Lecture Notes for Chapter 7 & 8
Evidence of Water Boundaries
Chapter 7 Lecture Notes

7-1 Introduction.
Water boundaries are perhaps the oldest and at times most disputed boundaries. The edge of the water forms an excellent natural boundary in that it is easily defended and easily recognized. The type of water body determines where the boundary will be drawn.

7-2 Determination of Public Title Interest.
A unique characteristic of many water boundaries is that they represent the line between privately owned upland and submerged land held in public trust.

Each state is sovereign and therefore hold absolute rights to all the navigable waters in their soils under them for their common use.

The rivers not navigable do, of common right belong to the owners of the soils adjacent. Bu rivers with ebb and tide flows, belong to the state or public.
Therefore, the state owns the beds of all navigable waters regardless of tidal influences, and the non-navigable water bodies is owned by the adjacent land owners. The boundary line for these three types of water will be discussed later in the chapter.

Navigability is by fact or statute…it is either being used as a navigable water body or by law it has been determined to be navigable.

7-3 Boundaries of Public Trust Waters
Tidal Waters under the law…Mean High Tide

Mean high tide is determined by a time period of 18.6 years and studying the elevations associated with this time period.

7-4 Evidence and Procedures for Tidal Boundaries
See the chart on page 180.

HHW Highest tide each day
MHHW Average of the higher high tides each day
MHW---------- Average height of all high waters over the 18.6 years
MTL } MR Average of the high and low waters over the 18.6 years
MLW---------- Average height of all low waters over the 18.6 years
MLLW Average of the lower low tides each day
LLW Lowest tide each day

Tidal Datum a reference plane for elevations based on an average tidal height. Heights determined over an 18.6 year period called a tidal epoch.

There are a number of equations listed on pages 182-184 used to determine the different tide heights.

7-5 Typical Tidal Datum Determination
Shows a typical calculation for a local tidal datum.

7-6 Tidal Waters under Law Departing from Civil and Anglo/American Common Law
There are six states that recognize Low Water marks differently than the other 44 states…we will not cover this portion of the chapter in this class since we are emphasizing California Law.

7-7 Boundaries of Non-Tidal Waters
Non-Tidal Waters uses the term Ordinary High Water line or mark! Some states are different but in California we use this definition. The line is found by examining the bed and banks and ascertaining where the presence and action of water are so common and usual and so long continued in all ordinary years, as to mark upon the soil of the bed a character distinct from that of the banks. “Where the vegetation ceases to grow!”

It is not to be determine mathematically but by physical evidence and inspection of the water body!

7-8 Types of Evidence
It takes an educated eye to determine where the high water mark is…the flood plain is NOT part of the high water mark…it is always the mark made by the action of the water upon the bed that locates the water mark.

7-9 Geomorphological Features

See the definitions of :
Natural Levees
Escarpment or scarp
Beach Ridge

7-10 Changes in the Composition of the Soil
Lakes will show a change in soil conditions of submerge land versus upland soil. This will assist the surveyor in locating the High Water Mark as the lake slowly relicts during the dry months.

7-11 Botanical Evidence
The lower limit of terrestrial plant life…will determine the HWM.

7-12 Hydrological Evidence
Water records may be another method of assisting the surveyor in locating the water mark…however, it still should be done with inspection rather than mathematics.

7-13 Typical Determination of Ordinary High Water Mark
See example in text on page 192-193

7-14 Boundaries of Nonpublic Trust Waters
Boundaries in streams….when deeds cal to the stream this means to the center of the stream…
The question is where is the center…Thread is generally referred to the geographic center of the stream at ordinary flow of the water. Black's Law Dictionary describes it as the line that gives adjacent land owners access to the water at ordinary low water times.

Boundaries of Lakes…this generally refers to the geographic center of the lake or pond…if it is long instead of circular, then the river or stream method would apply.

7-15 Changes in Water Boundaries
Water boundaries are dynamic in nature and therefore constantly changing…these changes can be classified into two categories…permanent changes and landform changes. Is it sudden or over a period of time…

IMPORTANT LAND SURVEYING TERMS-Water Boundaries

RIPARIAN: Pertaining to anything connected with or adjacent to the banks of a stream or other bodies of water.

EROSION: The wearing away of land or other structures by running water, glaciers, wind and waves.

ACCRETION: The act of growing to a thing; usually applied to the gradual and imperceptible accumulation of land by natural causes.

ALLUVION: Where, from natural causes, land forms by imperceptible degrees upon the bank of a body of water, either by accumulation of material or by the recession of water.

REVULSION: A strong or sudden pulling away or drawing back; withdrawal; a strong or sudden reaction, reversion or change.

AVULSION: The act performed by a stream when it suddenly breaks through its banks in an unexpected manner. Rapid erosion.

RELICTION: The gradual and imperceptible recession of water, resulting in the uncovering of land once submerged.

THREAD of STREAM: A line formed halfway between the high water marks on the banks of a stream.

THALWEG: The deepest part of a stream; the place where the last drop of water will flow.

BED: Normally that land which is covered by water sufficiently long enough to keep it bare of vegetation and destroy its value for agriculture.

MEANDER LINE: A line run by a surveyor for the purposes of platting a size and extent of a water body. Not meant to be ownership line. The water body has its own ownership relative to type of water body.

Apportionment of Water Boundaries:
Water boundaries perhaps provide the greatest opportunity for surveyors to use innovation in apportionment. Certain principles are accepted, but seldom understood.

Riparian rights pertain to the soil beneath said water body.

Accretion or Alluvium is the act of growing to a thing. Along waters it is the gradual and imperceptible growth of land by natural causes.

Erosion is the removal of land by actions of the water.

Lands lost to erosion are lost forever. If it reappears it is governed by the rules of accretion.

Revulsion or Avulsion is the sudden loss or removal of land where erosion is gradual.

Reliction is the increase of land caused by the permanent withdrawal of water.

Thread of a stream is the line ½ way between the average high water mark on the right and left banks.

Thalweg is the deepest part of the stream. “The place where the last drop of water will flow.”

Navigable Waters - Generally the state owns the bed of the inland navigable waterway.
1. By statute
2. By fact
3. Susceptible to navigation under normal conditions

Riparian owners have title to the bed of non-navigable waters.

Areas of accretion and reliction:
The direction of division between adjoiners is on an equitable basis instead of a prolongation.

Tidewaters:
Mean high Tide = Average of all high tides over an 18.6 year cycle. (Sun and Moon to complete full cycle)

Proportionate shore line method:

[(Shore line measured total) ¸ (Shore line recorded total)] x (Recorded Frontage Distance)

Lakes:
1. Pie Method for round lakes
2. Perpendicular Extension to thread for long lakes
3. Combination

Historical Knowledge as Evidence
Chapter 8 Lecture Notes

8-1 Purpose and Scope
History or knowledge of what happened in the past is an indispensable tool of the retracement surveyor.

History is the foundation of all of the surveyor’s responsibilities. A Surveyor must know :
· what are the basis of measurements?
· how were the measurements made?
· who made the measurements?
· what accuracy and precision was used?
· what instruments were used?
· what were the customary materials used for monuments?
· what laws were in force at the time of the survey?
· what knowledge did the surveyor have at the time of the survey?
· local knowledge?

“Following in the footsteps of the original surveyor”, is a feat that cannot be done without comprehensive knowledge of the past.

Underlying most of the US systems of surveys are the English measurements and methods. The establishment of the mile and the origin of the chain both play a key role in the definition of metes used to describe property.

8-2 Planned and Indiscriminate Land Conveyancing
In some states along the eastern seaboard, land was sold in accordance with a plan made prior to a sale. In other areas, land was conveyed in an indiscriminate manner; the purchaser was given a warrant for a given amount of land, a quantity, the purchaser sought out their parcel and then had it surveyed. This procedure allowed for many mistakes and encroachments. Georgia was sold 3.3 times over and North Carolina almost 2

times over!

Mexican and Spanish land grants were also indiscriminate in their origin, however because of the vast area involved, very little overlap produced. Each claimant was required to present proof of ownership to the federal courts, a survey was then required in effect both location and title were established at this time ...by the court.

PROPERTY SURVEYS IN EARLY HISTORY
8-3 Civilization and Land Ownership

· Egyptians
· Chinese
· Romans
· Greeks

8-4 Measurement
The surveyor must not take for granted measurements made by their predecessor's. The history of measurements is important in the retracing of property boundaries. Since the beginning of time man has had a need to measure. Original Units were body parts.

· Egyptian Units Pg. 15
· English Units Pg. 15

8-5 and 8-6 Biblical and Ancient Greek references to land surveying

8-7 Sovereignty and Ownership
From the earliest times, sovereign rights were vested to the rulers. Rulers conveyed parcels to members of their court, and collected moneys from their loyal subjects in return.

The term "estate" is derived from the word "status" which represents the rights and privileges one can enjoy.

One of the inherent and necessary attributes of sovereignty is the right of eminent domain. In the broadest sense, the right of the gov't to take private property for the good of the public. This is superior to all privately held property rights.

8-8 Feudal Land System
the King making lists checking them twice finding out whose naughty and nice. Public Inquiry and tax lists.

8-9 Livery of Seisin
The ancient ritual of land conveyance means "delivery of possession." Solemn acts were performed in the rituals. Written documents may have accompanied the act however it was just to document what happen not to be used as title.

8-10 Statute of Frauds
A parliamentary act of 1677 required contracts to be in writing. Read Pg. 19.

Of the five classes of contracts, one was "...any contract or sale of lands, tenements, hereditaments or any interest in or concerning them." Much of the statute of frauds has been eliminated or overruled. But the land conveyances must still be in writing and need both signatures to be valid. The Statutes of Enrollments rendered a conveyance void unless recorded.

8-11 Early Property Surveys in the New World.

8-12 Concept of Title
Fee simple ownership was first reserved for the favor of a few. Title may be defined as the legal basis or grounds for land ownership, and it may be transferred by descent through heirs or by purchase. According to law, conveyances include not only that acquired by purchase but by devise, will, grant, adverse possession, escheat, condemnation and others.

Real property is not a creation of humankind. It has always existed. Ownership is a creation and was generally done through conquest or discovery.

With the present high value of land, delineation of boundaries must be exacting and made with great caution.

Land titles are the most protected and legislated rights held today.

SURVEY SYSTEMS OF THE EAST AND SOUTH

8-13 The Origin of Title
An ideal situation could have existed if all this nation's land had been acquired at one time, from one source, and included no prior grants, claims, etc.

This nation is indeed fortunate to have such a vast an area covered by the Rectangular System. In spite of its problems, did have a tremendous benefit to growth, development and ownership. Only 20 states have not been subdivided under the Rect. Survey Syst.

8-14 Surveys in the Early States

8-15 The Subdivision of the Ohio Lands

8-16 Prior Land Grants in the Louisiana Territory

HISTORY OF PROPERTY OWNERSHIP IN THE SOUTHWEST
8-17 Lands of Spanish Origin
The Spanish era began with the discovery of America and ended with Mexican Independence in 1821. This area encompassed CA, AZ, NM, TX, UT, CO, WY, KS, OK. The Mexican era ended in 1848.

The Treaty of Guadalupe-Hidalgo, TX and the US agreed to recognize Spanish and Mexican titles. There are four sovereign sources of original titles: Spain, Mexico, Texas, and the US.

8-18 Seniority of Tiles
Land grants form Spain, Mexico and Texas were generally made in sequence with senior rights attaching to the older grant or patent.

US Rect. Survey Syst. takes a junior right to these.

8-19 Rights Included with Spanish and Mexican Grants
The US could have refused to recognize existing grants and rights but chose to as a matter of principle.

8-20 Minerals

8-21 Spanish Water Laws
Water laws stem from Roman Civil Law. Sovereignties own the bed only insofar as the tide ebbs and flows.

Spanish Law attached rights to not only the bed but to the water in the bed. They also made a distinction between navigable and non-navigable streams.

Spanish Law appropriated water for use. The US changed this and water rights could be established and therefor sold.

8-22 Road Beds
Road Beds were always under the rule of the Mexican and Spanish rulers...the US therefor took claim to these and still do today.

8-23 Early Settlements

8-24 Ordenanza de Intendentes

8-25 Mexican Land Grants

8-26 Empressario System

8-27 Suits Against the Sovereign

8-28 Instructions to Surveyors
Read instructions Pg. 232

8-29 Survey of Spanish and Mexican Grants

8-30 Gradient Boundary

8-31 The Effect of the Native Americans

8-32 Early California History
In 1821 only 20 private ranchos existed. By 1847 there were 800

Ranchos in CA. Size varied from 28 acres to 226,000 acres.

8-33 Resurvey of Land Grants of the Public Domain

PRINCIPLE 1. In the resurvey of a Spanish or Mexican land grant, the surveyor cannot go behind the court decree that established the grant; the field notes and survey are part of the grant, and the grant is senior to all sectionalized lands.

8-34 Units of Measurements or Length
A surveyor working in various sections of the US will encounter references in deeds and descriptions that may cause problems or questions in determining if the reference is to area or length.

Acres 43,560 square feet

Arpent 0.8507 Ac (AK, MO)

Arpent 0.845 Ac (LA)

Arpent 0.84725 Ac (LA, AL, MS, northern FL)

Arpent 32,400 square feet in Paris, 36,800.67 square feet in Canada or .8844827 Ac

Rod 16.5 feet or 17.5 feet or 18 feet also a unit of Area 160 square rods = 1 Ac

Chain 66 feet, 100 links to a chain, 80 chains to a mile, 10 sq ch to 1 Ac,
640 Ac to 1 sq mi

Vara 32”, 33”, 33.33”, 33.5” TX legislated the Vara = 33 1/3”

8-35 Summary
There are many different types of conveyances through out the State and Country. They differ with the are one surveys. It is of the utmost importance to understand the traditions, traits, and nuances of the area you are surveying. History too, tells us that if we know what happened then it will help us now.

We live with our mistakes from the past and therefor need to not re-make those same mistakes. Good education, licensing, regulations and standards will help to alleviate many of these problems.

Research, research, research! Take the time to do it right the first time. Make sure of yourself and your assumptions. Exhaust all possibilities before the easy fix.

THE U.S. RECTANGULAR SYSTEM
8-36 Public Domain
The major distinction between the GLO and metes and bounds systems is that the GLO is predicated on Statute law where as metes and bounds is predicated on common or case law.

Public domain is a story of force and fraud. It stretches from the local politician to the halls of Congress. Many volumes have been written as to how the land was acquired. Some say we stole it from the French and Spanish. Others say we purchased it legally. Others say it was deceit and fraud and large sums of money that procured the land. To say the least, a survey of this land, of this magnitude may never happen again. This system has been in constant motion for over 200 years creating new boundaries and re-identifying old ones.

Three-quarters of the nation can be traced back to public domain. There are at present 720,004,000 acres, 30% of the land mass, still in public domain.

PUBLIC DOMAIN: Vacant land held in trust by the federal government for the people.

This area does not include federal reserves or other governmental lands set aside or purchased for specific purposes.

The public domain system was one created by and conducted under Federal Laws. The laws dictate how the land would be surveyed, how the land would be disposed of, and how it would be resurveyed. All these directions can be found in the Manual of Instructions for the Subdivision of Public Lands - 1973.

8-37 The Ordinance of 1785:
In 1784 a task committee, headed by Thomas Jefferson, was to draft an ordinance establishing a land office for the U.S. Because of Thomas Jefferson's experience; college grad, attorney, surveyor; he seemed to be the best qualified for the job. Although much of the credit for the rectangular survey system is given to Jefferson, it was

not entirely original with him. His initial proposal was 10 mile squares with 100 sections to a square. The miles closely related to the nautical mile. This somewhat "metric" rectangular system never was ratified. His system was refined through the years to our present system of 6 mile squares, townships, with 36 sections included.

Egyptians were known to use a rectangular system in the Nile Valley surveys. Land division by meridian and parallels had been of religious and mystic origins. The decumanus (east and west) and cardo (north and south) were used with an instrument called a groma. The 1/100 of a nautical mile was the ancient division of a shire in England.

This system was adopted in the U.S. by some of the states. Most of the land as we discussed earlier, was indiscriminately conveyed. North Carolina had a law requiring orientation to true north, although many exceptions were permitted. After much debate a quadrangle with seven English miles on a side and 49 lot inside, was approved. Seven miles soon gave way to six miles, but the total number of 49 was overlooked. Later, the law provided for a numbering system of 1 - 36, always beginning the succeeding range of lots with the number next to that with which the proceeding one concluded. The final plan began numbering in the southeast corner, progressing north, then south, then north, etc. About half of the plats prepared for the Seven Ranges carried this system on the face, but it is felt that the surveyors did not follow such a pattern in the field.

Townships and sections sizes were compromised between the north and the south. The north wanted smaller size sections so the average person could afford to purchase them. The South wanted larger sections in the 1000 acre range for the building of vast plantations. The 640 acre (1 mi x 1 mi) unit was thought to be large enough to satisfy both the north and the south.

The new law specified lines to be run in cardinal directions, after correcting for variation. Certification was required by the surveyor, surveyor to mark trees, and set witness corners (BT).

The plats and notes were to include information on the topographic features of the land so the potential buyer could assess the property prior to purchase.
8-38 Prior Surveys
Surveying prior to selling land.

8-39 Geographer of United States
Simon De Witt held this post until 1784, succeeded by Thomas Hutchins…purpose to direct and transmit plats of completed surveys to the Board of Treasury.

8-40 and 8-41 Beginning the Survey of the Seven Ranges:
Began at the westerly line of Pennsylvania (one of the original thirteen colonies) at the bank of the Ohio River. Each state was to send at least one surveyor, only seven showed up. Because the crew was so poorly prepared and experienced, the requirement to run true north was changed to magnetic north. The calibration of chains and distances was accepted. All in all poor results.

8-42 Ordinance of 1796:
Sections marked at 2 mile intervals. Native Americans didn't like having their land surveyed or trespassed. Interior corners not set, in fact generally only three of the four corners were actually set. Sections were re-numbered to the method and style we know today. The surveyor's pay was increased from $2/mile to $3/mile.

More specifications appeared: marking of trees, notation of topographic features, standardized length, office of surveyor general in Marietta, OH were written into law instead of accepted practice. Provisions were made for prior surveys, bodies of water, and other irregularities. Military districts used 5 mile townships, monumented every 2 1/2 mile.

8-43 Act of May 10, 1800:
Placing excess or deficiency in the north and west tiers of the sections was established.

8-44 Act of February 11, 1805:
Subdivision of sections into quarter sections. The directions due north, south, east, west, were defined by the courts as meaning the average direction of the original lines, not astronomical directions.

8-45 Principle Meridian and Base Lines
First principle meridian was the boundary line between Ohio and Indiana. The 41st parallel of latitude served as the base line.

40 plus principle meridians in the U.S. The first 6 are numbered the rest were given names. Generally arbitrary positions instead of state boundaries as Jefferson first thought.

8-46 The Surveyor General:
As provided in the Act of 1796, the post of surveyor general, at a pay rate of $2000 per year, was to be

appointed to a man who would engage skilled deputy surveyors, administer oaths, frame regulations, and issue instructions. General Rufus Putnam was the first surveyor general. Jared Mansfield was to succeed Putnam. He was credited with the laying out of Principle Meridians and Base lines. The job of the surveyor general primarily was to control the work of the surveyors and to bring some order and consistency to the post.

8-47 Instruction to Deputies
Early contract usually contained specific instructions from the Geographer or Surveyor General.

8-48 Tiffin's Instructions
Generally considered the first uniform instructions for PLSS surveyors.
Throw excess and deficiency to the North and West
Corner markings
Procedure for running lines
Recording distances and note keeping

8-49 Later Instructions
Manual of Instructions started in 1855

8-50 Reorganization of the Land Office:
The General land Office, established in 1812, was reorganized on July 4, 1836. The contract system of subdividing lands began in 1796 and was abolished in 1910. In 1946, the general land office became the Bureau of Land Management under the dept. of the Interior. This agency employs professional cadastral surveyors who use the latest methods and equipment to locate and subdivide the public domain. Much of their activity is in Alaska, however they are also working in the western states. In 1973 the BLM published a manual of instructions that is presently in effect. A new manual is now being written.

8-51 1947 Surveying Instructions
Initial Points
Principle Meridians
Baselines
Standard Parallels
Guide Meridians
Township Exteriors
Subdivision of Townships
Limits of Closure
Marking Lines between corners
Corner Monuments
Running Section Lines
Subdivision of Sections
Meandering
Corner Accessories
Instruments

8-52 Manual of 1973
The newest of all the manuals…basically always use the manual of instructions at the time the survey was performed…if you were to do new survey then this manual would be the appropriate instructions.

8-53 Rectangular System Protraction Program
Subdivision by plat

8-54 Summary of Public Lands Surveys
Instructions on how to subdivide public lands have varied from time to time…it is necessary to use the appropriate list of instructions for the are on which you are surveying…it would be foolish to apply the principles of 1973 to a n original survey in Ohio.

8-55 Timber Culture Act
Grow trees for the gov't…they would give you public domain land to do so!

8-56 Classification of National Forests
Some lands set aside for National Parks so that they would never be developed.

8-57 Land Acquired by Homesteading
Steps to homesteading:
1. The person must file and application stating their intentions and qualifications
2. A fee must be paid, nominal in nature $1.25 / acre or less
3. Must reside in or occupy the tract for a given period of time (3 to 5 years) and make certain improvements
4. Taxes are applied as soon as entry is made.

8-58 Obtaining Small Tracts within the Public Domain
In some cases people are able to obtain small tracts of land (less than 5 acres) for residence, recreation, or other purposes. They may be leased, purchased or optioned. No timber or mineral rights.

8-59 Land Ownership in Hawaii

8-60 Lands in Alaska

8-61 Court Reports
One of the most important sources of written historical records is found in court reports. What the law was and how it was interpreted at the time of the survey.

8-62 Necessity of Legal History
History is the foundation of the retracing surveyor!