	1) Navigable rivers & all rivers not classed <u>navigable</u> , the right angle width of which exceeds three chains will be (cont.)	1) Same as (D) 1871	1) Same as (G) 1890	1) Meander lines will not be established at the segregation line between dry & swamp or overflowed land, (cont.)

MANUAL	LAKES, PONDS, BAYOUS	STREAMS, RIVERS	ISLANDS	TIDE WATERS	MISCELLANEOUS
1894, cont.		<p>1) meandered on both banks, at the <u>ordinary mean high water mark</u> (H).</p> <p>2) Same as (F) (1890)</p> <p>3) Shallow streams, without any well defined channel or permanent banks will not be meandered except tide water streams (I).</p>			<p>1) but at the <u>ordinary high water mark</u> of the actual margin of the rivers or lake on which they border (K).</p> <p>2) Same as (L) 1890- where the meander corners marking the ends of a meander line in a fractional section are located on standard, township or section lines, the above limit increased by $\frac{1}{4}$ or the regular perimeter of the fractional sec.</p>
1902	1) Same as (J) 1894	<p>1) Same as (H) (1894)</p> <p>(cont.)</p>	1) Same as (D) 1871	<p>1) Notes only that meander corners may temporarily be</p> <p>(cont.)</p>	1) Same as (K) 1894

MANUAL	LAKES, PONDS, BAYOUS	STREAMS, RIVERS	ISLANDS	TIDE WATERS	MISCELLANEOUS
1930, cont.		<p>2) Same as (F) (1890)</p> <p>3) Same as (1) (1894)</p> <p>4) Same as (M) (1902)</p> <p>5) All tide water streams should be meandered at ordinary high water mark, as far as tide water extends.</p>	<p>2) Note: See Misc. (1930).</p>		<p>2) Agricultural upland within the limits of swamp and overflowed lands will not be meandered as a island.</p> <p>3) Closure: The boundaries of each fractional section of meanders should close within a limit to be determined by the fraction $1/640$ when the error in either lat. or departure is considered separately.</p>

Apportionment of Lake Beds

THE AMERICAN HERITAGE DICTIONARY OF THE ENGLISH LANGUAGE defines apportionment as "the act of apportioning or the condition of being apportioned" and then defines apportioning "To divide and assign according to some plan or portion; allot; partition." When applied to the bed of a lake, apportionment is a method of defining the limits of ownership of a lake bed.

An upland owner along a lake generally has riparian rights; these rights are attached to the upland parcel in the way of use or possible use of the water or lake bed. There are basically two types of ownership of lake beds. One being sovereign ownership, where the state or federal government owns the bed of the lake. The other being non-sovereign or private ownership, where the upland owners hold title to the lake bed.

When the surveyor is apportioning a lake bed, the first question they must address is whether the lake is a sovereign or non-sovereign body of water? Each must be treated differently in accordance with state laws and statutes, and occasionally federal regulations.

A non-sovereign lake requiring apportionment is typically a non-navigable meandered lake with more than two upland owners. A riparian owner along a non-sovereign lake generally holds title to the center point of the lake or to a center or median line. A navigable sovereign lake may have to be apportioned to the thalweg or deepest area, thus insuring the upland owners an interest to the waterway.

Apportionment of the simplest nature would be a circular lake where upland ownership extends to the geographical center of the lake. The result would be a pie shape figure with division lines extending radially the center point to the upland property lines (FIGURE 1). Few lakes are perfectly circular, most are irregular, therefore another method or combination of methods may be required to ensure the upland owners receive their portion of the lake bed.

A method used under special circumstances is section or property line projection. This type of apportionment is used when a lake is situated entirely within sectionalized land and or there are few upland owners (FIGURE 2). In this instance the section or property lines are projected across the bed of a small lake and the upland owners take title along the projected lines.

An elongated lake can be divided by the long lake method. This method uses a median line along the length of the entire lake (FIGURE 3). A median line, as defined in the 1973 Manual of Instructions, "is a continuous line, formed by a series of intersecting straight line segments or a combination of straight line and curved line segments, every point of which is equidistant from the nearest point on the opposite shore."

The long lake method, in most cases, uses a hybrid of the long lake method which includes a median line and incorporates the pie type apportionment at the end points (FIGURE 4). When a lake is to be apportioned the courts have held the main issue of apportionment is equitability, the division lines must be **equitable** to all parties. Thus a small parcel with a long shore line generally holds title to more lake bed than a larger parcel with a lesser shore line. When apportioning a lake bed the amount of shore line generally dictates the amount of the lake bed apportioned.

The first step in apportioning a lake bed is establishing the configuration of the old lake. Although this seems simple, the surveyor will be faced with several possible lake bed configurations depending on the topography and geographical history of the lake. Surveys showing historic meander line positions, deed calls, aerial photographs and old maps may

indicate different shoreline positions. (An example would be if a lake bed is flat and slowly relicted, surveys preformed at different times would show a substantially different shore line position for adjacent parcels FIGURE 5). Thus, a survey of the lake must be performed, an earlier survey adopted, or some other evidence used to locate and fix the position of the shoreline. Once the lake configuration has been located or agreed upon, the method of establishing the center point, median line, thalweg, or end points of the lake can be undertaken.

The shoreline should be plotted with coordinates from which the center point or median line can be calculated. If the center point method is to be used, the center point can be calculated and the division lines established simply by inverting between the upland property lines and the center point. If the long lake method is used the geographic points along the shoreline used in controlling the center line or the median line should be obvious or agreed upon.

After the shoreline has been located, the method of establishing the median line needs to be adopted. There are two basic methods, one is the Center Point Method (FIGURE 6) and the other is the Salient Point Method (FIGURE 7). The center point method is commonly used when apportioning a river, however it will work exceptionally well on a long lake. The center point method uses two points one on each side of the shore, the center line is then located midway between the two. The other common method is the salient point method and is described in detail in *Sea and Shore Boundries*, Aaron L. Shalowitz, U. S. Dept. of Commerce, Coast and Geodectic Survey. The salient point method uses three points along the shore line instead of two. The salient point method regardless of the lake's configuration, yields only one position for the median line.

With the median line located, the surveyor must then decide whether end points are necceary, if so, thier positions on the median line will have to be determined. The end points should be far enough into the lake bed as to ensure the upland owners at the end points recieve thier equitable share of the lake bed.

When the lake configuration has been fixed, the method of establishing the center point and or center line agreed upon, the median line located, the area of the lake bed calculated, coordinates on all points, the surveyor must now determine the division lines. To reiterate, the courts have held that the most important issue when addressing the apportionment issue is equitability. Possible choices of division lines used when apportioning lake beds and water ways are listed as follows:

Proportionate Shoreline Method - This method is where each upland parcel owner recieves a precentage of the median line based upon the ratio of the total shoreline and the shoreline of their particular parcel. All though this method is equitable the division lines may have to be skewed to force the divison lines to fit acreage calculations (FIGURE 8).

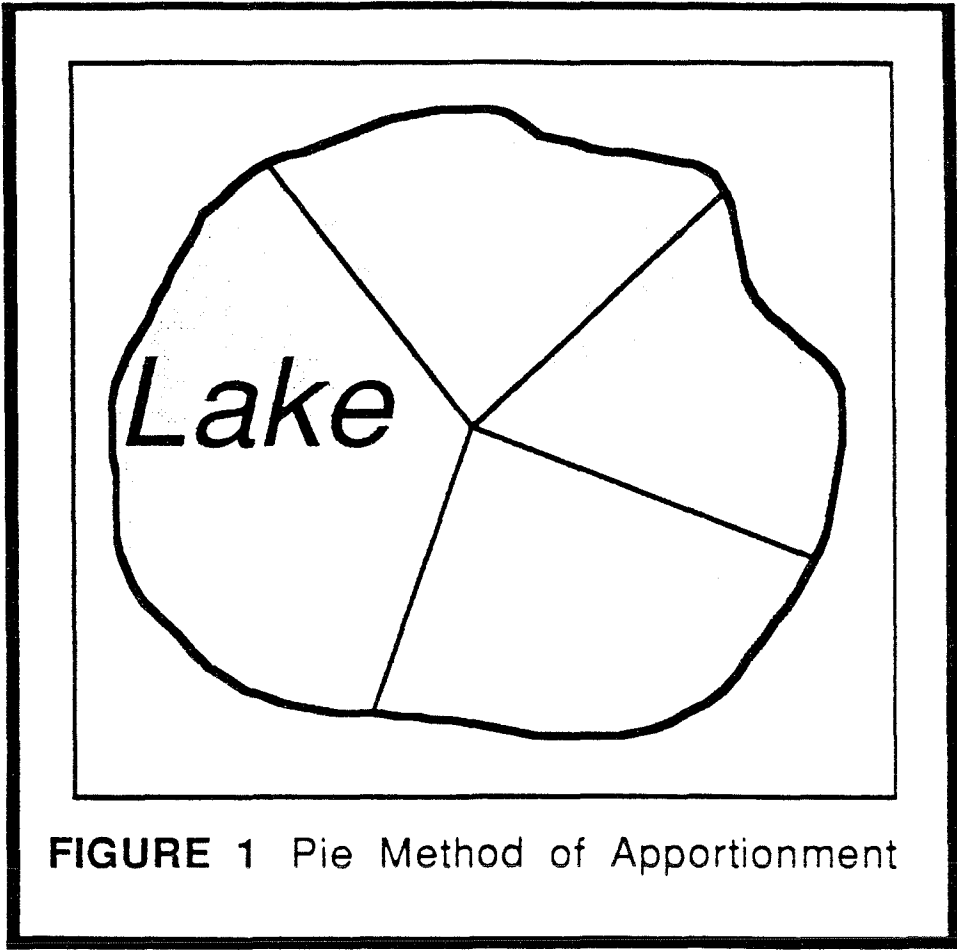
Proportional Acreage Method - This method is where each upland parcel owner recieves a portion of the lake bed based upon the total acreage of the lake and the percentage of their shoreline with that of the entire shoreline. Since this method would give an equal amont of the old river bed to each upland owner it would seem this would be the most common method of apportionment used. However the equal acreage method has no direction for division lines, thus unless the division lines extend towards the center of the lake this type of apportioning would, under most situations, be unacceptable (FIGURE 9).

Proportionate Thread of the Stream Method - This method is used when a navigable water way is to be apportioned and the upland owners have an existing right to the waterway. In the case of a lake the deepest portion may not be in the center, if access to the waterway is of importance, a line along the deep area or thalweg could be used (FIGURE 10).

Perpendicular To the Center Line - When applied to the long lake method is when the division line are perpendicular from the median line to the upland parcel boundary lines (FIGURE 11).

Colonial Method - Is where a base line is run from upland parcel to upland parcel corner and the division lines projected out at right angles from the base line to the median line. This method has been used when apportioning tidelands, but can be adapted for apportioning lakes (FIGURE 12).

In summary when apportioning a lake bed there are many methods of apportioning available to the surveyor. The surveyor must choose a method or methods that are equitable to all the upland owners and equitability does not necessarily mean the lake is to be apportioned merely on the amount of acreage, other factors must be included when apportioning. Agreement between the upland owners is an important factor. The surveyor should divide the lake bed as equitably as possible and obtain as much input from all concerned parties. After the lake bed has been apportioned the upland owners should exchange deeds indicating thier acceptance. What ever apportionment method is used, it should be retraceable.



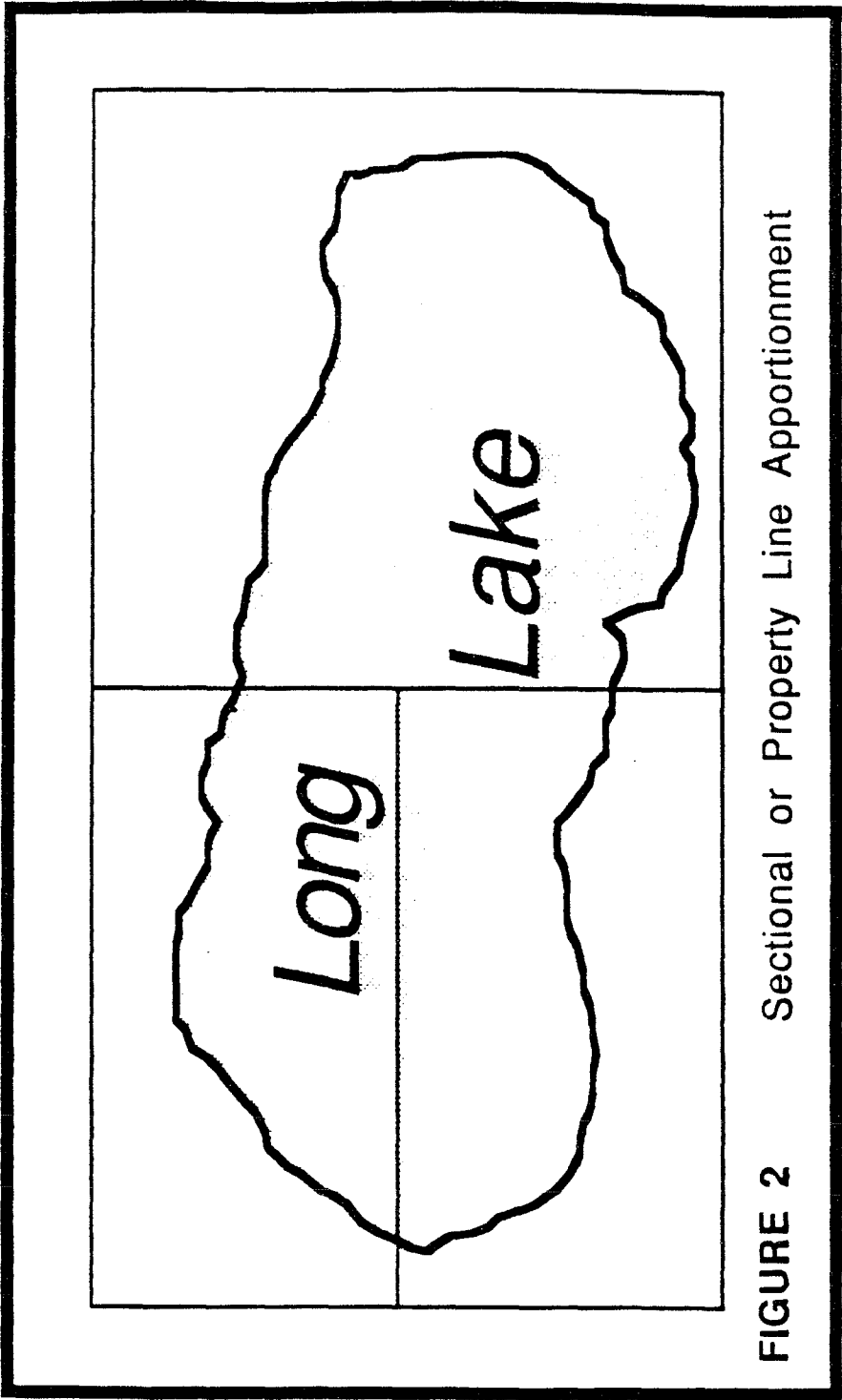


FIGURE 2 Sectional or Property Line Apportionment

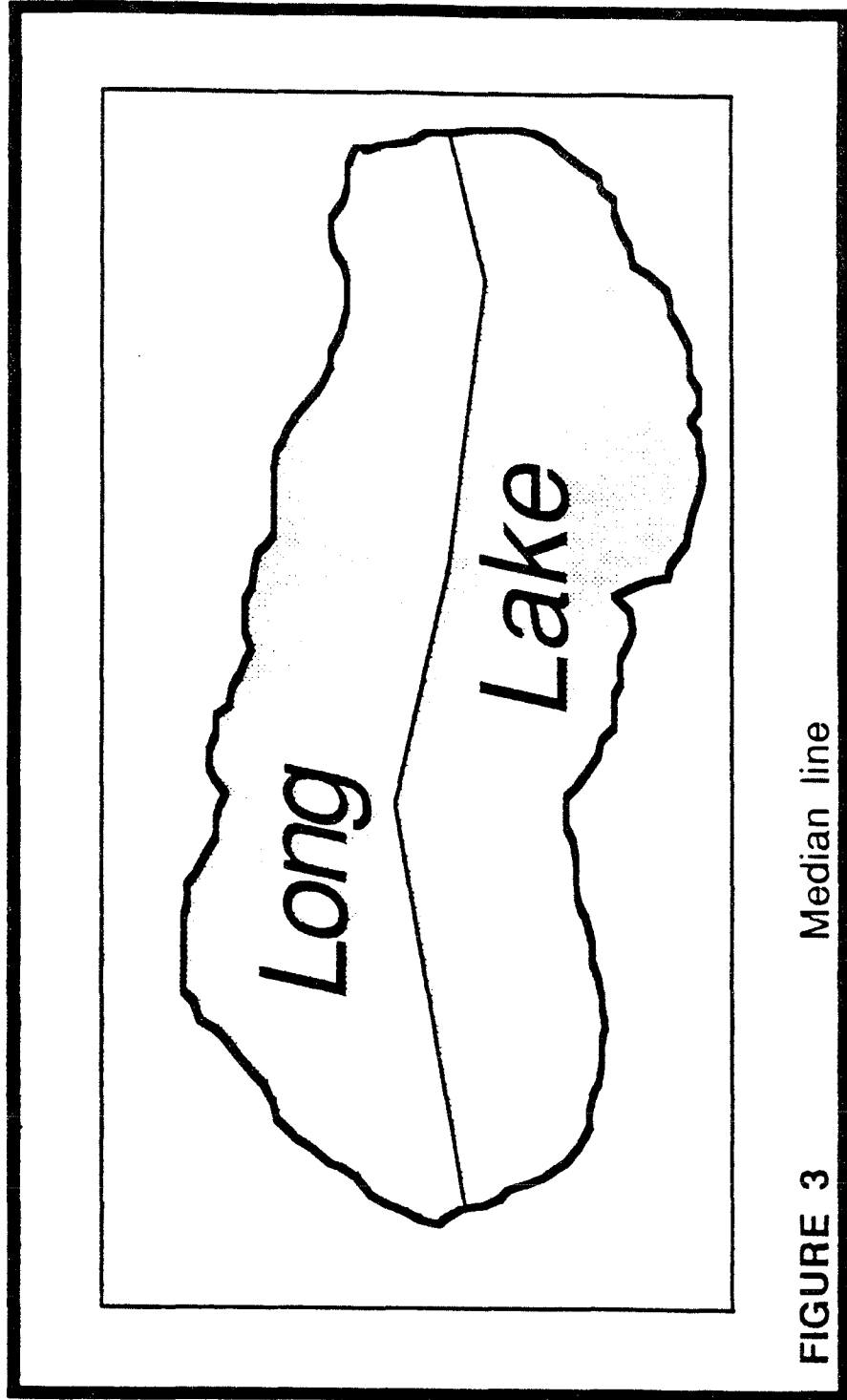


FIGURE 3 Median line

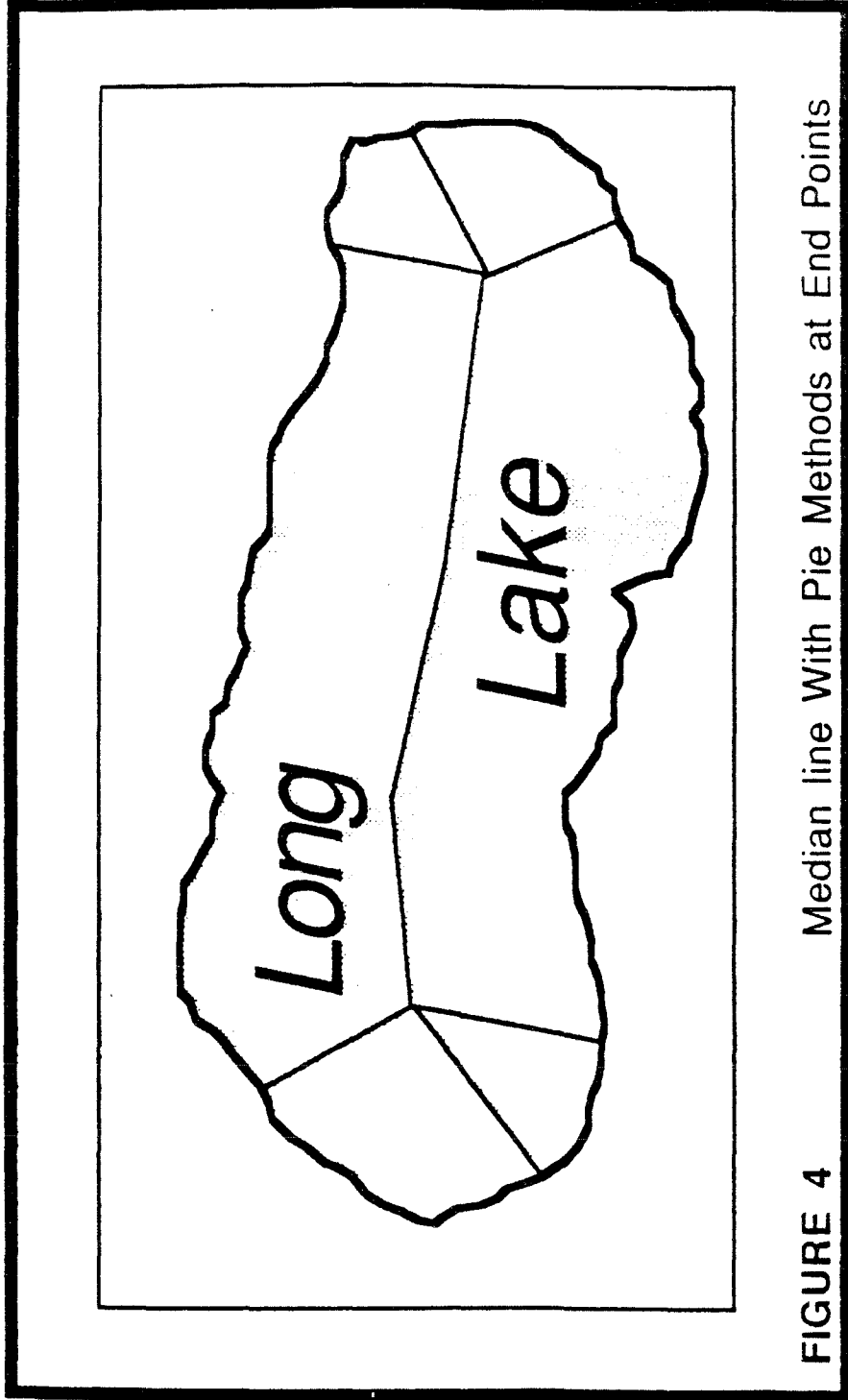


FIGURE 4 Median line With Pie Methods at End Points

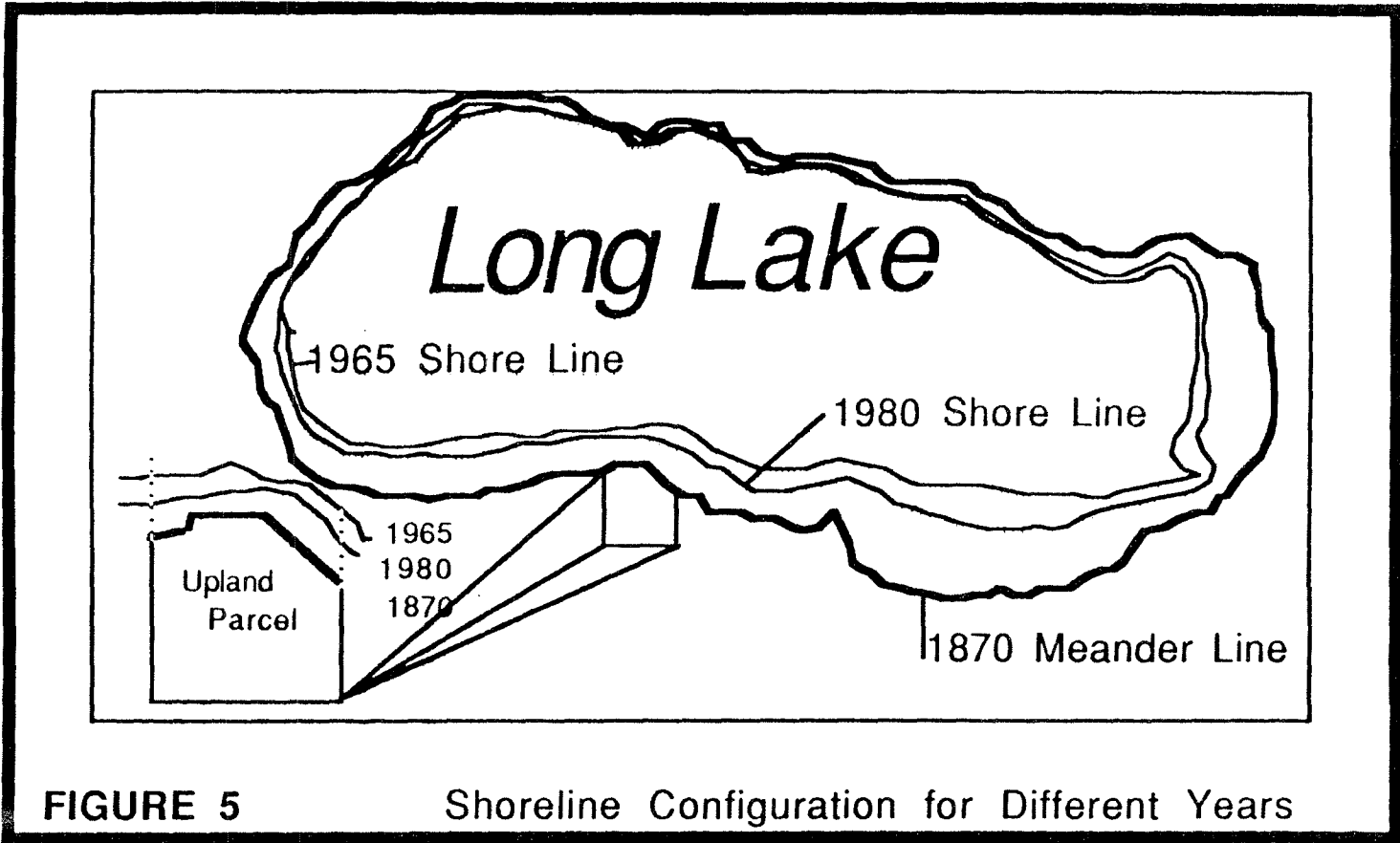


FIGURE 5

Shoreline Configuration for Different Years

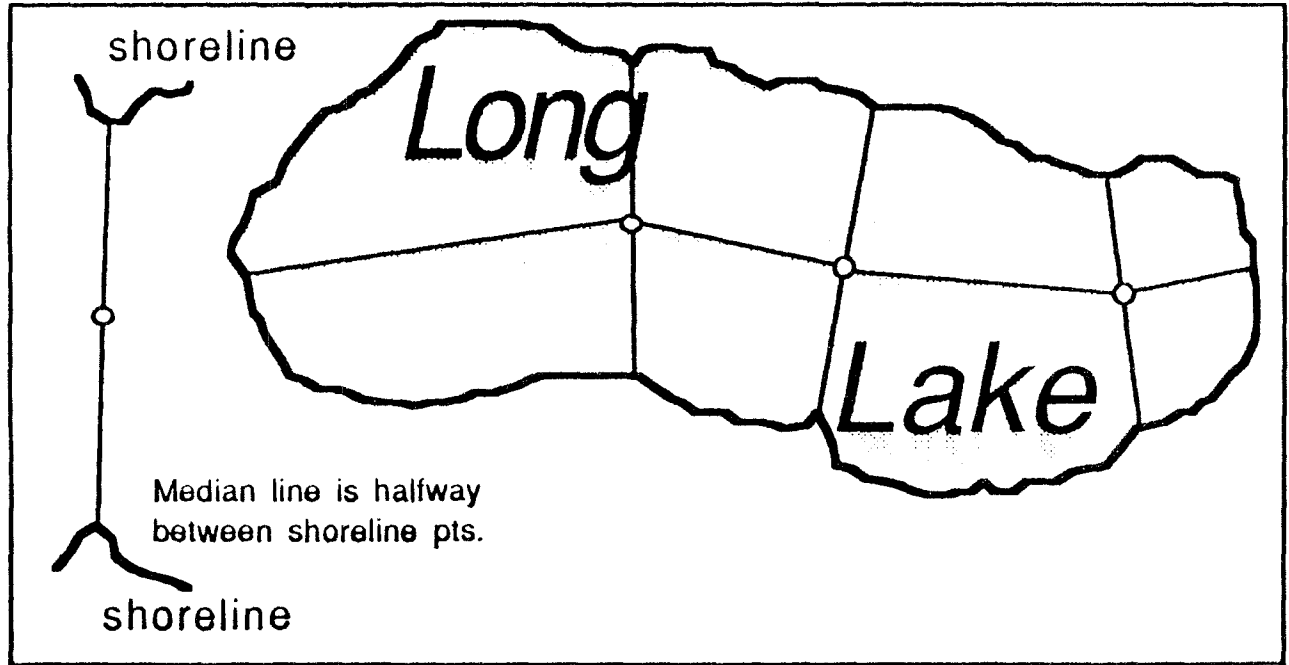


FIGURE 6 Median Line by Center Point Method

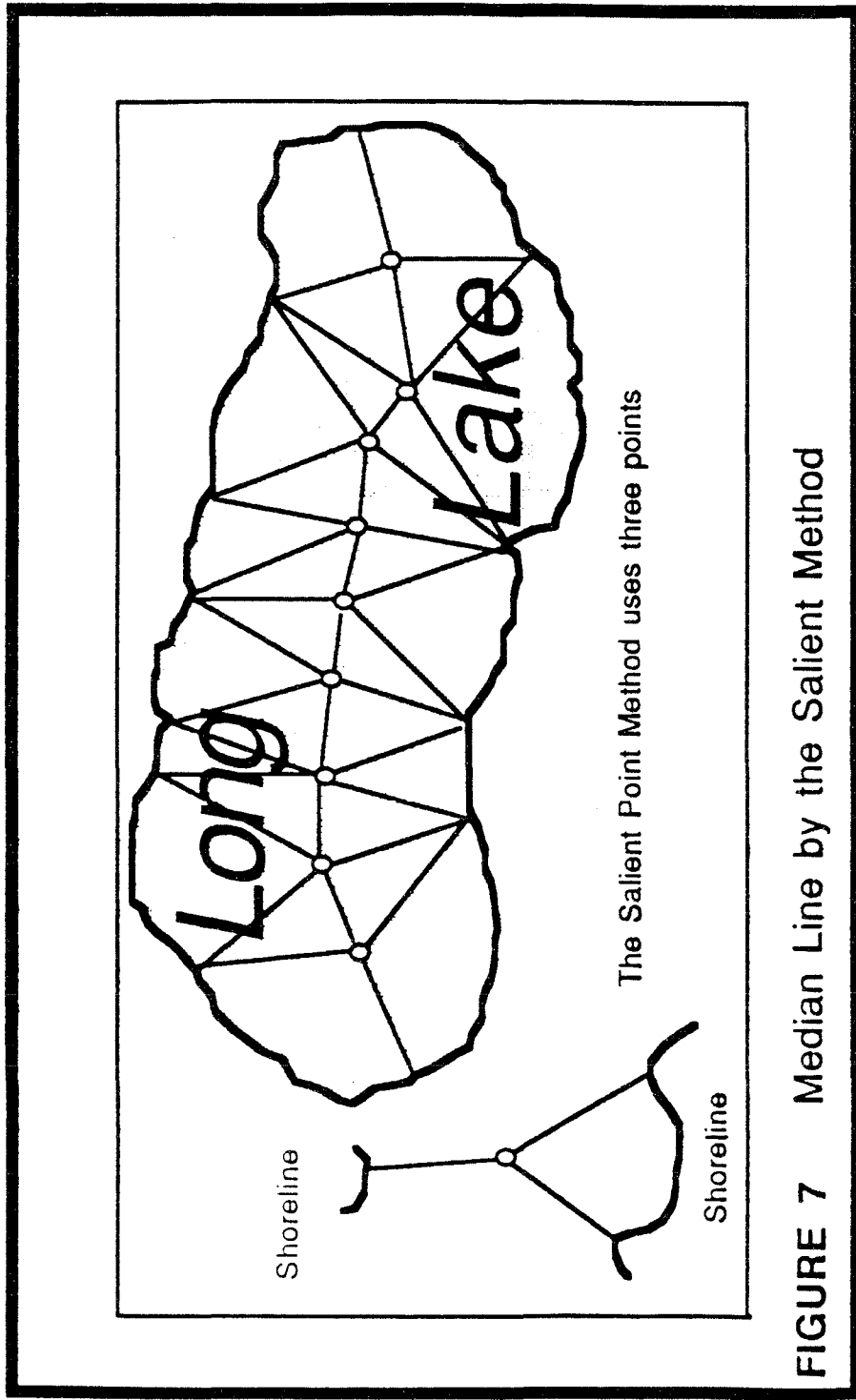


FIGURE 7 Median Line by the Salient Method

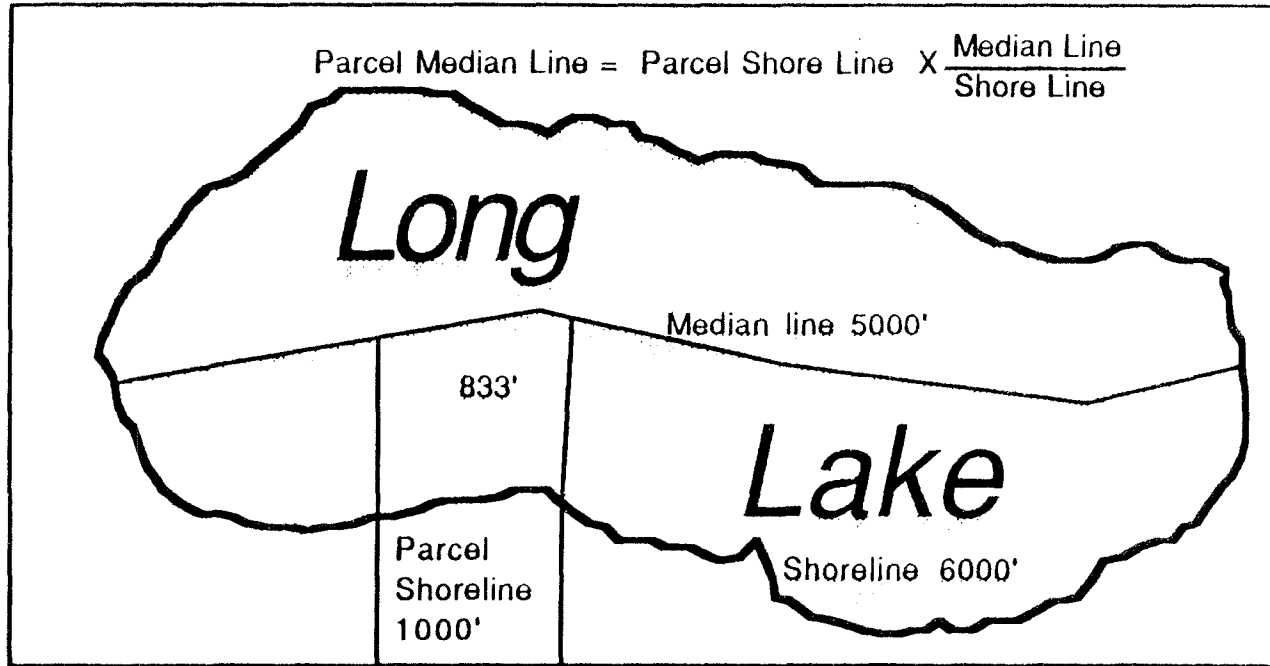


FIGURE 8

Proportionate Shoreline Method

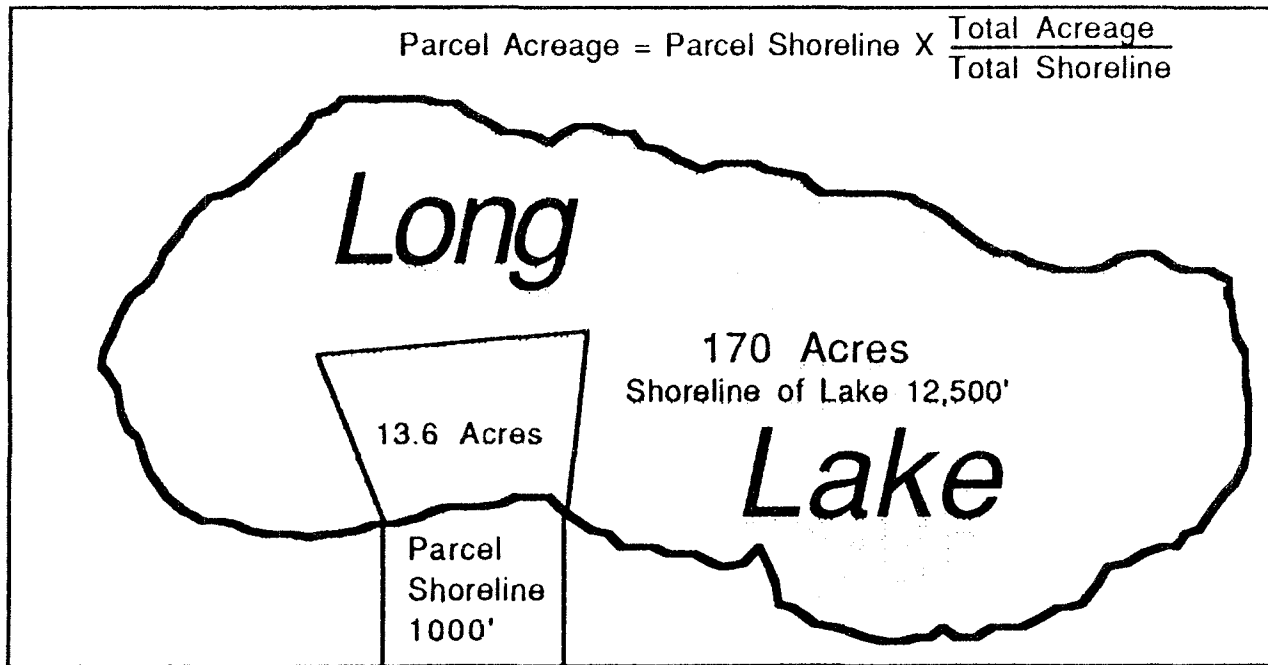


FIGURE 9

Proportionate Acreage Method

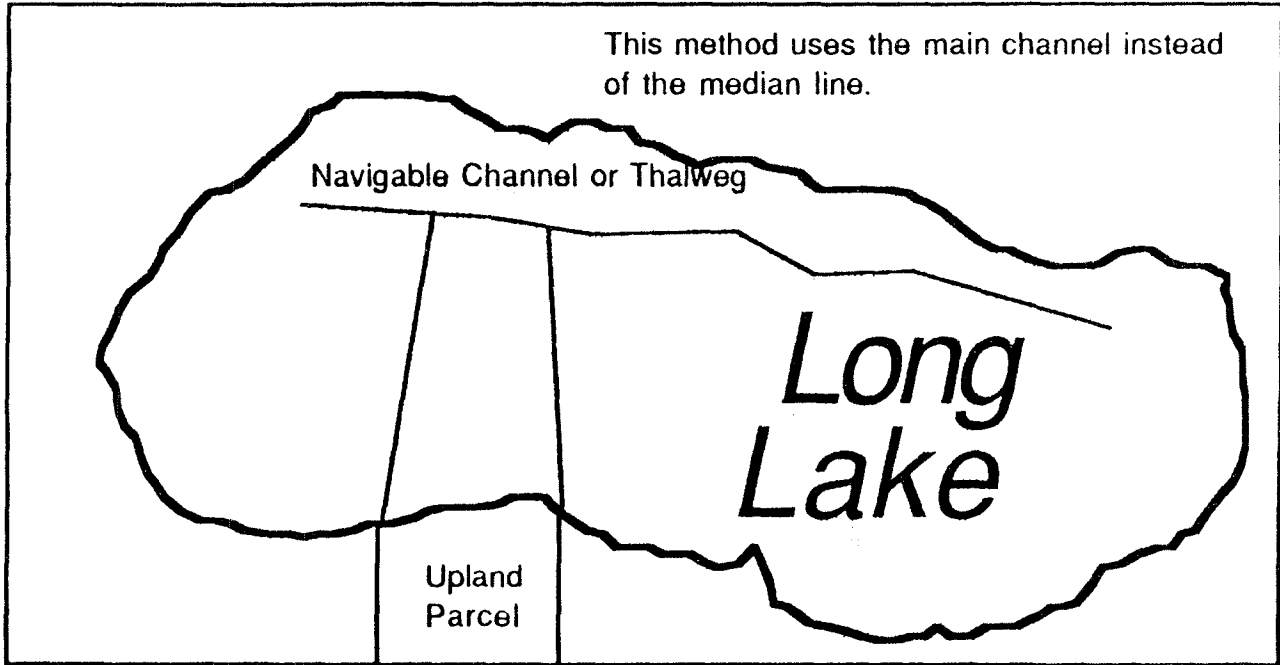


Figure 10

Porportional Thread of Stream

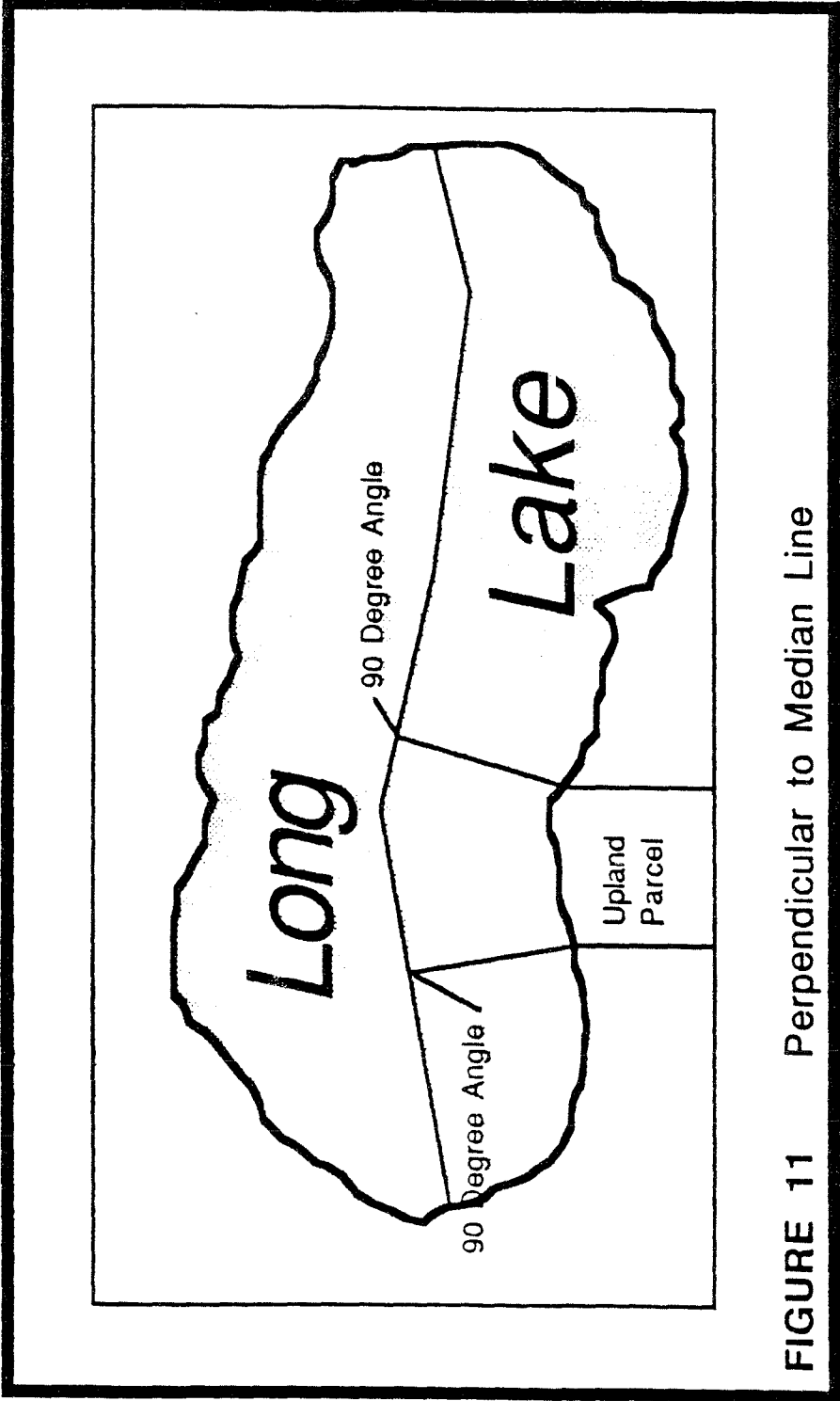


FIGURE 11 Perpendicular to Median Line

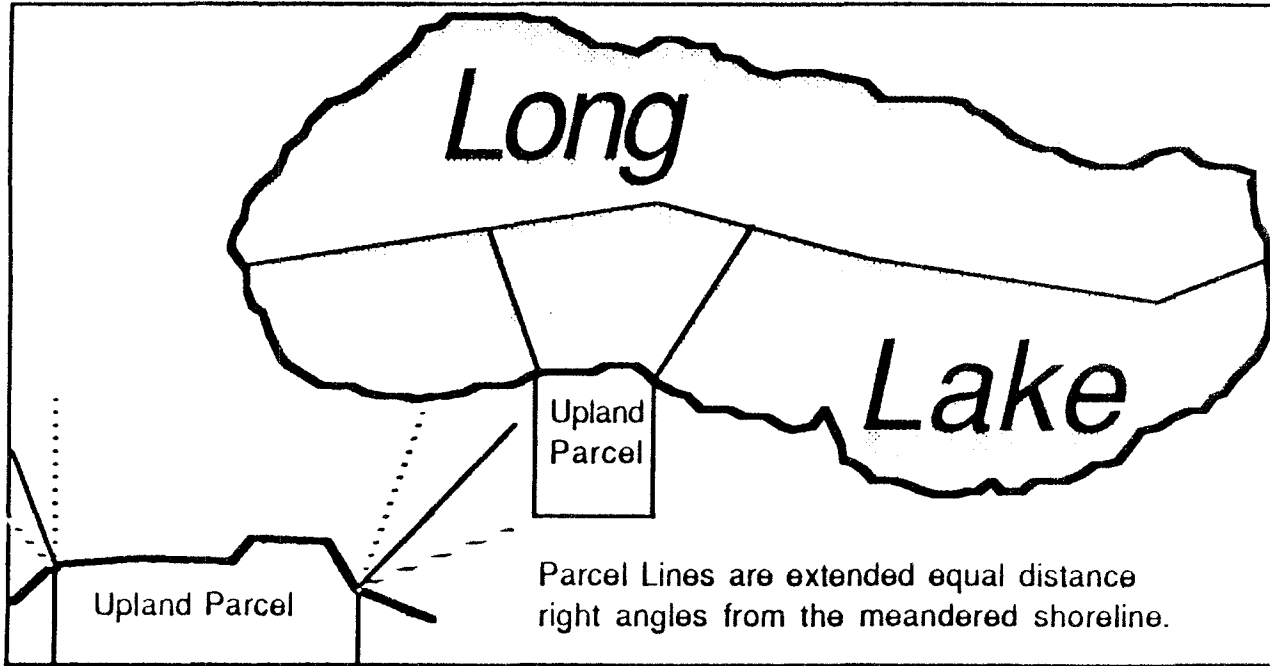
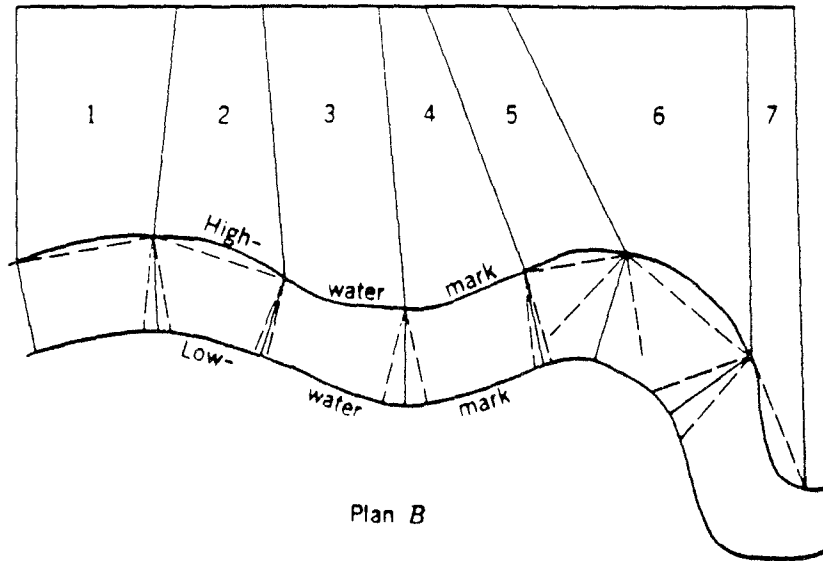


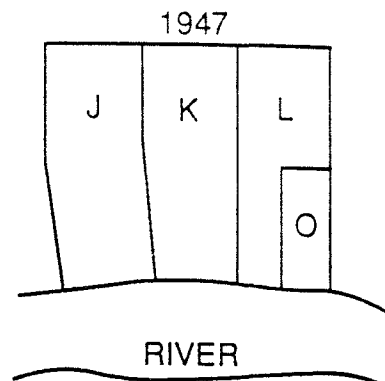
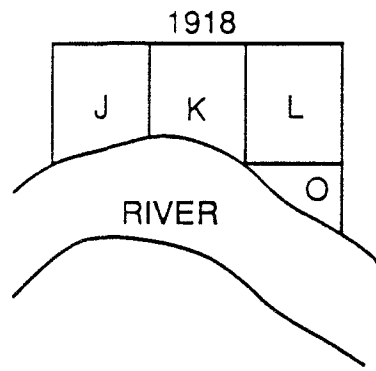
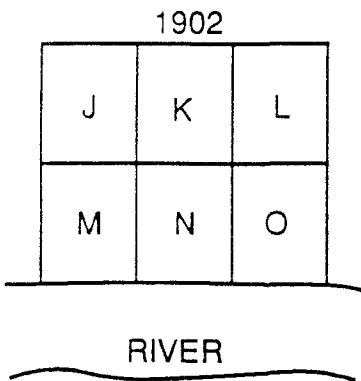
FIGURE 12

Colonial Method



Colonial method. Emerson v. Taylor. 9Me35.

From: Brown, Robillard & Wilson, 1986



** Not to Scale **

LSTTM - 1

O S A N G E L E S C O U N T Y



U.S.
COAST AND GEODETIC SURVEY
F. M. THORN SUPT.
TOPOGRAPHY
OF
COAST IN VICINITY
OF
SAN JUAN CAPISTRANO

SECTION X.
CALIFORNIA
1885
Scale 1:62,500
Register No. 1645

Topography taken by A. J. Rodgers, Ass't
Geographer, U.S. Coast and Geodetic Survey

Approved
B. H. Colman
Assistant Chief of Office

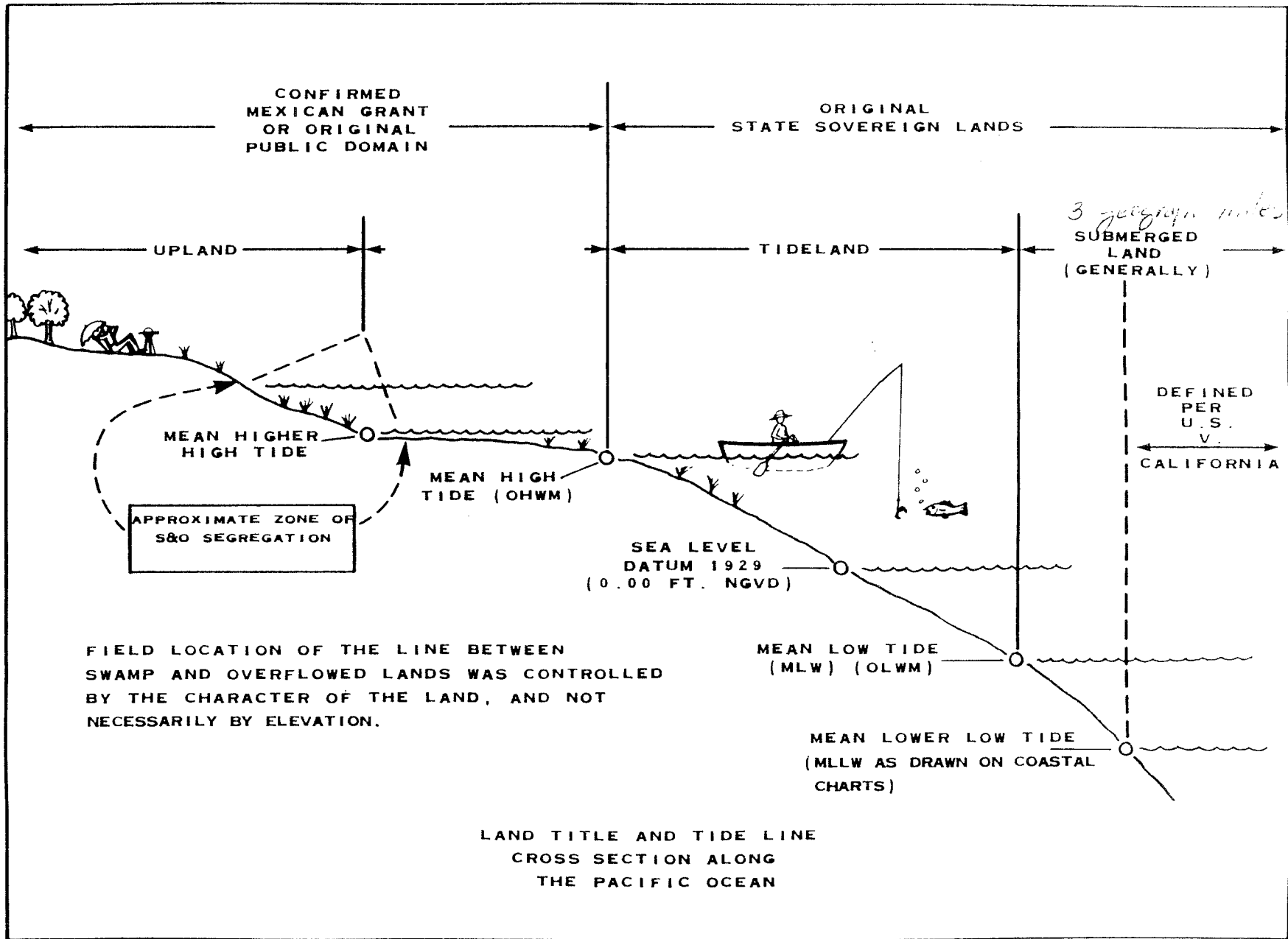
Examined and corrected
F. M. Thorn
Superintendent

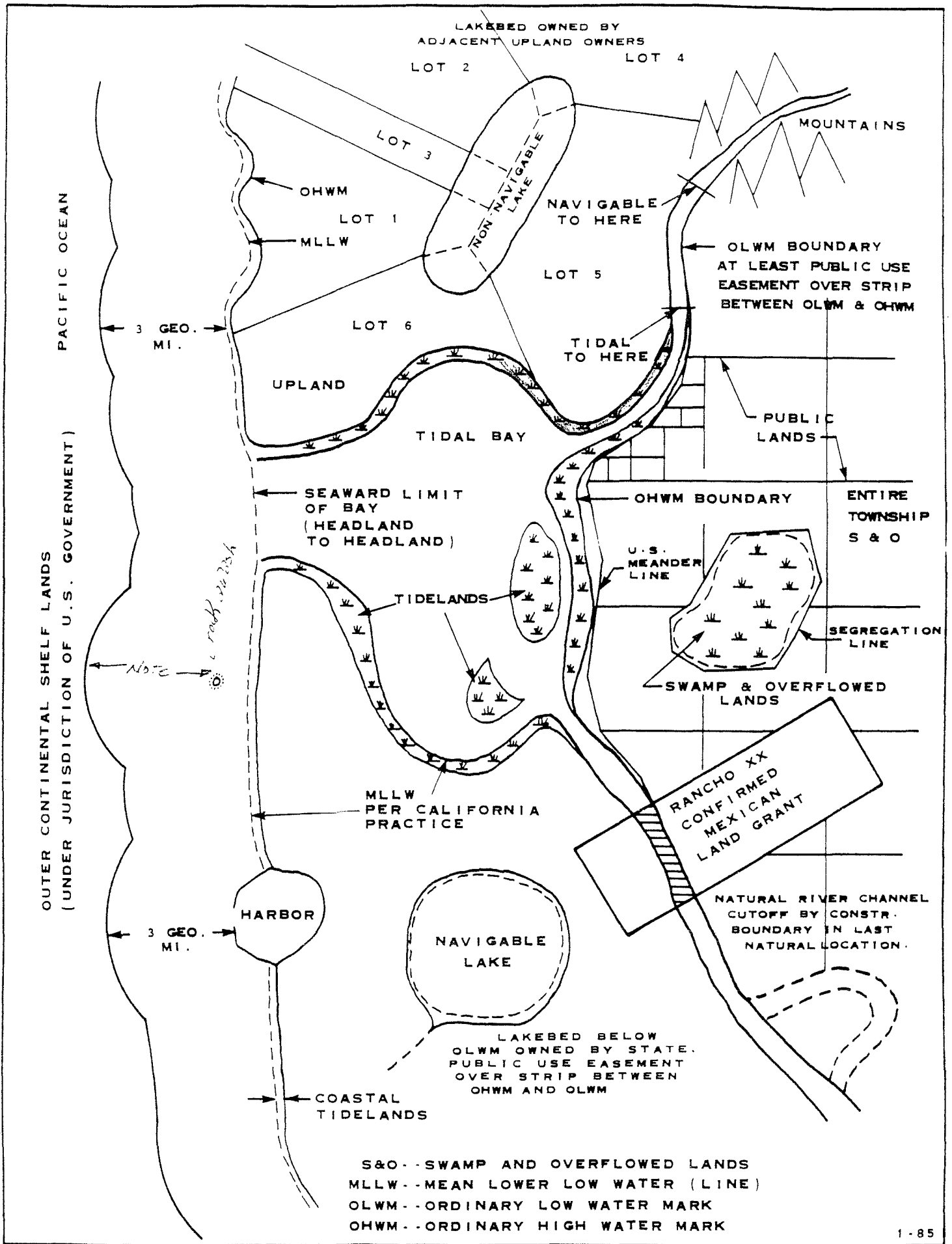
The United States Government, through the Copyright
Office, has caused this map to be printed in
large numbers of copies for the use of the Government.

E A N
56

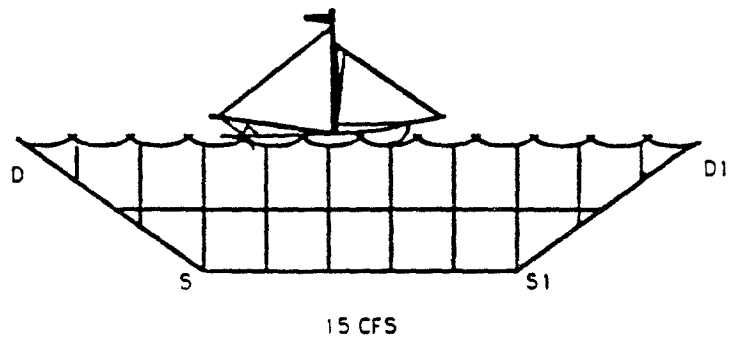
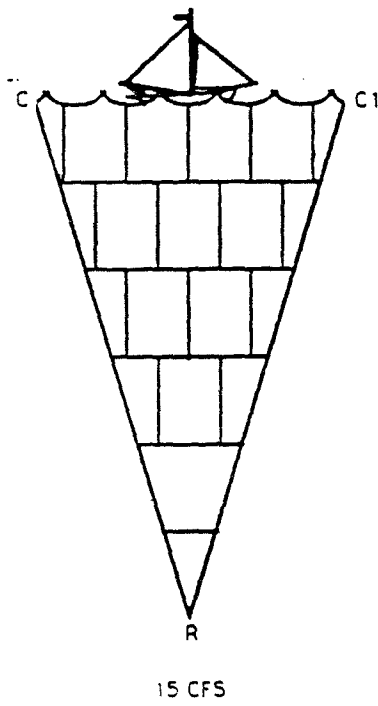
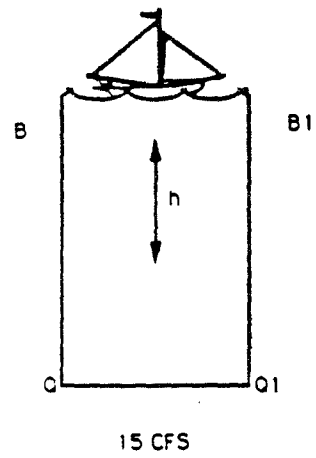
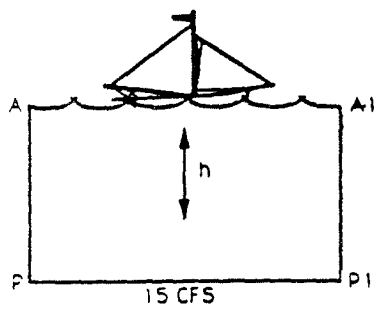
Lat.	DM.	Long.	DP
36 32 42.6		122 07 42.3	

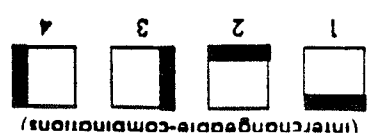
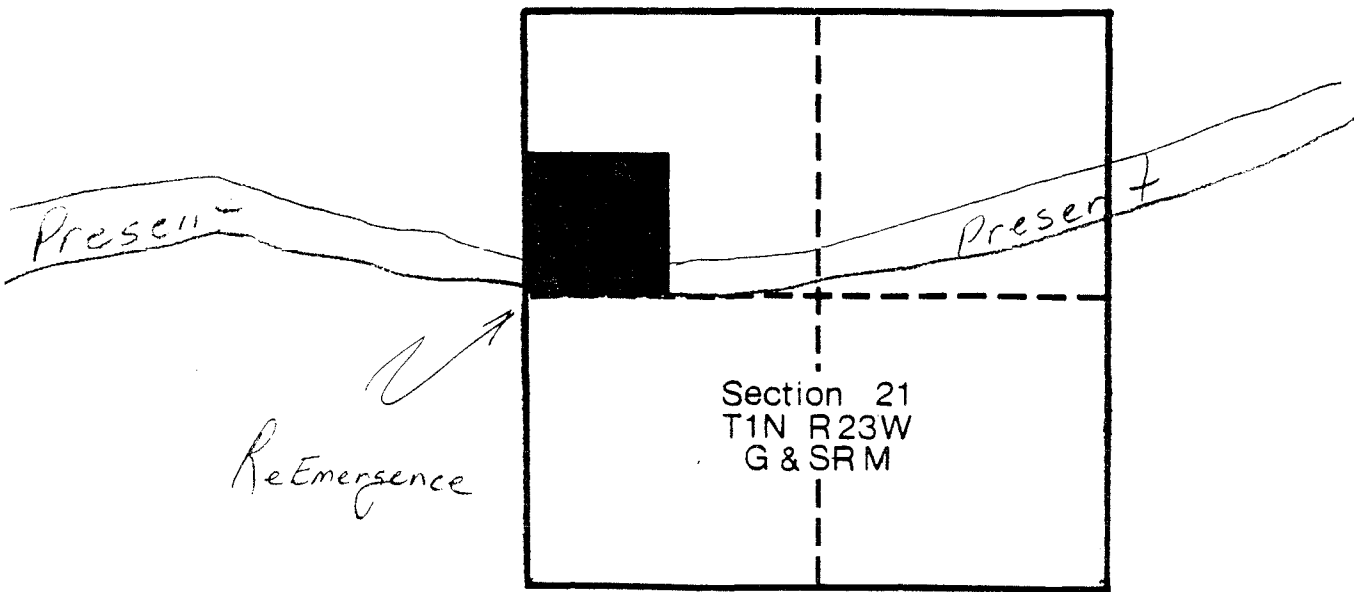
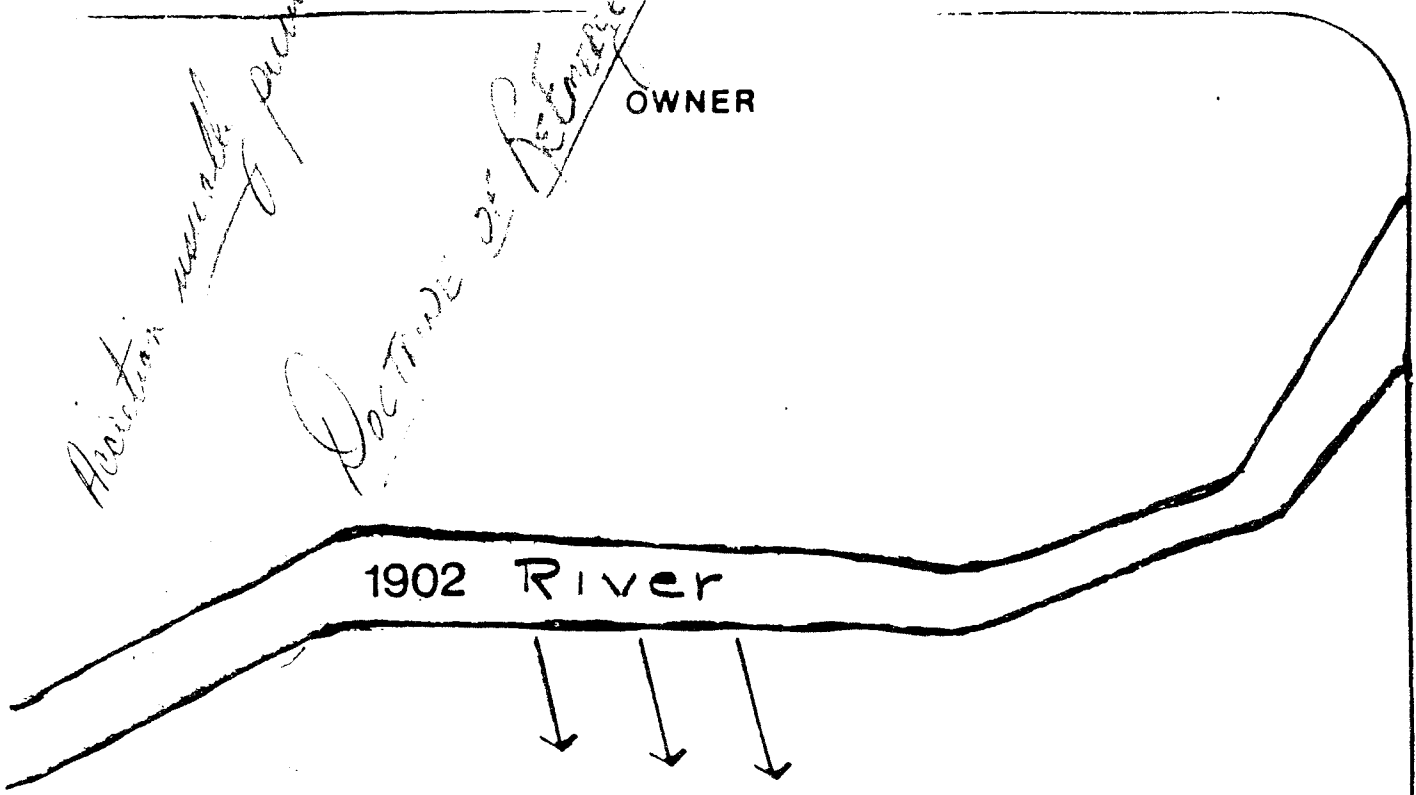
T1645





S&O -- SWAMP AND OVERFLOWED LANDS
 MLLW -- MEAN LOWER LOW WATER (LINE)
 OLWM -- ORDINARY LOW WATER MARK
 OHWM -- ORDINARY HIGH WATER MARK





09

Hinge overlays on 1 edge only. Example:

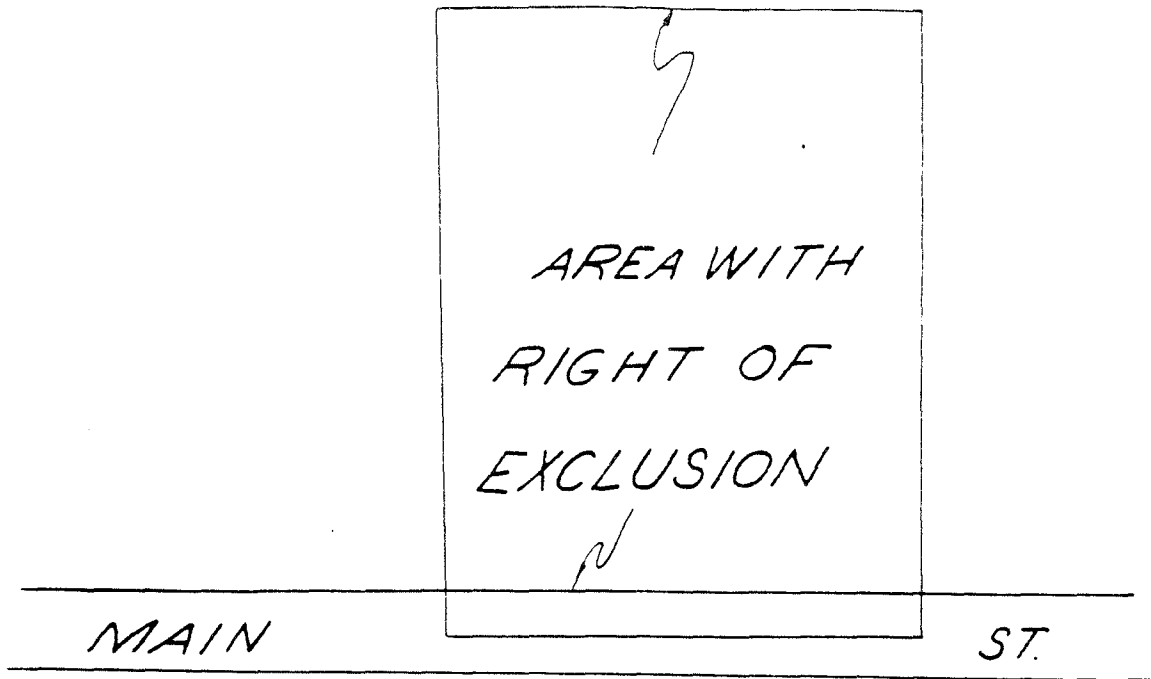


FIG. 102-1

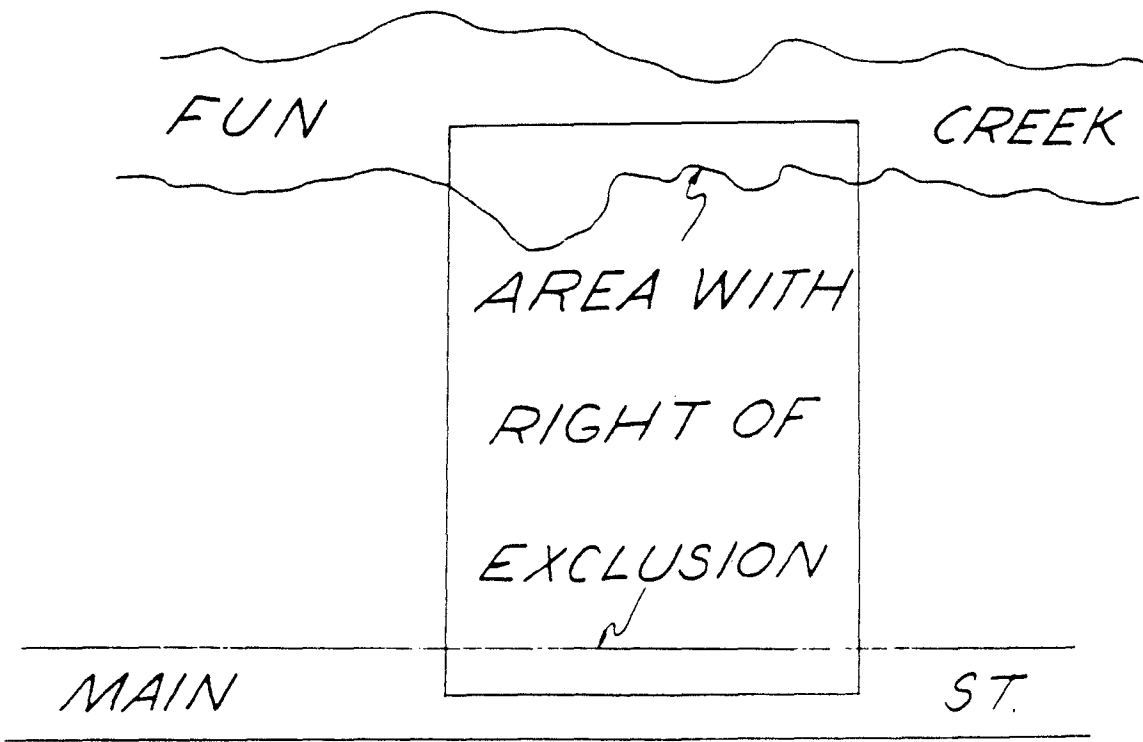
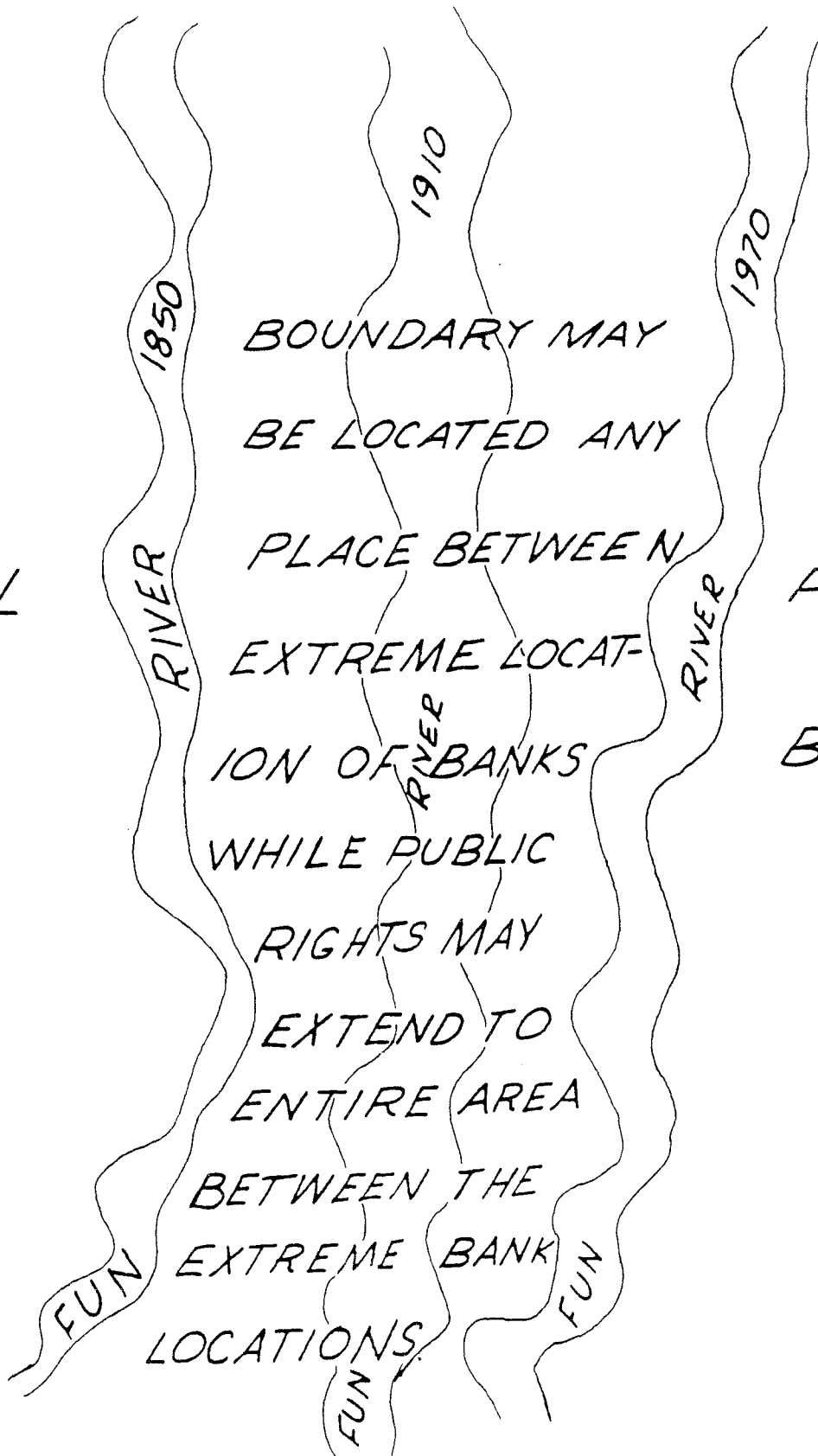


FIG 102-2

PARCEL

A



PARCEL

B

FIG. 102-3

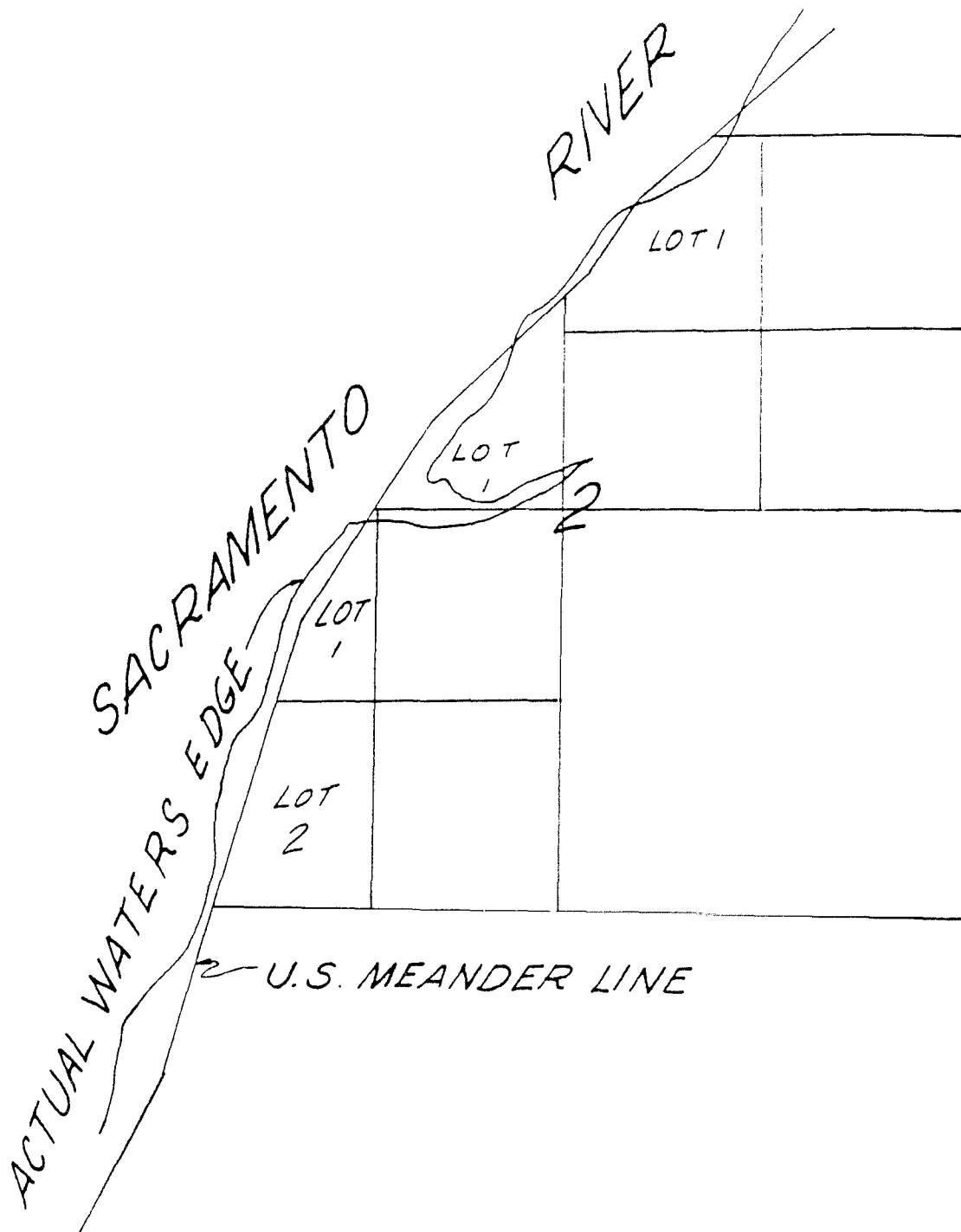


FIG. 203-1



FIG 407-1

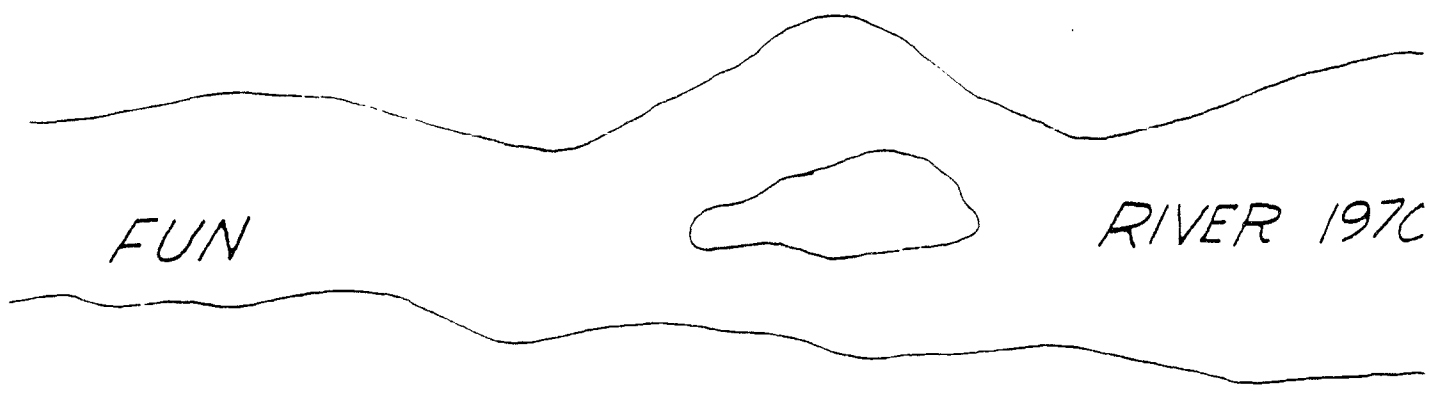


FIG. 407-2

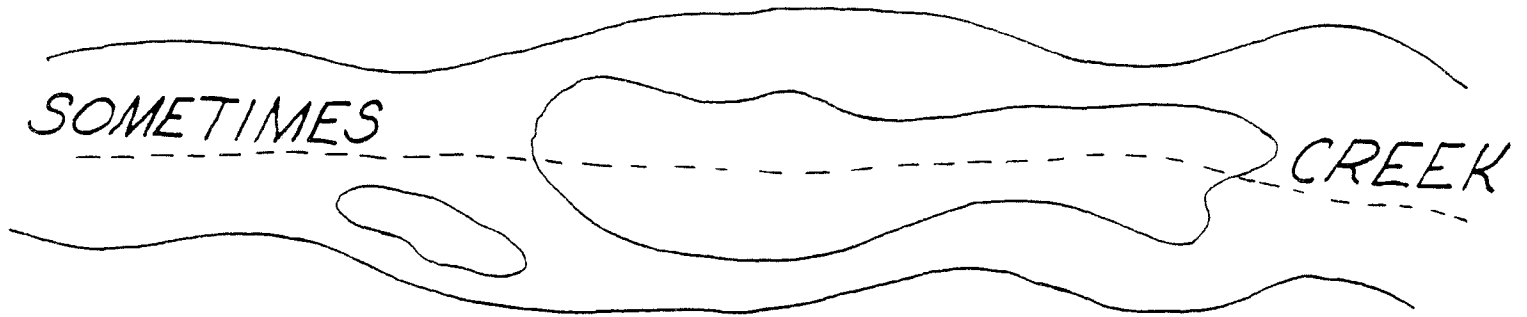


FIG. 407-3

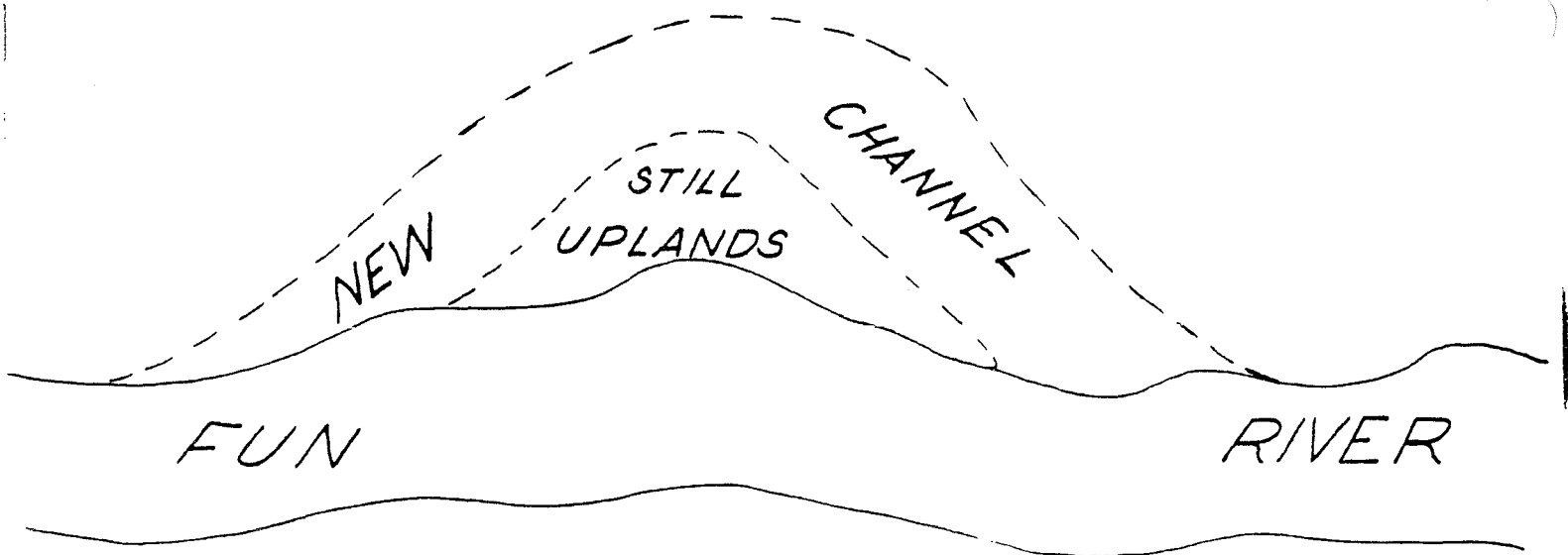


FIG. 407-4

AREA GAINED
BY ACCRETION

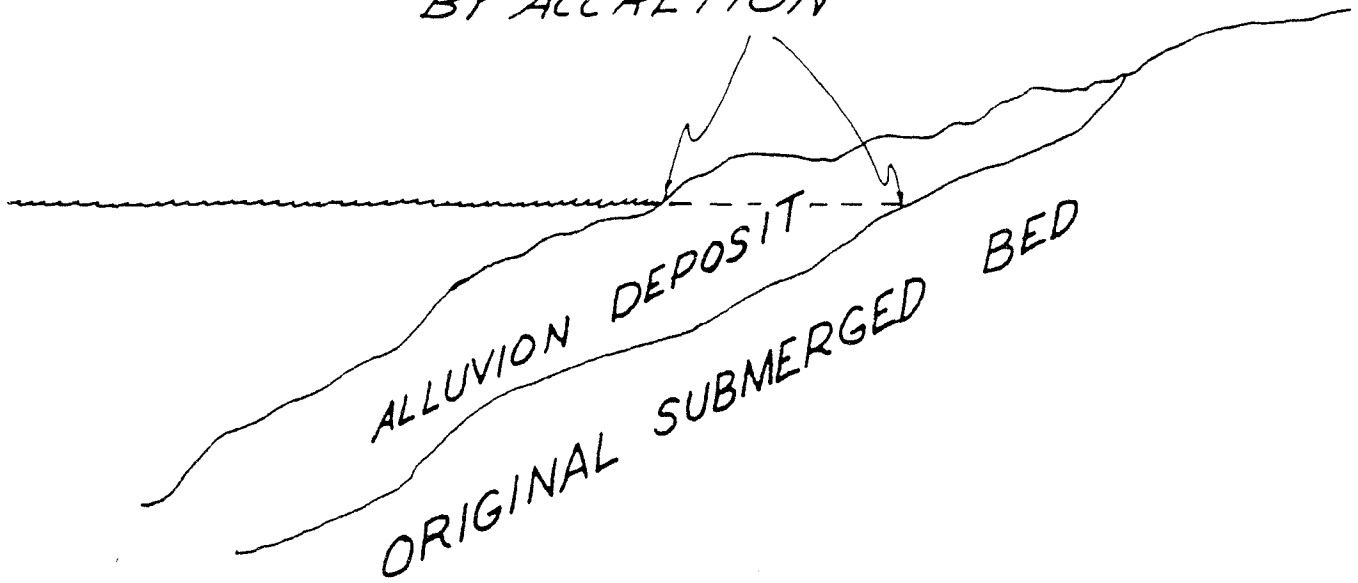


FIG. 408-1

AREA GAINED BY
RELICTION

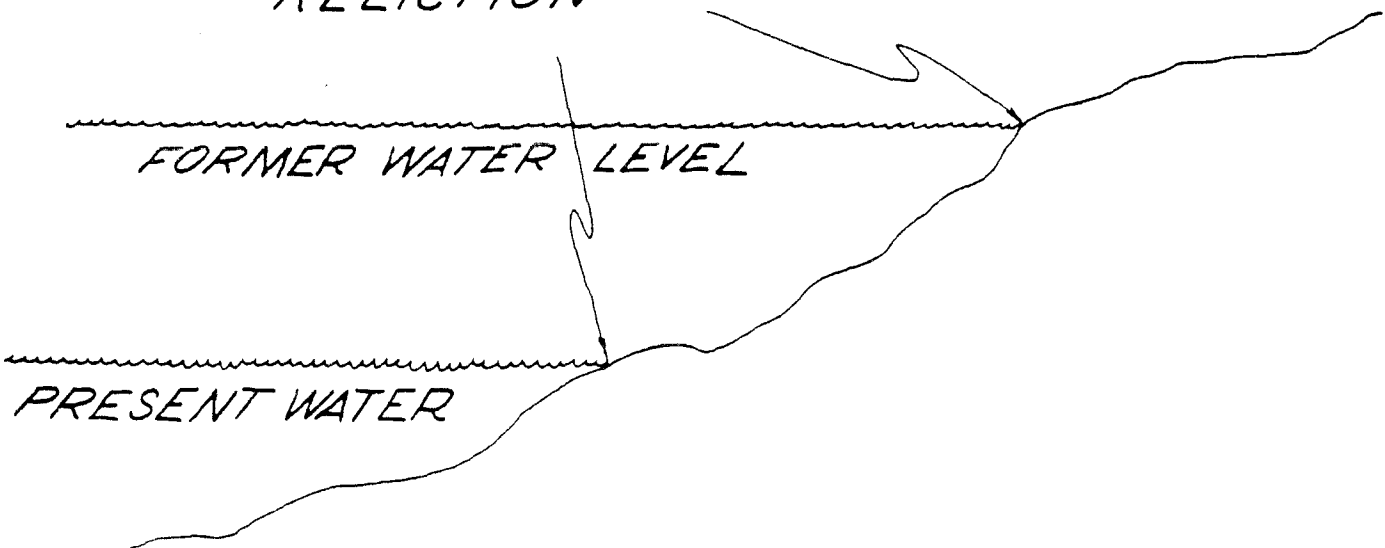


FIG. 408-2

FUN (PRESENT LOCATION) RIVER

TITLE BOUNDARY
LOCATION OF SHORE WHEN ARTIFICIAL CONDITION INTRODUCE.

LOCATION OF SHORE IN 1850

FIG. 408-3

TIDELAND BOUNDARY
AFTER ACCRETION

O.H.W.M.

O.L.W.M.

ALLUVION

TIDELAND BOUNDARY
BEFORE ACCRETION

FIG 408-4

UPLANDS

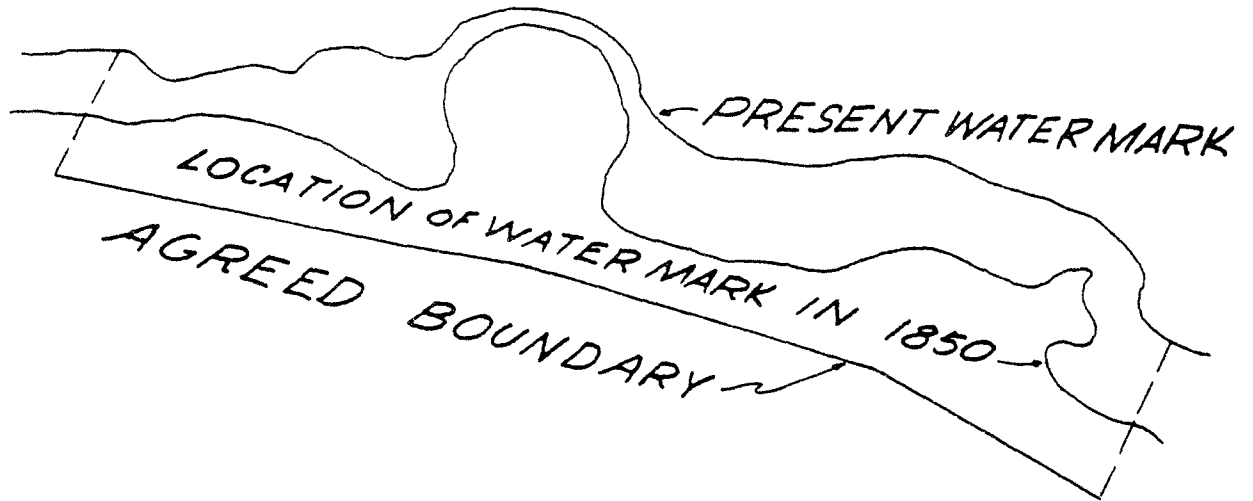


FIG 410-1

UPLANDS

LOCATION OF WATER MARK IN 1850



PRESENT WATER MARK

FIG 410-2

California Part I - Northern California

The difference between sea-level datum of 1929 (SLD) and mean lower low water (MLLW) for each location where the tidal bench marks and the geodetic bench marks of the precise level net have been connected by spirit levels is given below:

Bench mark elevations above sea-level datum of 1929 may be obtained by subtracting the tabular difference from the published elevations above mean lower low water.

<u>Index Map Number</u>	<u>Locality</u>	<u>SLD-MLLW Feet</u>
1	Crescent City	3.63
4	Eureka	3.39
7	Shelter Cove	3.35
16	Bodega Bay, Bodega Harbor	1.35
17	Sand Point, Tomales Bay	2.35
18	Tomales Point, Tomales Bay	2.38
19	Hamlet, Tomales Bay	2.42
20	Blake Landing, Tomales Bay	2.37
21	Marshall, Tomales Bay	2.24
22	Inverness, Tomales Bay	2.38
23	Point Reyes, Drakes Bay	2.59
24	Bolinas, Bolinas Lagoon	1.86
25	Point Bonita, Golden Gate	2.95
26	Ocean Beach	2.96
27	Princeton, Half Moon Bay	3.16
29	Santa Cruz, Monterey Bay	2.71
30	Monterey Harbor	2.78
31	Carmel Cove, Carmel Bay	2.81

Mean lower low water at Monterey Harbor is based on five years of records, 1974 through 1979, reduced to mean values. Elevations of other tide planes referred to this datum are as follows:

	1941-59 <u>Feet</u>	1960-78 <u>Feet</u>
Mean higher high water	5.40	5.42
Mean high water	4.70	4.72
Mean tide level	2.85	2.91
Mean low water	1.10	1.10
Mean lower low water	0.00	0.00

The estimated highest water level to the nearest half foot is eight feet above mean lower low water. The estimated lowest water level to the nearest half foot is two and one half feet below mean lower low water.

NGVD - National Geodetic Vertical Datum of 1929 (formerly Sea-Level Datum of 1929).

Santa Cruz, Monterey Bay

-2-

BENCH MARK 8 (1946) is a standard disk, stamped "8 1946", set vertically in concrete facing of stone retaining wall on west side of Washington Street at foot of Second Street, about on center line of Second Street (extended). It is 1 1/2 feet above sidewalk, 8 1/2 feet north of south end of concrete facing, 9 1/2 feet south of north end of facing and 24 feet west of center line of Washington Street. Elevation: 17.26 feet above mean lower low water.

Mean lower low water at Santa Cruz is based on 9 months of records, November 11, 1924 - February 21, 1925, and August 1, 1932 - January 31, 1933, reduced to mean values 1941-59. Elevations of other tide planes referred to this datum are as follows:

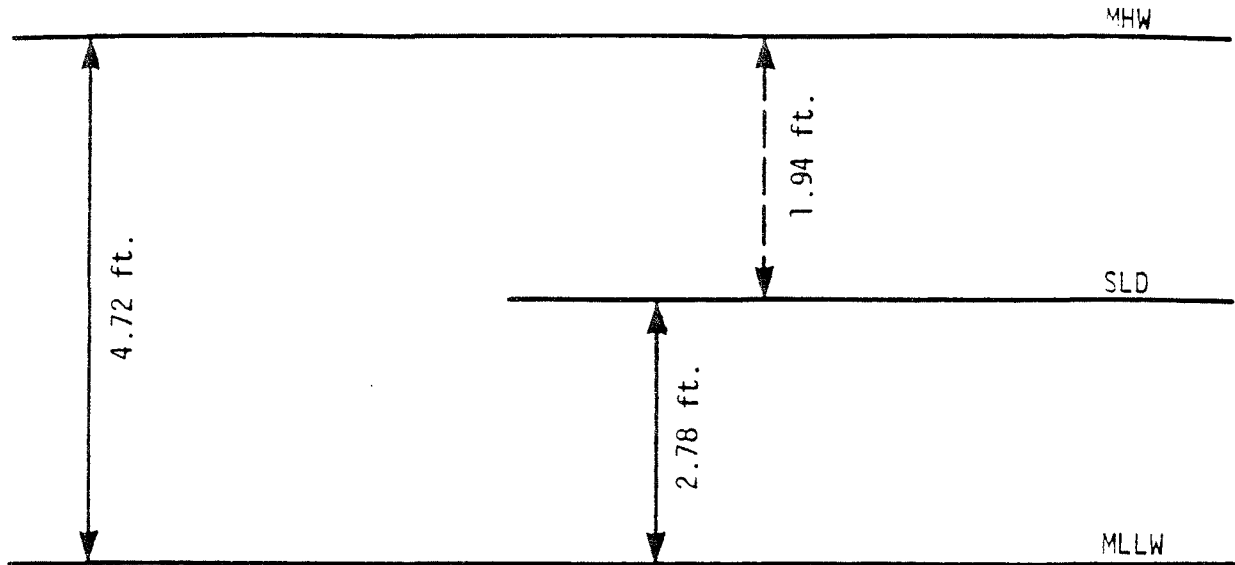
	1960-78 <u>Feet</u>	1941-59 <u>Feet</u>
Mean higher high water	5.38	5.30
Mean high water	4.68	4.60
Mean tide level	2.89	2.8
Mean low water	1.09	1.10
Mean lower low water	0.00	0.00

The estimated highest water level to the nearest half foot is 8 feet above mean lower low water. The estimated lowest water level to the nearest half foot is 2 1/2 feet below mean lower low water.

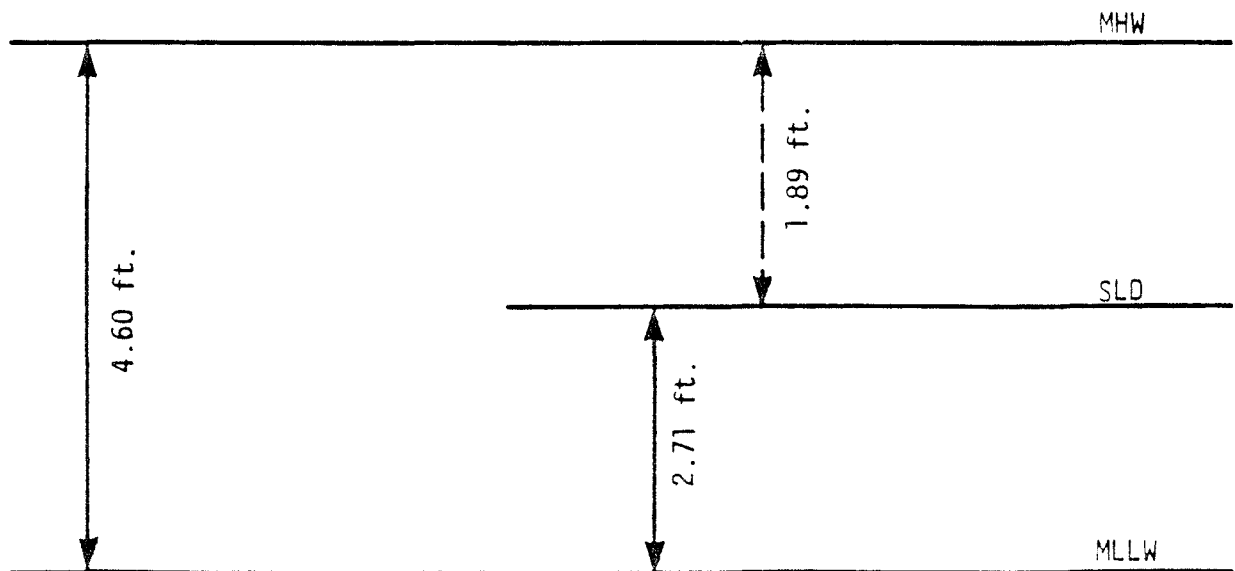
NGVD - National Geodetic Vertical Datum of 1929 (formerly Sea-Level Datum of 1929)

Mean Sea-Level rose 0.1 foot at San Francisco and Monterey Harbor between the 1941-59 Tidal Epoch and the 1960-78 Tidal Epoch.

MONTEREY HARBOR
Calculations for Monterey Harbor

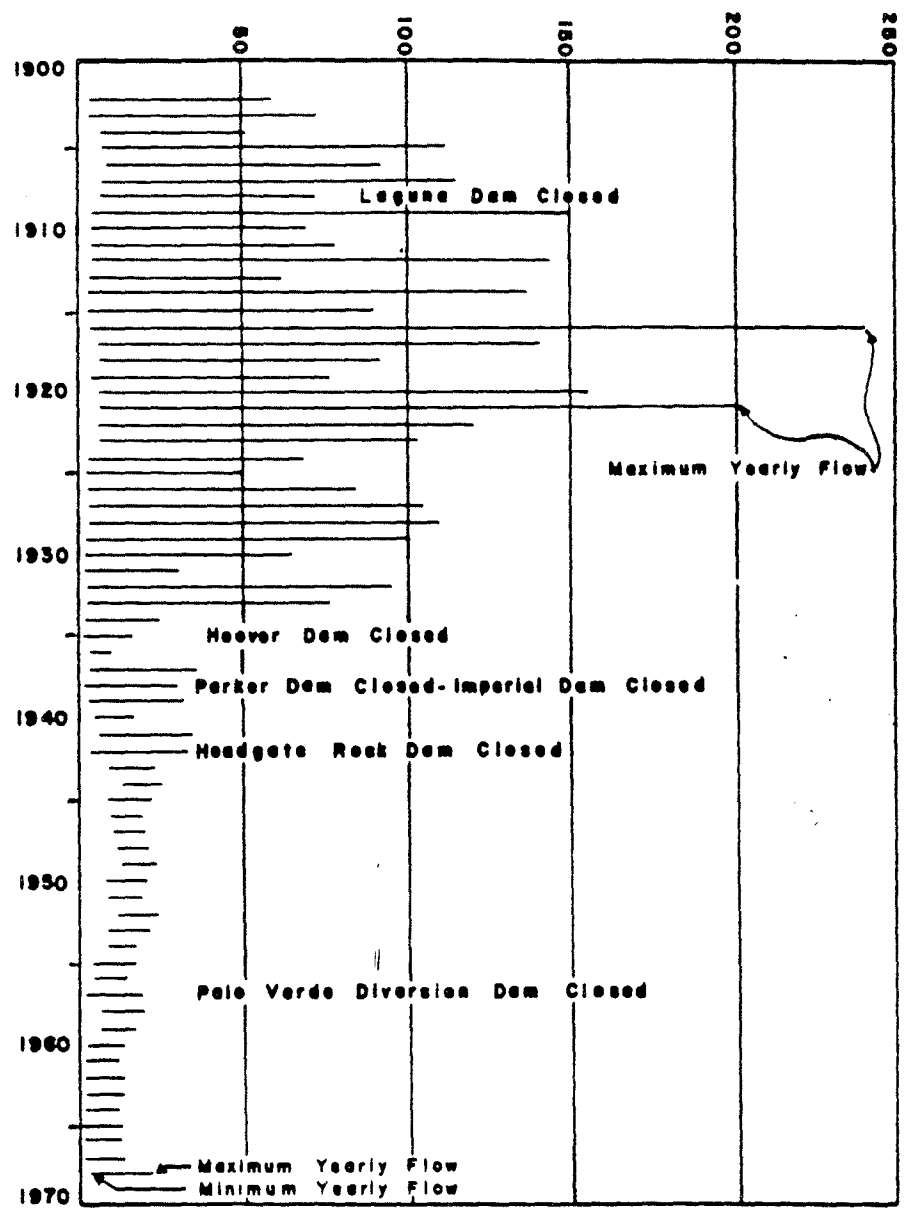


SANTA CRUZ, MONTEREY BAY
Calculations for Mean High Water



APPENDIX VII

FLOW
(in thousand cubic feet per second)



COLORADO RIVER
(MAXIMUM AND MINIMUM FLOWS)

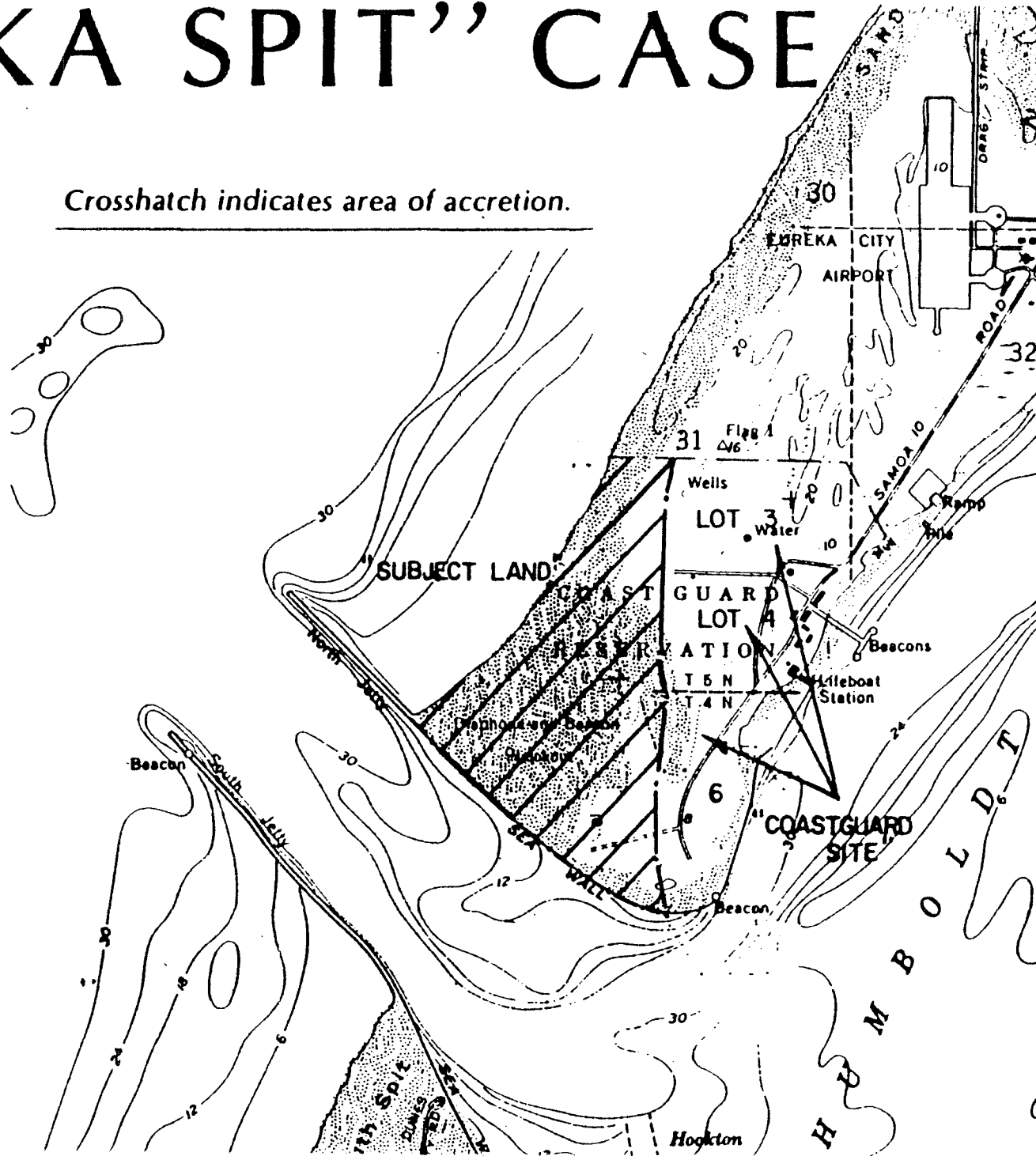
APPENDIX VII

COLORADO RIVER FLOWS IN C.F.S. FROM YEAR 1902 - 1968

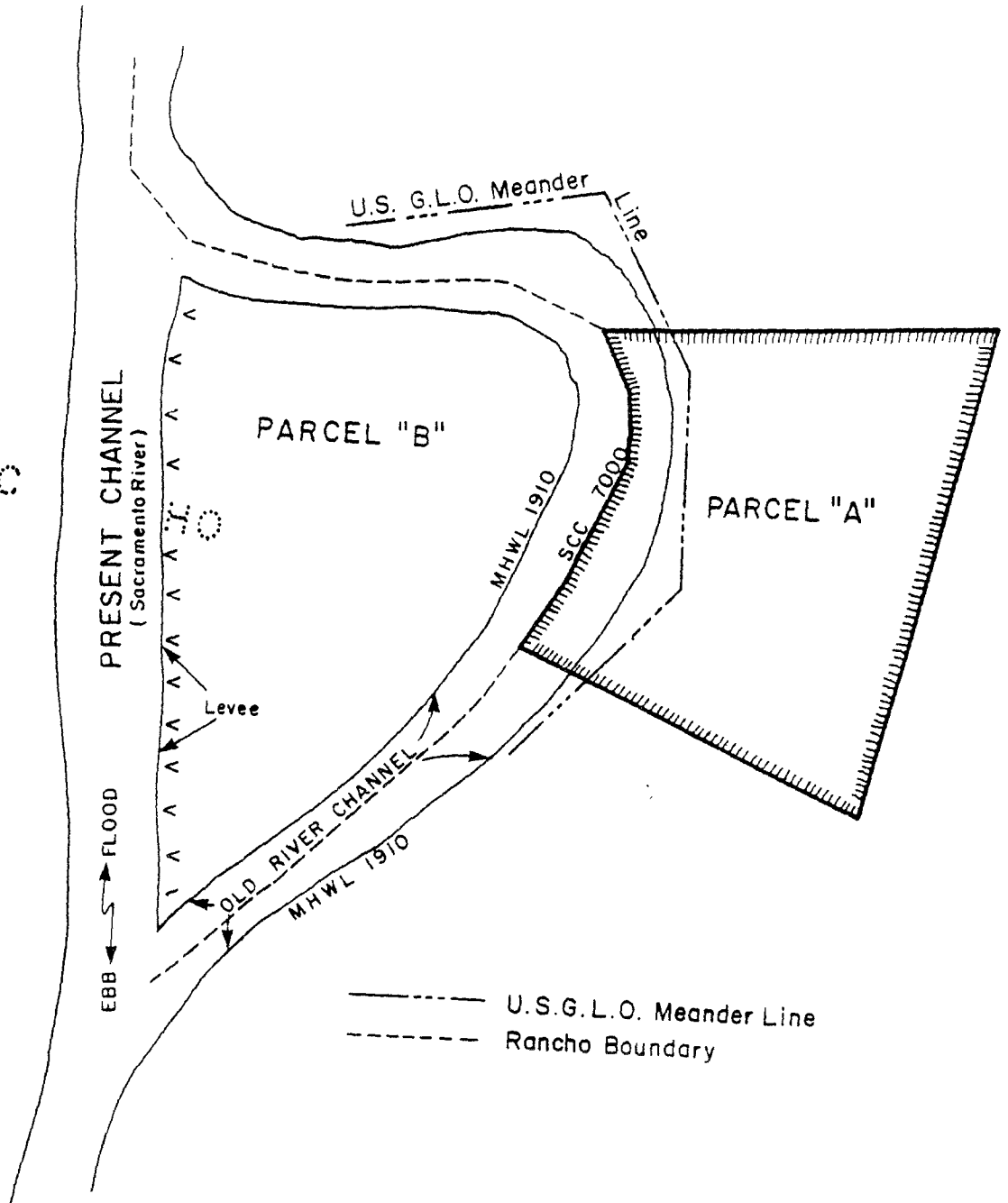
YEAR	YEARLY HIGH	YEARLY LOW	MEAN MONTHLY HIGH	MEAN MONTHLY LOW	GAUGE LOCATION
1902	59,200	3,050	17,253	6,408	YUMA
1903	72,200	2,690	25,321	8,741	"
1904	51,200	3,340	20,982	8,189	"
1905	111,000	3,750	62,739	16,108	"
1906	92,200	4,260	44,308	18,065	"
1907	115,000	5,800	53,308	23,225	"
1908	72,500	5,600	35,692	12,583	"
1909	150,000	4,100	57,333	21,683	"
1910	70,300	4,300	31,500	12,025	"
1911	78,300	3,700	38,800	15,533	"
1912	144,000	3,400	38,892	14,867	"
1913	62,500	2,600	24,175	10,358	"
1914	137,000	2,700	48,783	18,608	"
1915	90,000	2,700	36,950	13,050	"
1916	240,000	3,800	71,008	18,075	"
1917	140,000	6,000	65,437	21,019	TOPOCK
1918	92,000	6,000	31,521	11,325	"
1919	77,300	4,000	30,292	11,562	"
1920	155,000	5,550	47,715	13,987	"
1921	200,000	6,000	47,617	17,150	"
1922	121,000	5,600	39,671	16,530	"
1923	102,000	6,150	43,533	16,767	"
1924	70,400	3,250	26,431	10,462	"
1925	50,400	1,980	25,701	11,627	"
1926	83,800	3,510	28,258	10,972	"
1927	105,000	3,410	43,246	14,089	"
1928	110,000	3,260	31,043	11,123	"
1929	100,000	3,630	41,657	15,327	"
1930	64,000	3,410	26,137	11,048	"
1931	30,700	2,420	14,958	5,965	"
1932	96,300	3,300	37,635	12,852	"
1933	77,300	2,820	21,208	8,296	"
1934	25,100	1,570	8,745	4,088	"
1935	18,300	422	10,212	7,119	"
1936	11,600	4,520	8,737	6,626	BELOW PARKER DAM
1937	39,700	3,960	11,549	7,106	"
1938	31,000	1,890	11,780	6,626	"
1939	33,200	2,610	24,445	7,843	"
1940	17,000	4,860	12,355	8,503	"
1941	36,000	6,200	26,458	15,510	"
1942	34,700	3,640	25,267	13,948	"
1943	23,700	9,670	19,500	13,989	"
1944	26,200	14,400	22,492	14,183	"
1945	22,000	8,830	18,667	14,436	"
1946	20,200	9,830	16,083	10,769	"
1947	20,600	10,400	17,267	11,892	"
1948	21,000	11,800	19,100	15,033	"
1949	25,100	13,200	20,842	15,875	"
1950	21,700	8,230	16,227	12,878	"
1951	20,300	8,190	14,412	9,963	"
1952	25,100	11,000	22,758	18,800	"
1953	21,600	8,150	16,518	12,831	"
1954	18,400	9,230	15,417	11,697	"
1955	17,700	3,760	12,845	9,813	"
1956	15,400	4,140	11,067	8,017	"
1957	20,400	1,700	11,784	7,752	BELOW PALO VERDE DAM
1958	21,500	5,950	15,833	11,580	"
1959	17,400	6,000	11,751	8,785	"
1960	14,000	2,090	11,172	6,926	"
1961	12,500	1,380	9,797	6,290	"
1962	14,100	2,020	10,259	6,049	"
1963	13,900	1,580	10,379	6,245	"
1964	12,900	1,770	9,190	5,592	"
1965	13,500	1,850	9,169	5,463	"
1966	12,800	1,840	9,138	5,481	"
1967	13,000	1,480	9,397	5,118	"
1968	12,300	2,610	9,219	4,987	"

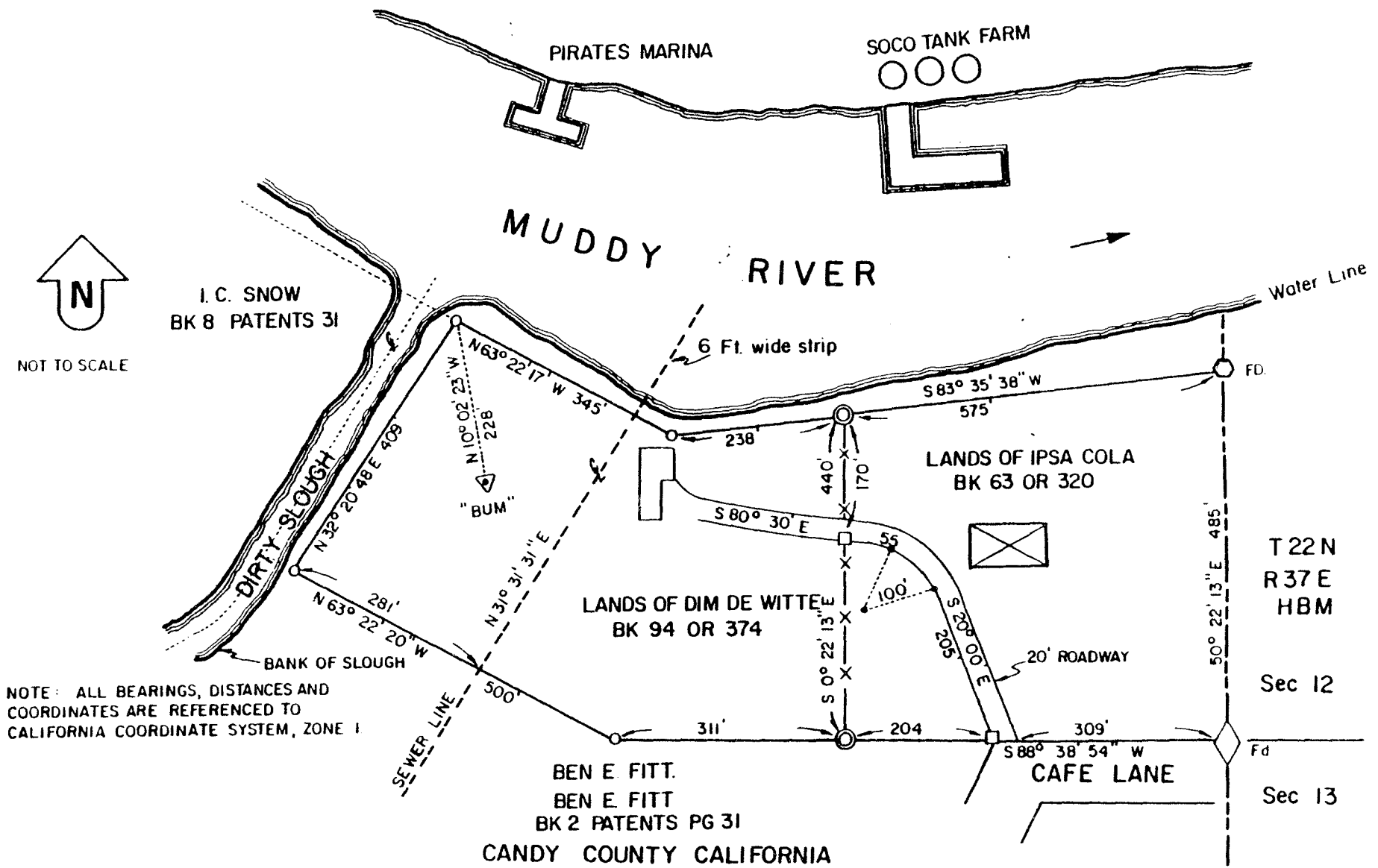
EUREKA SPIT" CASE

Crosshatch indicates area of accretion.



R A N C H O



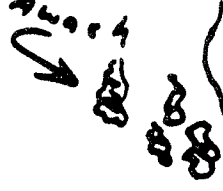


NOTE: ALL BEARINGS, DISTANCES AND COORDINATES ARE REFERENCED TO CALIFORNIA COORDINATE SYSTEM, ZONE 1

- SET 2 INCH (O.D.) IRON PIPE w RCE TAG 48,000
- ▽ NGS (USC & GS) STA "BUM", x = 1,375,270.00, y = 478,120.00
- ⊙ FD "T" IRON W/LS TAG 4901
- ⬡ U.S. GOVT MEANDER CORNER
- SET RAILROAD SPIKE

CURVE DATA
 △ = 60° 30' 00"
 R = 100 ft
 L = 105.59 ft

Rocks Beach



Rocky PT

HEADland DETER.

BAY

Tanger - 1952