Course 1: History, Records & Administrative Systems Study Guide

COURSE DESCRIPTION:

This is an introductory series of videos that establishes the context of the CFedS Program. Topics covered in this course include:

- Brief history of surveying as it relates to the United States
- Cultural Awareness
- History of Indian Land Law
- Bureau of Land Management and Bureau of Indian Affairs structures and records that each may have
- Basics of federal survey authority

COURSE OBJECTIVES:

Upon completion of this course, students will be able to:

- Review administrative functions, structures, and process of the Bureau of Land Management and the Bureau of Indian Affairs
- Increase awareness of cultural and historical legal issues when working in Indian Country
- Identify records sources for survey projects in Indian Country

COURSE INSTRUCTOR(S):

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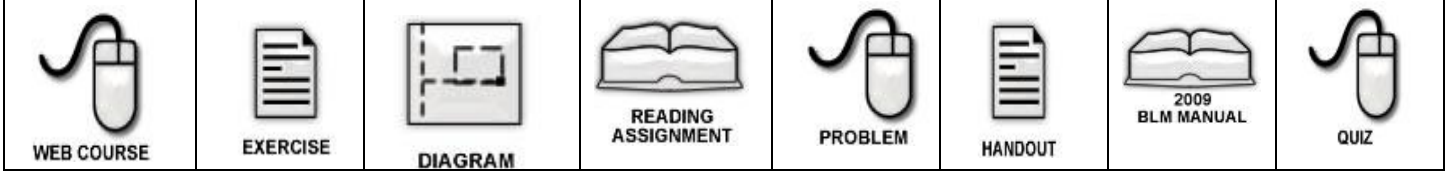
VIDEO LECTURE TITLE:

Introduction to PLSS & Records Sources – Part 1 (28 minutes)

ICON LEGEND



INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

Introduction

Hello and welcome to the next lecture in the CFedS Video Training Program. My name is Dominica Van Koten and I am going to be your speaker for this segment.

Let me introduce myself before we get into the topic. I am a BLM Cadastral Surveyor and I work in the Alaska State office. I have worked there now for 15 years and as far as my career as a professional surveyor is concerned, I guess you could say I have been born and raised at the BLM. I started working on the field crew in the summers when I was going to college then accepted a permanent job after my graduation.

Since that time I have worked in many different capacities, from my beginning in the field, running field survey crews, to my experience in pre-survey preparations, writing special instructions and into my current position where I am involved in the planning and budget process of all of our survey projects in Alaska. I have also been an instructor here at the training center for a few years now and thoroughly enjoy sharing my knowledge of BLM Cadastral program with others so I am very happy to be here today and be part of this program and I would like to thank Dennis and Ron for asking me to be a part of this endeavor.

Public Land Survey System
(PLSS)

How did we get to our current system?

Objectives

Now let's get started on the topic. We are talking about the history of the Public Land Survey System and how did we get to our current system from its beginnings.

INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

Our objectives for this lecture are that by the end of the lecture you will be able to identify key concepts and goals of the Public Land Survey System. You will be able to identify some key factors in the evolution of the system and explain the role of the Manual and of instruction memorandums.

Objectives

- Identify key concepts and goals of the PLSS
- Identify the key factors in the evolution of the System
- Explain the role of the manual and instruction memorandums

To begin our discussion on this on this topic, I would like to start by placing our Public Land Survey System which is a rectangular system, into the bigger picture of being a part of a total **Land Tenure System** and if we look at the general definition for the term Land Tenure, "it is the relationship among people with respect to the land and it consists of a combination of social, legal, technical, economic, institutional and political aspects that all work together to form the land ownership and use within a society."

And that is where our rectangular system falls; it is part of our Land Tenure System here in the United States.

Land Tenure

- The relationship among people with respect to the land.
- Consists of combination of social, legal, technical, economic, institutional and political aspects that work together to form the land ownership and use within a society

INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

Again, the rectangular system is part of this collection of laws and policies that form the basis of the land ownership system in the United States. It is important to our overall social, political and economic structure.

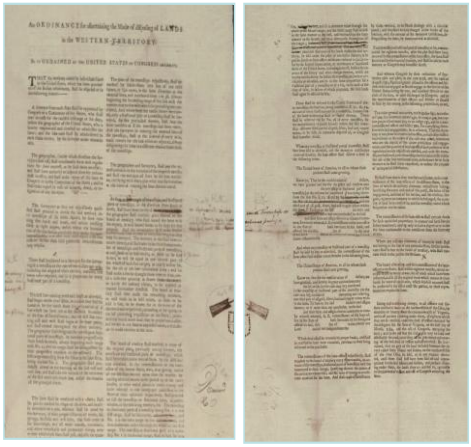
This rectangular system is not the only Land Tenure System that exists in our country. You heard in the previous segment from Dennis about other Land Tenure programs that used metes and bounds type systems and this new rectangular system when it was enacted was not a complete new idea away from any other systems, but it was a combination of the best parts of all of the existing systems that had come with us from England and were in existence at the time.

So, our rectangular system was enacted by Land Ordinance Act of 1785.

Land Tenure

- The collection of laws and policies that form the basis of land ownership in the United States.
- Its important to our overall social, political and economic structure.

And to illustrate how important these concepts of land tenure and title are to the overall social factors of our country, I would like to put the date of this Act into context, and Dennis has already talked the history that happened before this was enacted, but if we think about in 1785 what had just happened, we had our Independence was declared in 1776 and we had the Revolutionary War ending around 1781 and then right away four years later we had an Act to deal with land issues and land title and legal descriptions in our country because the founders realized how important these issues were going to be for money reasons and for our total overall social structure.



INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

PLSS Principles

Let's look more closely at some of the principles that were contained in this Land Ordinance, some of the foundational principles and these principles stay the same throughout history and are reflected in our rectangular Survey System.

Principles of the Land Ordinance of 1785

- Survey before patent
- Unique identifiers for each parcel
- Adjoining parcels created simultaneously
- Plats are public records
- Small enough parcels to be conveyed to individuals
- Evidence on the ground relates to record to allow entry
- Survey data made part of conveyance document

The principle of **Survey Before Patent**, this Act called for the surveys to be completed before the patents were issued so that the locations on the ground were known before the titles actually passed.

It also called for unique identifiers for each parcel within the system and each corner within those parcels. It created adjoining parcels **simultaneously** and alleviated some of the gaps and overlaps that were existing in the Metes and Bounds system. It created plats as public records, the concept of these plats being available to the public and assessable so that people knew where their parcels were and could get to those records. It was a control grid that was created so that small identifiable parcels could be located in order to meet the needs of the land disposal laws.

So it wasn't to be a system that was going to contain all the monuments that were necessary in an area right away, but it was that **control** grid to allow the entry men to locate themselves within reason on their parcels that they were going to claim. It called for the monuments on the ground to control the location of parcels over the records.

This gave certainty to the entrymen of where the location of their boundaries would be because they could physically see those monuments on the ground. And it combined the survey data and made it part of the conveyance document and this system was creating legal description that could be easily shown directly on the conveyance document and the plats and field notes could be made part of that conveyance document through its history.

INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

Plat Creates All Corners in a Section

I mentioned that the system created unique parcel identifiers and corner identifiers within its areas. So, now I would like to take a look at a diagram, and this diagram is in your handouts, and this diagram is showing, giving a reference to the naming of all of these points within the sections within this rectangular area that was created.

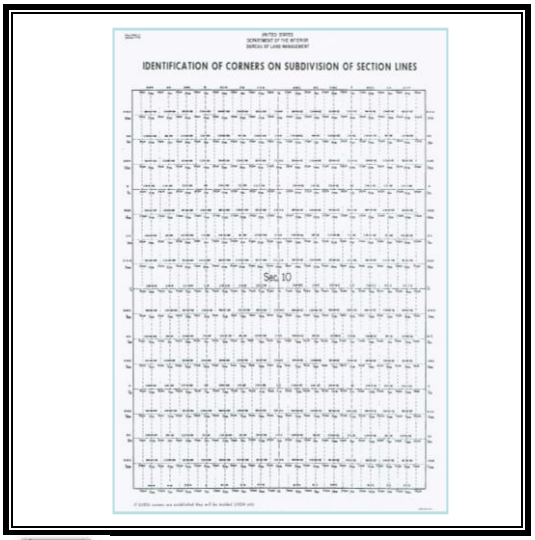


DIAGRAM **A full size version can be found in the Diagram section at the end of this study guide.**

And not all of these points were necessarily monumented and most of them weren't actually, but by the creation of that plat at the time it was accepted, all of these points had a unique position on the face of the ground and were uniquely identifiable. And that is one of the foundational principles.

If we look at an enlargement of the northeast quarter on this diagram, we can see some of the different naming four points in the area from the quarter corners down to smaller pieces and again, not all of these positions were monumented but just by the creation of that plat all of these positions had unique locations and unique names and could be located following the rules of the system.

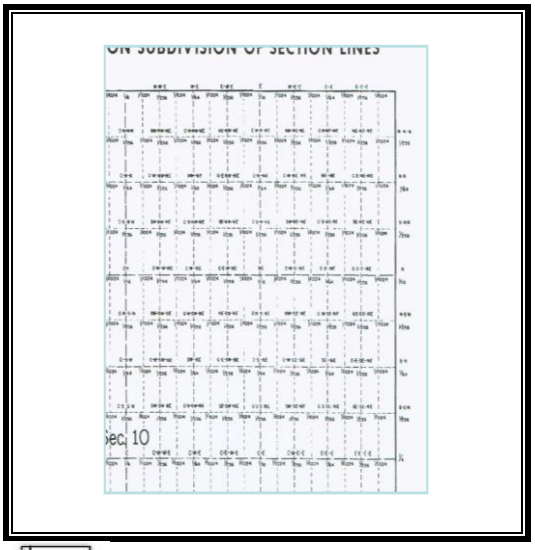


DIAGRAM **A full size version can be found in the Diagram section at the end of this study guide.**

After the enactment of this new rectangular survey system, the surveyors headed to the field and started performing the very first rectangular surveys in our country. These surveys were much different than, were performed in much different ways than our surveys were today. They were monumenting township boundaries only and they were setting monuments every two miles.

INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

They were supervised by the United States geographer and he was on the ground with them working to perform these surveys so there weren't written procedures and policies, they came from those very first surveys.

However, it did set up the structure that we still see in BLM today, having an office, a headquarters, in Washington and then having lead or chief surveyors in each of the geographic areas of our country that have public land surveys going on. And those original surveyors that were performing on those first surveys were from a representative from each of the original 13 colonies.

The accuracy of those very first surveys may not have been in today's standards viewed as very accurate surveys, but in consideration of the technology that was being used and the logistical problems that they had to overcome, they were very good surveys for the time when they were preformed and they were setting the foundation for our system today.

And it was very evident after those surveys that there were many details that would need to be worked out on the execution of those surveys and the monumentation and the sale of parcels that would happen utilizing these surveys but the fact that this system was making the legal description so simplistic to be used in those conveyance documents it was very evident that this would be a system that would work for our country.

Right away, once these first surveys started, the system began evolving and there were a lot of changes and the monumentation scheme became different, we had monuments coming in at mile intervals and at half-mile intervals and this evolution of our system started as soon as it had begun.

INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

Evolution of the System

Let's look at some of the key factors that were involved in this evolution. There were new laws regarding surveys and land disposal being passed throughout history that were influencing the way we would perform these surveys.

The survey laws would change the requirements for monumentation and for accuracy would change. These things would affect the way that our public land surveys were performed. The land disposal laws would change and the parcel sizes that needed to be conveyed and different configurations of parcels would change throughout history and these would also influence the system throughout its history.

There were formations of new government entities in the beginning they were dealing with territories and the United States' relationship to these territorial governments and then it evolved into state governments throughout the years and that also had an influence on how the system was created.

One of the other factors in this evolution was obviously technology, the technology changes, we all know if we go buy a new system or computer, by the time we get it off the shelf, there is already a new version in the works.

So the evolution of technology played a major role in this survey system from changing from a magnetic declination for a basis of bearing to using solar compasses and later on photogrammetry all the way through today's technology of using GPS, these have had an influence on the accuracy and the way these surveys were performed.

Another factor was location. The areas that needed to be surveyed and that were part of the public domain system to be surveyed under this rectangular system were getting further and further away and more separated and there was a need to keep this system consistent so that it would facilitate all of the land disposal laws that were enacted, and so the communication between the Washington office and the individuals in the areas in the different regions of the country and the distances that were involved in getting communication between those had a factor in how this system was created.

Key Factors in the Evolution of the PLSS

- New laws regarding surveys and land disposal
- Formation of new government entities
- Technology
- Location
- Organization

INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

And by organizationally I'm talking about the organization of BLM and its location. Not the organization of BLM but the organization of Cadastral, and where Cadastral survey fit into the government organization.

It started in Treasury and then moved into the General Land Office involving all sorts of land actions and then into BLM and located under the Department of Interiors in later years. And these factors became political factors that would affect how our system was extended and to the land.

During this time there were multiple laws and memos and instructions from the Surveyor General that was located in Washington at that time that were being published and sent out to the different Chief Surveyors in each area and if you put them altogether there would be a huge stack of documents that had been formed, and not only the instruction memorandums that came from the Surveyor General, but the legislation that was passed and court cases that had been decided and the judicial opinion of the interpretation of these laws. These were all factors that the surveyor had to take into account when he was executing these surveys.

Origins of "The Manual"

By 1855 it became apparent that there was a need for a formal guidance document and that is when we had the first version of the Manual of Survey and Instructions for the Public Lands of the United States. However, having a formal instruction manual that would be the same and sent out to all of the different offices, was not the end of the change.

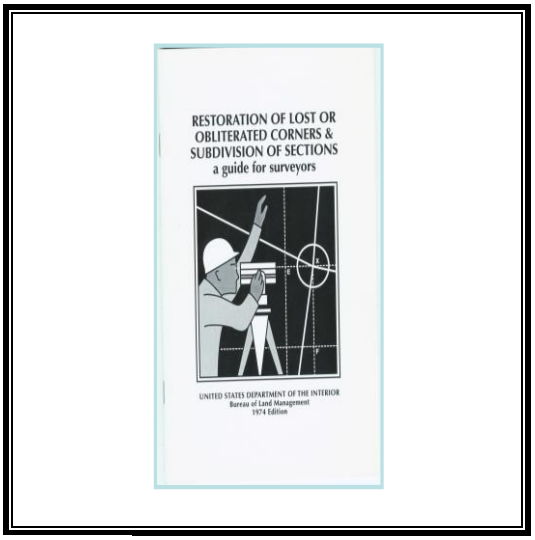
There continued to be new polices and procedures and instruction memorandums. So this Manual was re-issued at later dates, the 55 Manual was republished in 71. And again there was a new version in 1881, 1890, 1894, 1930, 1947, 1973 and to our current version of the Manual, which is the 2009 Manual of Surveying Instructions.

And this Manual was a compilation of all of these different aspects that the surveyor needed to know when he was in the field. It contained the legal history, the laws that were affecting the execution of these surveys and court cases, judicial opinions of the

INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

legal interpretation along with technical guidance and procedures to be used in the subdivision and survey of these townships. And it was all combined into this one document that the surveyor could use to have one place to go for all of this interrelated information.

There have been other publications since the Manual, such as the pamphlet that BLM published, titled, *Restoration of Lost or Obliterated Corners & Subdivision of Sections* which can be found in the Handout section of this study guide. Also there was an ephemeris published to give the astronomic information to be used in solar observations.



HANDOUT **A full version can be found in the Handout section at the end of this study guide.**

So these publications continued throughout all these years. And in fact BLM has a current effort under way to create a new manual. And you may be looking for that in the near future because these changes are still evolving and we have had many instruction memorandums and many different laws passed, so we are working on publishing a new manual that will incorporate all of those different rules into a new set of instructions.

These changes that happened throughout the years are very evident if you begin to look at some of our records and what our plats look like. And if we take a look at a plat that was created in the 1800s.

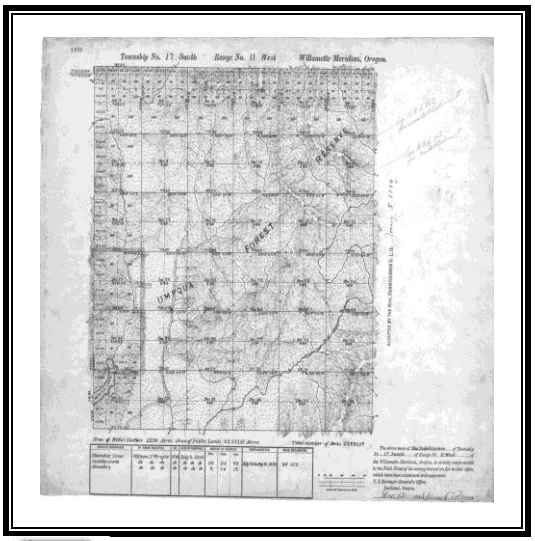


DIAGRAM **A full size version can be found in the Diagram section at the end of this study guide.**

You can see right away that there is lots of information on this plat, there is topography and all sorts of physical characteristics of the land and that was because those very first surveys were really, sometimes the surveyors were the first people to go into those areas and they were really acting as explorers also and laying out what the land looked like so that the entry people and the entry men could take these documents and have a general idea of what the physical characteristics in an area looked like.

INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

Again, here is another plat that shows topography in an area. And as the system evolved, then you look at some of our new modern plats and they will look totally different. But all of these plats that we are creating are following the same foundational, fundamental principles that were outlined in that original Act in 1785 and although they may look different, they are still representing the foundation principles that were enacted in that original Act.

Being from Alaska, I am a first hand witness of the results of some of these changes as we have actually gone back to two mile monumentation that was used on those very original survey in order to convey the huge amounts of lands that were required under our Statehood Act and our Alaska Native Settlement Act so what goes around comes around, sometimes.

So our current Public Land Survey System through its evolution the current standards that are there are that townships will be extended from initial points, they contain 36 sections, and there is monumentation at half mile intervals on the section lines but no monumentation was done below the section level.

And that was because the subdivisional work was and that was part of the system and working as private surveyors, we are all part of this overall big system because that subsection level monumentation was called to be performed by local surveyors after the lands had been passed into private ownership.

PLSS Current System

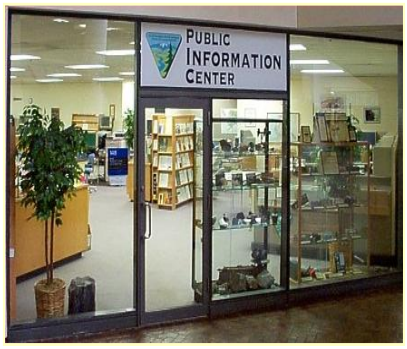
- Townships extend from initial points
- Townships contain 36 sections
- No monumentation below the section level

INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

There is no better illustration of how this system looks on the ground then if you are flying in a plane over any of the western states and you can see these squares laid out all over the country side and that is an illustration of the history of how this whole system has evolved and the large amount of area that it covers.

We've talked about a lot of history and there that were laws and instruction memorandums and manuals that were issued throughout history that have influenced our system.

Now I would like to touch on where you might find some of these historical documents.

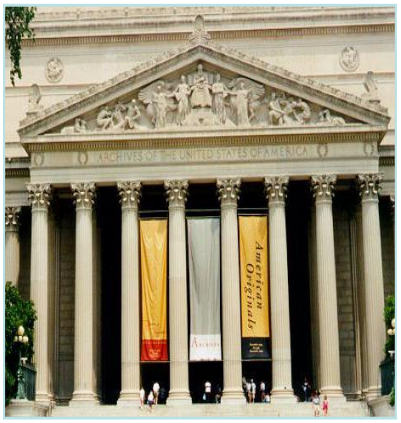


Generally when you go to perform a BLM Cadastral survey, the information that you need to perform that work will be given to you through whoever is asking you to do that work.

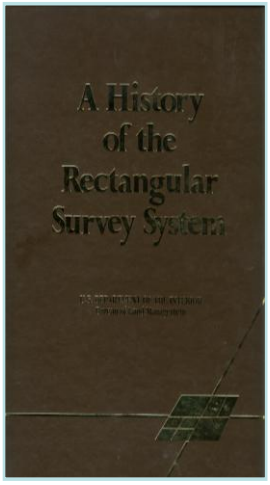
However, sometimes you may find it necessary to go back to some of the historical documents and locate more information in order to define the boundaries of your project, and if that becomes the case, you would work through your build surveyor and through the BLM to access some of these records, but the places you would look would be Public Information Centers, or public rooms of your BLM state office in your area.

INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

They can provide lots of information and if they don't have the information there they would certainly know where to find it. And again, the historical documents would be kept at the national archives and there is system in place that those records could be viewed also.



Another great resource for a very detailed history of all of these Acts and what was going on at different times in history with the rectangular system is Al White's book, *A History of the Rectangular Survey System*. And that is a great resource that you can reference and it also contains the verbiage and written words from those manuals that were issued.



Non-PLSS Parcels

Now Dennis, in the previous segment talked about metes and bounds descriptions and irregular boundaries that did not fit into a rectangular pattern. And our rectangular system doesn't count for those parcels, and realize that not all boundaries were going to fit into a rectangular pattern.

INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

So let's take a look at how our rectangular system accounts for **non-rectangular entities** and bounds. It allows for deviations from the rectangular system to fit these irregular boundaries, it will fit the same procedures as the rectangular plat and go through the same steps in order to be created and they will be filed in the same offices and located in the same places as the rectangular plats.

Non-Rectangular Entities

- Public Land Survey System allows for deviations to fit non-rectangular parcels
- Surveys follow same procedures as rectangular plats
- Records filed in same offices as rectangular plats

These nonrectangular parcels generally fit into two different categories or the reasons for them to fit into two different categories, they were created to recognize a prior title and an example of these are grants, or reservations or ranches that were conveyed and privately owned before the rectangular surveys came into the area or to comply with Land Disposal Legislation that created parcels or called for parcels that did fit into the rectangular system.

Such as Homestead Entry Surveys, Townsites, we have United States Surveys or US Surveys in Alaska and Mineral Surveys all fit into these categories. Some examples of what these plats would look like, here is an example of a US Survey Plat in Alaska. It is not rectangular. However, in this new system these parcels were given a unique identifier that could be used in the title documents when they were conveyed.

Categories of Non-Rectangular Parcels

- Created to recognize prior title
  - Examples Grants, Reservations or Ranches
- Compliance with Land Disposal Legislation
  - Examples Homestead Entry Surveys (HES), Townsites, United States Surveys (Alaska), Mineral Surveys

INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

We talked about the different laws and so they had different identifiers depending on the laws they were being conveyed under.

But each one was sequentially given a number and in this case, US Survey 12899 and that would become that parcel's legal description. So the principles that were in place for the rectangular parcels were incorporated into these irregular metes and bounds type parcels.

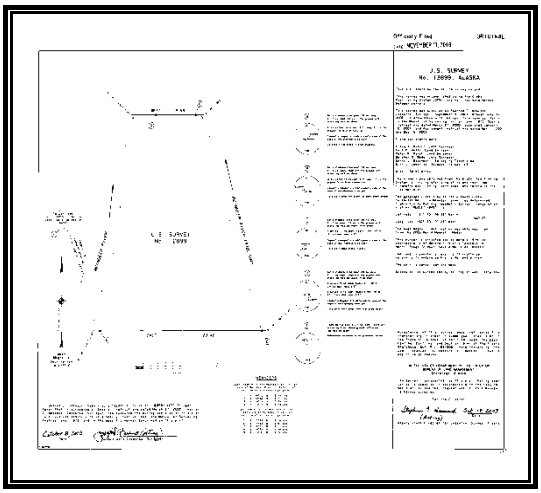


DIAGRAM **A full size version can be found in the Diagram section at the end of this study guide.**

Another example of an irregular boundary came be found in the back sleeve of the Manual with a sample Mineral Survey plat, shown here. Mineral surveys were to be located relative to the location of the minerals in an area.

So they were not going to fit into a rectangular survey system, so the system accounted for that and allowed for deviations and the way these irregular boundaries would be shown on our overall rectangular system were as exclusions. And you can see this is also the sample plat out of the back sleeve of the Manual and it shows a sample rectangular plat and you can see on here examples of how these irregular parcels would be shown.

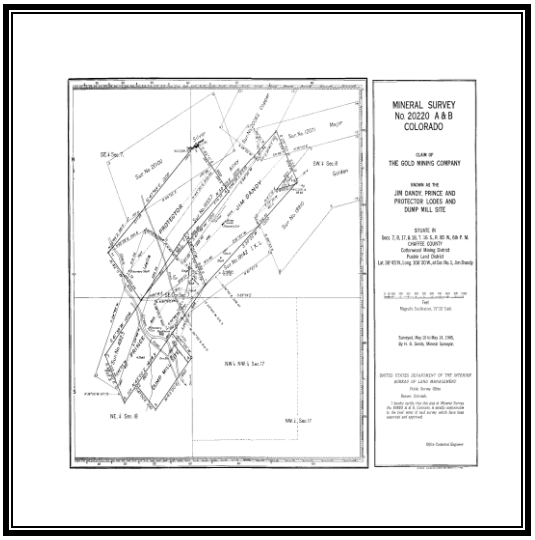


DIAGRAM **A full size version can be found in the Diagram section at the end of this study guide.**

INTRODUCTION TO PLSS & RECORDS SYSTEM – PART 1

Here there are some mineral surveys located up in this area and there is also a blow up of those down in the corner, and then there is also an example here.

So all of those parts those irregular boundaries were to be incorporated into the rectangular system and the rectangular system would be projected up to those boundaries that were either existing title before or conveyed under new land disposal laws without rectangular boundaries.

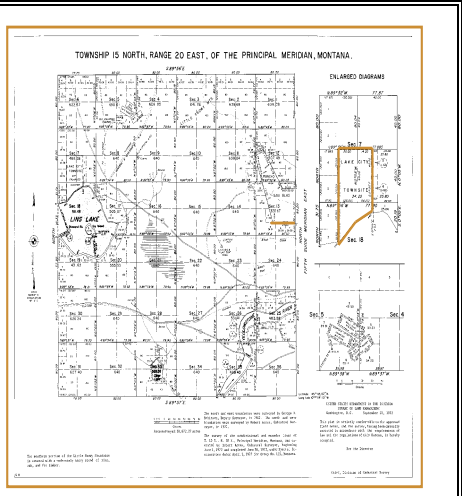


DIAGRAM **A full size version can be found in the Diagram section at the end of this study guide.**

In summary, our Public Land Survey System is the rectangular system adopted in 1785 and this system is a living system that evolves, has evolved, and will continue to evolve to meet the changing needs of our Land Tenure System.

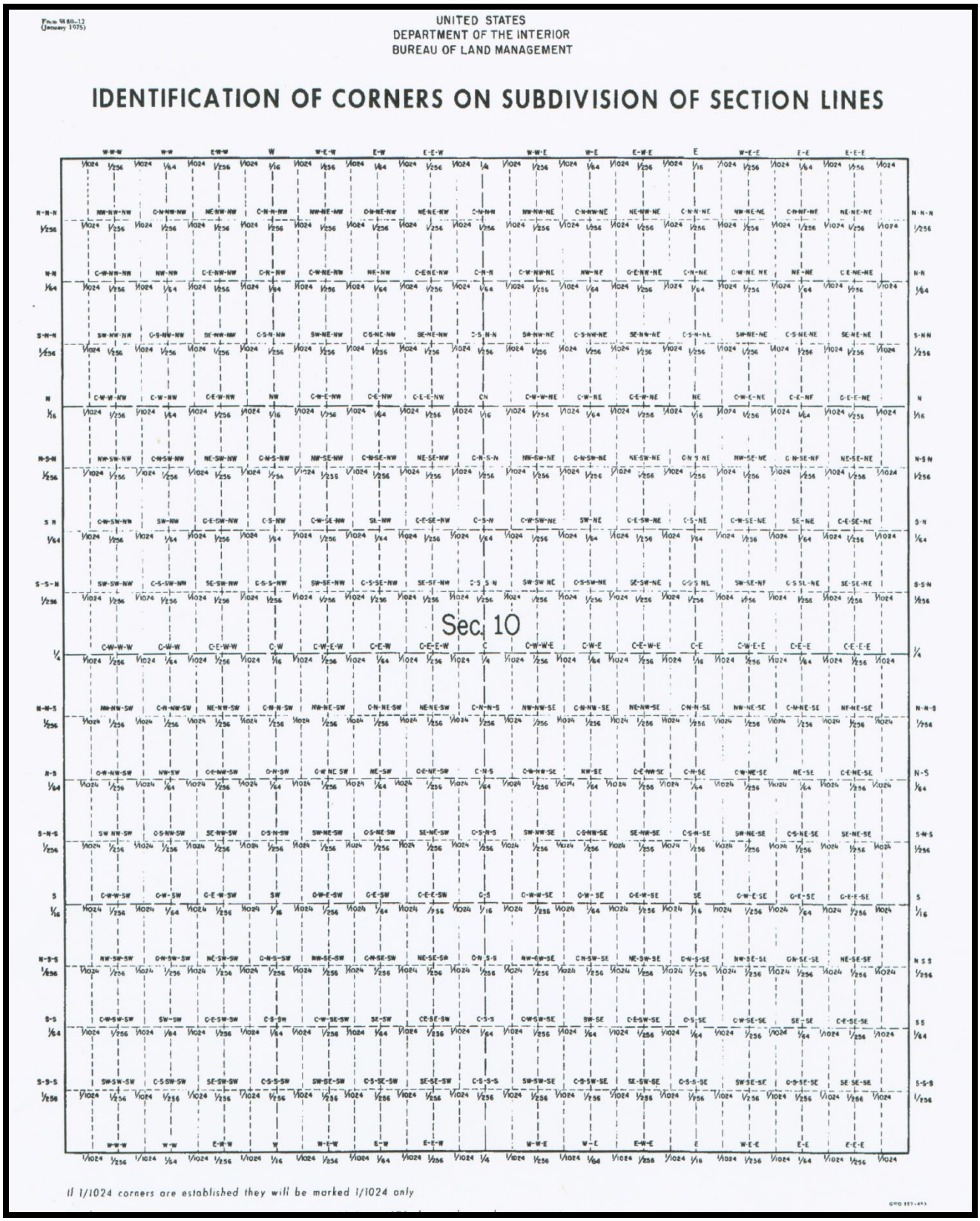
The Manual of Surveying Instructions gives guidance and direction for the surveying of this system and also includes reference to laws and judicial opinions that affect the way we perform our surveys. And our rectangular system allows for exceptions to the rectangular form of parcels by incorporated in smaller specialized surveys under different sequential numerical labeling.

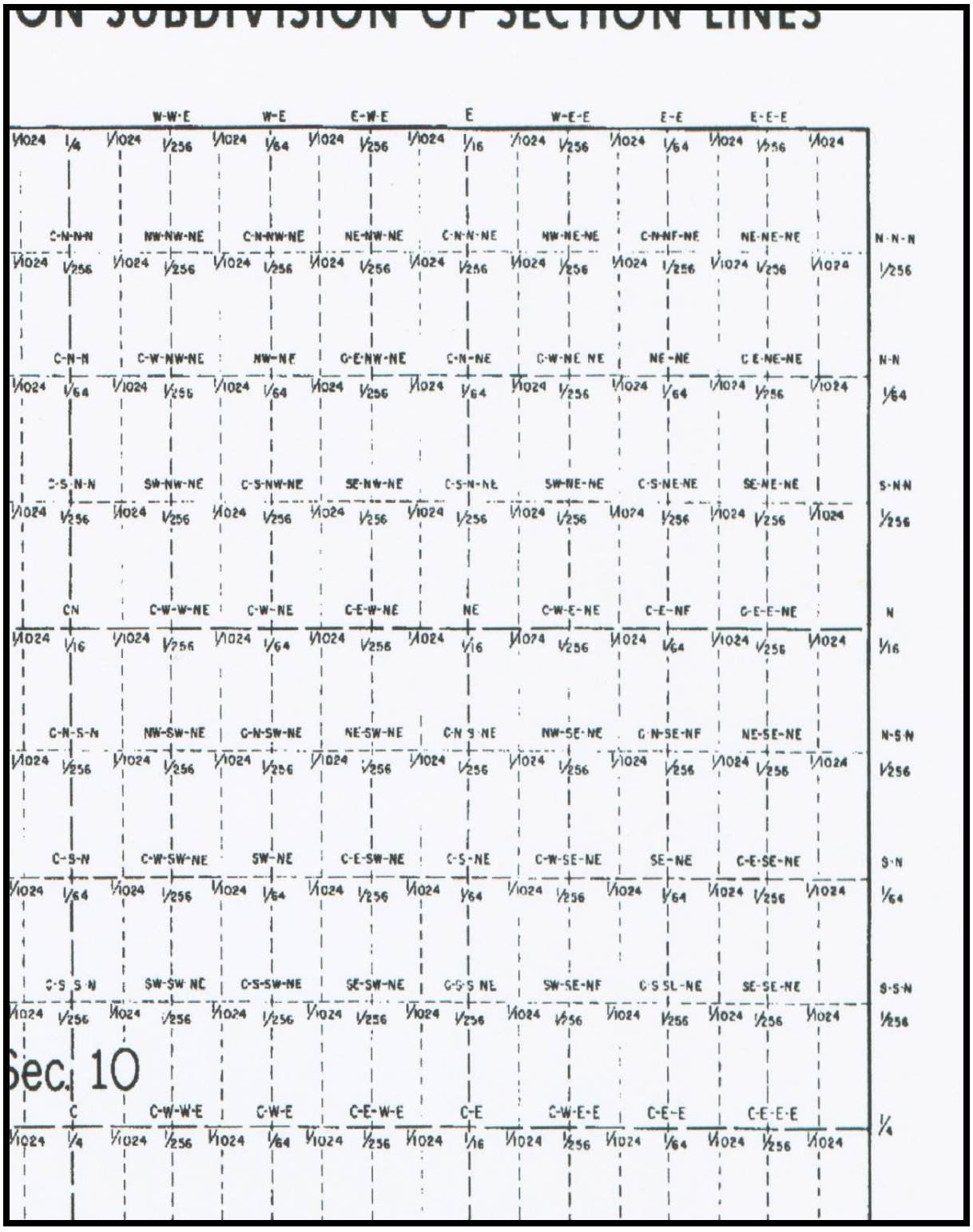
Thank you for your attention and I look forward to sharing more information with you in further segments.

PLSS Summary

- Rectangular System adopted in 1785
- Living System that evolves to meet the changing needs of our land tenure system
- The Manual of Surveying instructions gives guidance and direction for surveying the Rectangular System
- Exceptions to the Rectangular System

DIAGRAM


Form 9180-12
(January 1975)
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
IDENTIFICATION OF CORNERS ON SUBDIVISION OF SECTION LINES
Sec. 10
If 1/1024 corners are established they will be marked 1/1024 only


ON SUBDIVISION OF SECTION LINES
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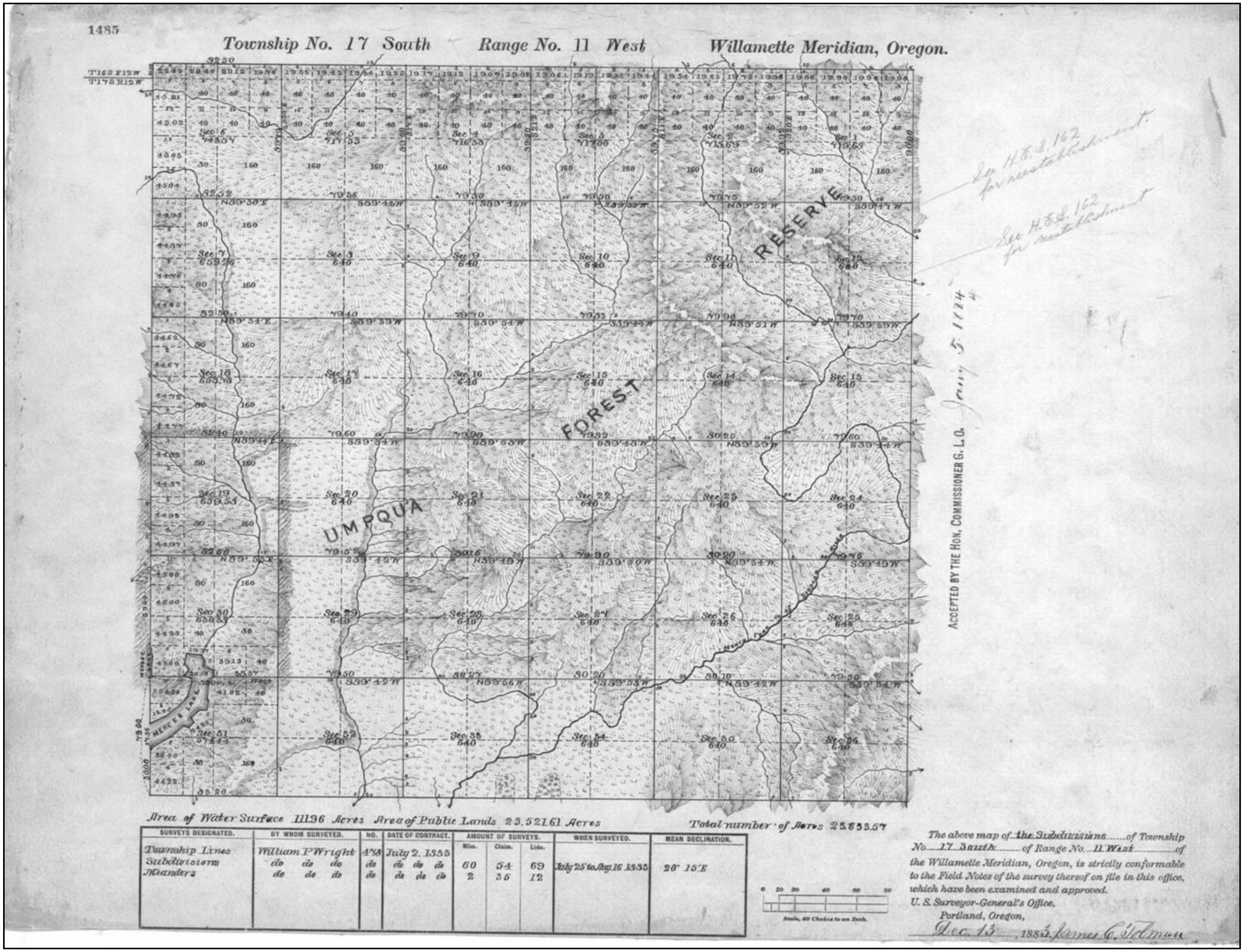
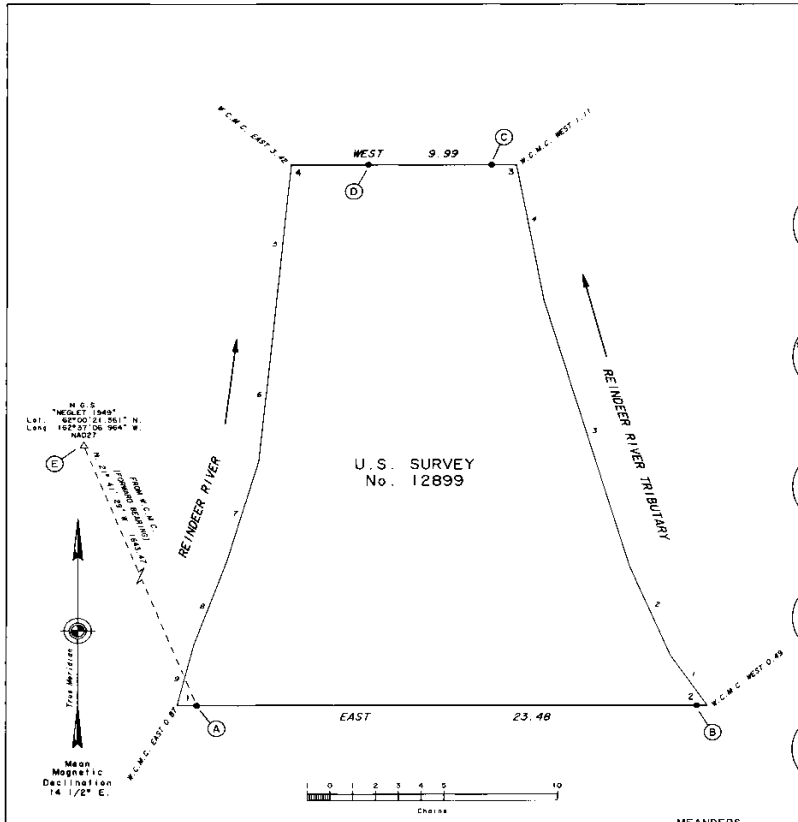

1485
Township No. 17 South Range No. 11 West Willamette Meridian, Oregon.
UMPQUA
FOREST
RESERVE
ACCEPTED BY THE HON. COMMISSIONER G. L. O.
Area of Water Surface 111.96 Acres Area of Public Lands 23,521.61 Acres
Total number of Acres 23,633.57
SURVEYS DESIGNATED.
BY WHOM SURVEYED.
NO.
DATE OF CONTRACT.
AMOUNT OF SURVEYS.
Miles. Chains. Links.
WHEN SURVEYED.
MEAN DECLINATION.
Township Lines
Subdivisions
Meanders
William P Wright
July 2. 1883
60 54 69
2 35 12
July 25 to Aug 16 1883
20° 15'E
Scale, 40 Chains to an Inch.
The above map of the Subdivisions of Township No. 17 South of Range No. 11 West of the Willamette Meridian, Oregon, is strictly conformable to the Field Notes of the survey thereof on file in this office, which have been examined and approved.
U. S. Surveyor-General's Office,
Portland, Oregon,
Dec. 13, 1883. James C. Tolman

Officially Filed ORIGINAL
DATE NOVEMBER 17, 2003



A — Set a stainless steel post, 28 ins. long, 2 1/2 ins. diam. 26 ins. in the ground, with brass cap mkd. as shown. Drive a steel fence post, 6 ft. long, 3 ft. to the ground, 1 ft. N. of witness cor. Deposit a magnet in a white plastic case at the base of the stainless steel post. Located in tall grass, at small clearing.

B — Set a stainless steel post, 28 ins. long, 2 1/2 ins. diam., flush with the ground, with brass cap mkd. as shown. Drive a steel fence post, 6 ft. long, 3 ft. in the ground, 5 ins. N. of witness cor. Deposit a magnet in a white plastic case at the base of the stainless steel post. Located in alder and brush, on bank above slough.

C — Set a stainless steel post, 28 ins. long, 2 1/2 ins. diam., 24 ins. in the ground, with brass cap mkd. as shown, from which A spruce, 17 ins. diam., bears S. 45 1/4° W., 132 lks. dist., mkd. X BT. Deposit a magnet in a white plastic case at the base of the stainless steel post. Located in open grassy tundra.

D — Set a stainless steel post, 28 ins. long, 2 1/2 ins. diam., flush with the ground, with brass cap mkd. as shown, from which A spruce, 9 ins. diam., bears S. 1 1/4° E., 124 lks. dist., mkd. X BT. A spruce, 9 ins. diam., bears S. 65 1/4° W., 62 1/2 lks. dist., mkd. X BT. Deposit a magnet in a white plastic case at the base of the stainless steel post. Located in thick alder, with scattered spruce.

E — Found an iron pipe, 2 1/2 ins. diam., firmly set, projecting 6 ins. above ground, with brass cap mkd. as shown. Referenced as shown on the published record.

I, Daniel L. Johnson, Supervisory Cadastral Surveyor, HEREBY CERTIFY upon honor that in pursuance of Special Instructions dated March 27, 2000, Therron C. Woerner, Cadastral Surveyor, has executed the survey depicted on this plat in strict conformity with said Special Instructions, the Manual of Surveying Instructions, 1973, and in the specific manner described on this plat.

October 8, 2003
Date

Joseph P. Burns (acting)
Supervisory Cadastral Surveyor

TCW/YPRN

U.S. SURVEY
No. 12899, ALASKA

This plat contains the entire survey record.

This survey was accomplished using the Global Positioning System (GPS), and no lines were marked between corners.

This survey was executed by Therron C. Woerner, Cadastral Surveyor, September 5, 2001 through July 31, 2002, in accordance with the specifications set forth in the Manual of Surveying Instructions, 1973, Special Instructions dated March 27, 2000, approved January 10, 2001, and Assignment Instructions dated May 1, 2001 and May 16, 2002.

Field assistants were:

Craig S. Dukart, Land Surveyor
Kurt D. Huhta, Land Surveyor
Peter R. Nanok, Land Surveyor
Marshall D. Wade, Land Surveyor
Emily J. Davenport, Surveying Technician
Bill J. Lavallen, Student trainee (LS)

Area: 39.97 Acres.

The azimuth was obtained from the Global Positioning System, utilizing static relative and real-time kinematic positioning techniques, and refers to the true meridian.

The geographic position of the witness corner to corner No. 1, a meander corner, as determined from a tie to National Geodetic Survey triangulation station "MEGLET 1949", is:

Latitude: 61° 43' 49.92" North
NAD 27
Longitude: 162° 23' 07.26" West

The mean magnetic declination was obtained from from the 2000 World Magnetic Model.

This survey is situated approximately 16 miles southwesterly of Marshall, within Township 19 North, Range 72 West, Seward Meridian, Alaska.

The land is generally level, with scattered spruce, with undergrowth of alder and willow.

The soil is sandy loam and muck.

Access to the survey was by helicopter and floatplane.

Acceptance of this survey does not purport to transfer any interest in submerged lands to which the State of Alaska is entitled under the Equal Footing Doctrine and Section 6(m) of the Alaska Statehood Act, P.L. 85-508, notwithstanding the use, location, or absence of meander lines to depict water bodies.

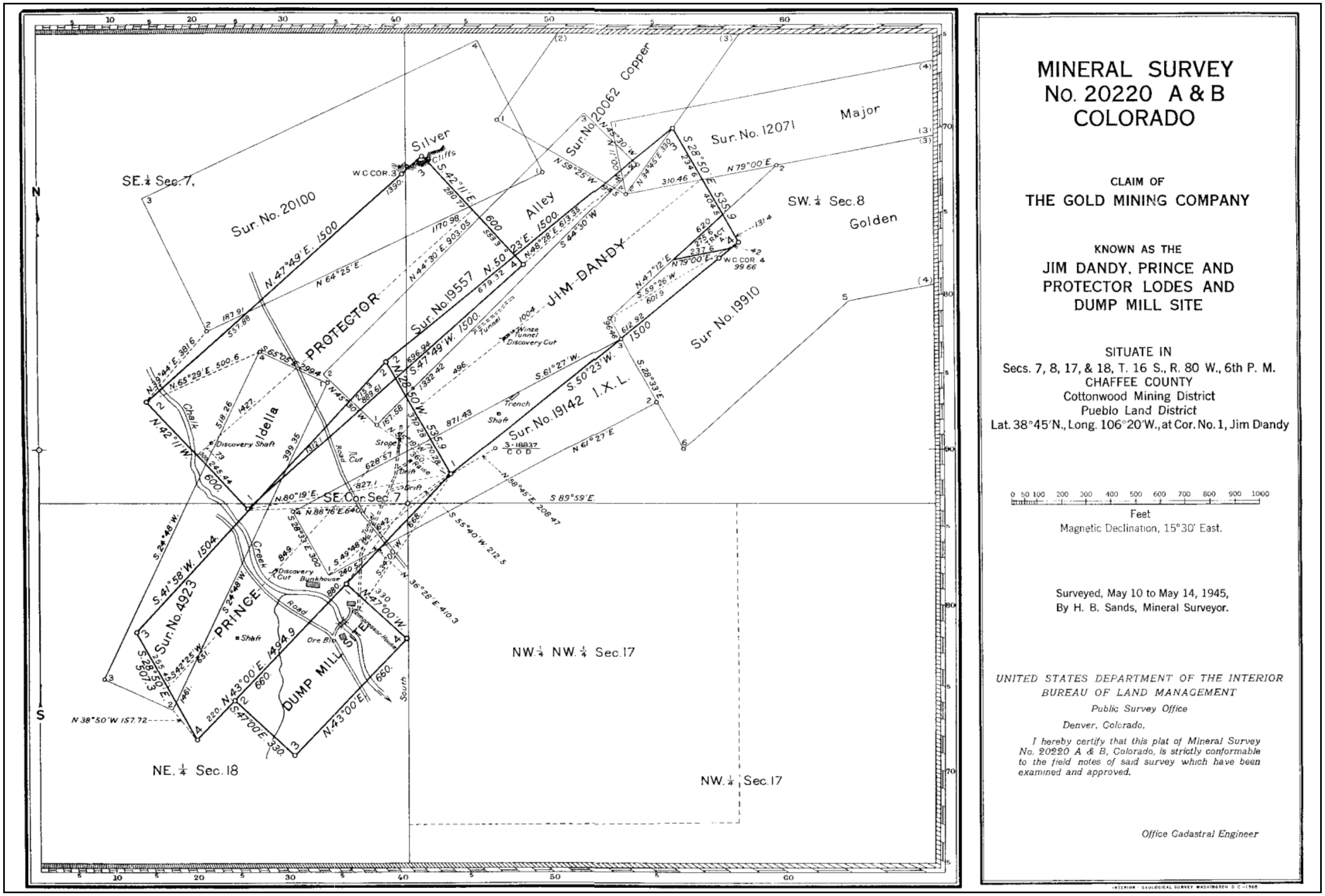
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Anchorage, Alaska

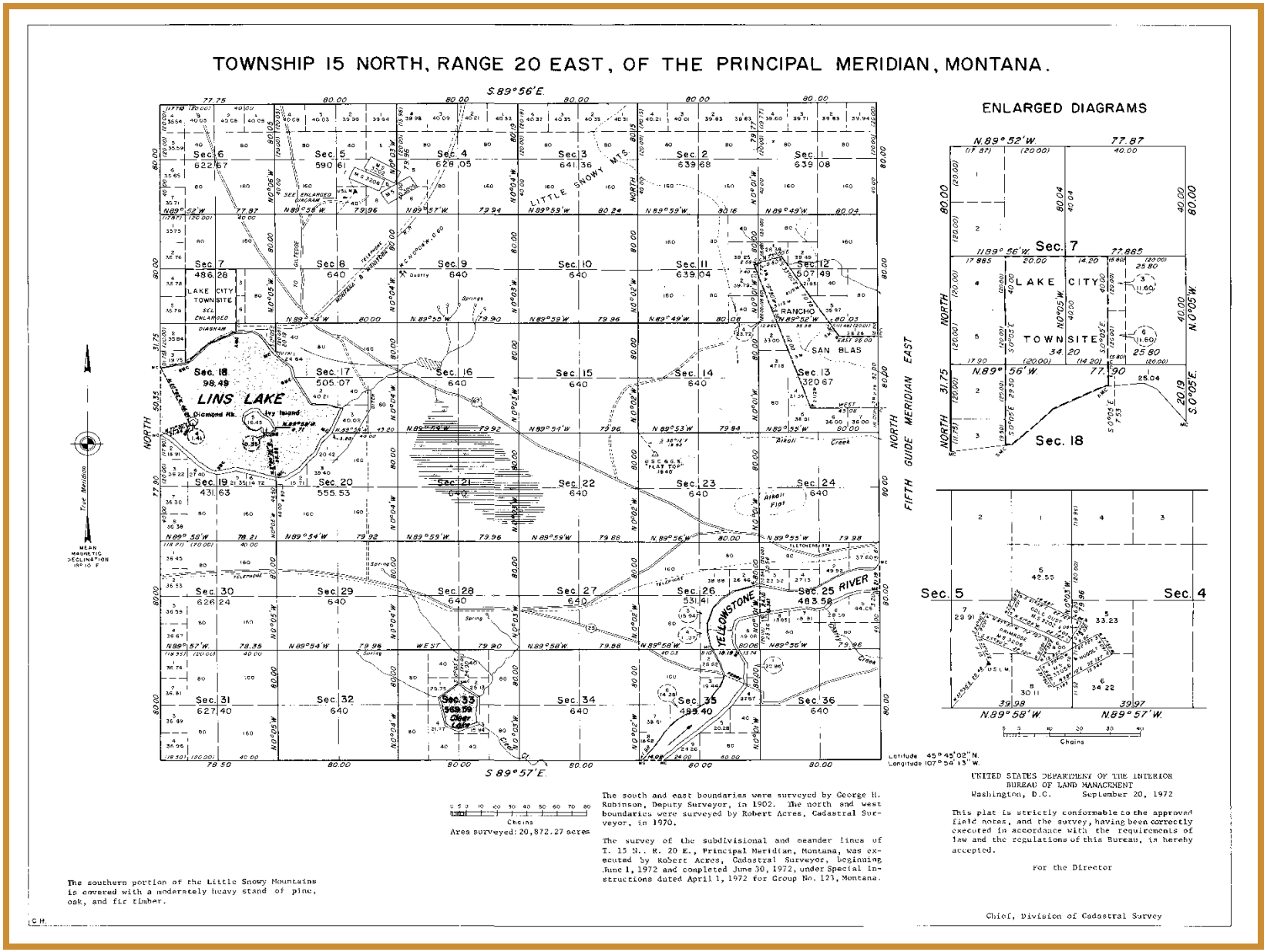
The survey represented by this plat, having been correctly executed in accordance with the requirements of law and the regulations of this Bureau, is hereby accepted.

For the Director

Stephen B. Hamrick (Acting) Oct. 14, 2003
Date
Deputy State Director for Cadastral Survey, Alaska

S.D.R.


MINERAL SURVEY
No. 20220 A & B
COLORADO
CLAIM OF
THE GOLD MINING COMPANY
KNOWN AS THE
JIM DANDY, PRINCE AND
PROTECTOR LODES AND
DUMP MILL SITE
SITUATE IN
Secs. 7, 8, 17, & 18, T. 16 S., R. 80 W., 6th P. M.
CHAFFEE COUNTY
Cottonwood Mining District
Pueblo Land District
Lat. 38°45'N., Long. 106°20'W., at Cor. No. 1, Jim Dandy
Feet
Magnetic Declination, 15°30' East.
Surveyed, May 10 to May 14, 1945,
By H. B. Sands, Mineral Surveyor.
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Public Survey Office
Denver, Colorado,
I hereby certify that this plat of Mineral Survey No. 20220 A & B, Colorado, is strictly conformable to the field notes of said survey which have been examined and approved.
Office Cadastral Engineer
SE.¼ Sec.7.
Sur. No. 20100
Silver
Cliffs
Sur. No. 20062 Copper
Sur. No. 12071
Major
SW.¼ Sec.8
Golden
Alley
PROTECTOR
Sur. No. 19557
JIM DANDY
Sur. No. 19910
Idella
Sur. No. 19142 I.X.L.
SE. Cor. Sec. 7
Sur. No. 4923
PRINCE
DUMP MILL SITE
NW.¼ NW.¼ Sec.17
NE.¼ Sec.18
NW.¼ Sec.17
Chalk
Creek
Road
South


TOWNSHIP 15 NORTH, RANGE 20 EAST, OF THE PRINCIPAL MERIDIAN, MONTANA.
S.89°56'E.
S 89°57'E.
FIFTH GUIDE MERIDIAN EAST
NORTH
LITTLE SNOWY MTS.
LINS LAKE
Diamond Rk.
Ivy Island
Alkali Creek
Alkali Flat
YELLOWSTONE RIVER
LAKE CITY TOWNSITE
SAN BLAS RANCHO
Sec. 1 639.08
Sec. 2 639.68
Sec. 3 641.36
Sec. 4 628.05
Sec. 5 590.61
Sec. 6 622.67
Sec. 7 486.28
Sec. 8 640
Sec. 9 640
Sec. 10 640
Sec. 11 639.04
Sec. 12 607.49
Sec. 13 320.67
Sec. 14 640
Sec. 15 640
Sec. 16 640
Sec. 17 505.07
Sec. 18 98.49
Sec. 19 431.63
Sec. 20 555.53
Sec. 21 640
Sec. 22 640
Sec. 23 640
Sec. 24 640
Sec. 25 488.58
Sec. 26 531.61
Sec. 27 640
Sec. 28 640
Sec. 29 640
Sec. 30 626.24
Sec. 31 627.40
Sec. 32 640
Sec. 33 639.28
Sec. 34 640
Sec. 35 489.40
Sec. 36 640
ENLARGED DIAGRAMS
Sec. 7
Sec. 18
Sec. 5
Sec. 4
Chains
Area surveyed: 20,872.27 acres
The southern portion of the Little Snowy Mountains is covered with a moderately heavy stand of pine, oak, and fir timber.
The south and east boundaries were surveyed by George H. Rubinson, Deputy Surveyor, in 1902. The north and west boundaries were surveyed by Robert Acres, Cadastral Surveyor, in 1970.
The survey of the subdivisional and meander lines of T. 15 N., R. 20 E., Principal Meridian, Montana, was executed by Robert Acres, Cadastral Surveyor, beginning June 1, 1972 and completed June 30, 1972, under Special Instructions dated April 1, 1972 for Group No. 123, Montana.
Latitude 45°45'02" N.
Longitude 107°54'13" W.
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Washington, D.C. September 20, 1972
This plat is strictly conformable to the approved field notes, and the survey, having been correctly executed in accordance with the requirements of law and the regulations of this Bureau, is hereby accepted.
For the Director
Chief, Division of Cadastral Survey

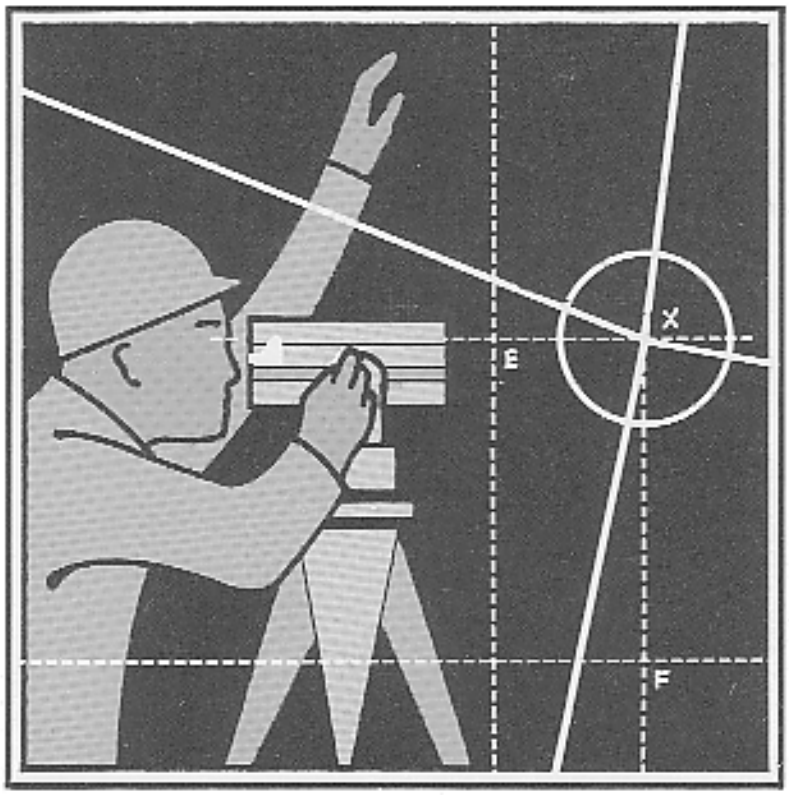
HANDOUT

DISCLAIMER

The following is a retyped electronic version of *"RESTORATION OF LOST OR OBLITERATED CORNERS AND SUBDIVISION SECTIONS"*, a supplement to the Manual of Surveying Instructions, designed to be word searchable for ease in finding selected passages. There is no intent, expressed or implied, that this is an exact facsimile of the publication itself.

References are contained herein to certain publications available for sale by the Superintendent of Documents, which are now, in fact, out of print and may no longer be maintained as stock items by the U.S. Government Printing Office. Also, certain addresses are no longer current.

RESTORATION OF LOST OR OBLITERATED CORNERS & SUBDIVISION OF SECTIONS
a guide for surveyors



UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Land Management
1974 Edition

PENALTY FOR THE DESTRUCTION OF MONUMENTS

A penalty for the unauthorized alteration or removal of any Government survey monument or marked tree is provided in Title 18, U.S.C., SEC. 1858 (62 Stat. 789). It reads as follows:

Whoever willfully destroys, defaces, changes, or removes to another place any section corner, quarter-section corner, or meander post, on Government line of survey, or willfully cuts down any witness tree or any tree blazed to mark the line of a Government survey, or willfully defaces, changes, or removes any monument or bench mark of any Government survey, shall be fined not more than $250, or imprisoned not more than six months, or both.

The Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, has for sale to the public the following publications of the Bureau of Land Management:

The Manual of Instructions for the Survey of the Public Lands of the United States, 1973.

Standard Field Tables, 1956 (a Supplement to the Manual of Surveying Instructions), containing traverse tables; stadia coefficients; five-place natural and six-place logarithmic sines, cosines, tangents, and cotangents; six-place logarithms of numbers; and other tables and data of particular application in land surveying practice.

The Ephemeris of the Sun, Polaris, and Other Selected Stars, published annually in advance (a supplement to the Manual of Surveying Instructions).

Copies of the approved field notes and plats of the public land surveys, excepting those in Illinois, Indiana, Iowa, Kansas, Missouri, and Ohio, may be procured from the Director, Eastern States Office, Bureau of Land Management, 7981 Eastern Avenue, Silver Spring, Maryland, 20910, and from State Offices of the Bureau. A charge is made for making copies of records furnished the public. The Bureau's copy of public survey records of the excepted States has been transferred to the National Archives and Records Service, General Services Administration, Washington, D.C. 20408.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

RESTORATION OF LOST OR OBLITERATED CORNERS AND SUBDIVISION OF SECTIONS

A supplement to the Manual of Surveying Instructions, containing a discussion of practices followed by the Bureau of Land Management, prepared especially for the information and guidance of county and local surveyor.

Prepared in the Division
of Cadastral Survey

UNITED STATES GOVERNMENT PRINTING OFFICE
WASHINGTON : REPRINTED - 1979

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402
Stock Number 024-011-00012-7

UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Land Management

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other concerns of America's "Department of Natural Resources".

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States--now and in the future.

OUTLINE OF SUBJECTS

Key to Citation of Authorities by Volume and Page or Section

Stat.: United States Statutes at Large.
R.S.: Revised Statutes of the United States; citation will include section number.
U.S.: United States Reports; decisions of the Supreme Court of the United States.
Fed.: Decisions of Circuit Courts of Appeals and District Courts of the United States.
U.S.C.: United States Code (The Code of Laws of the United States).
L.D.: Decisions of the Department of the Interior relating to the public lands.
I.D.: Decisions of the Department of the Interior after 1930.

UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Land Management
Washington, D.C. 20240

This supplement to the Manual of Instructions for the Survey of the Public Lands of the United States has been in print since 1883. The purpose of the supplement is to provide an introduction to the rectangular system of public land surveying and resurveying and a compendium of basic laws relating to the system.

The information is of interest to county and local surveyors in retracing the lines of the public land surveys. Attorneys, title insurance company personnel and others who have professional interests in former or present public lands find this explanation of survey procedures valuable.

The pamphlet deals mainly with general practices and rules for the restoration of lost corners and the subdivision of sections. These procedures are used by the Bureau of Land Management in its surveys and resurveys of public lands. There has been little change in these procedures since their first publication in 1883. The presentation has been designed to answer many of the common questions arising in practical work. The pamphlet does not cover controversial questions or exceptional situations.

Included also is an explanation of methods generally successful in the retracement of lines and the recovery of corner evidence and other marks of the original public land surveys. Meander lines and riparian rights are discussed briefly at the close of the pamphlet.

Suggestions for the revision or improvement of later editions of this volume are welcomed.

Director

RESTORATION OF LOST OR OBLITERATED CORNERS

JURISDICTION

The Director, Bureau of Land Management, under the Supervision of the Secretary of the Interior, has complete jurisdiction over the survey and resurvey of the public lands of the United States.

After title to a piece of land is granted by the United States, jurisdiction over the property passes to the State; the Federal Government retains its authority only with respect to the public lands in Federal ownership. Where the lands are in private ownership, it is a function of the county or local surveyor to restore lost corners and to subdivide the sections. Disputes concerning these questions must come before the local courts, unless settled by joint survey or agreement. It should be understood, however, that no adjoining owner can make a valid encroachment upon the public lands.

The various states were surveyed under somewhat different practices according to the date of survey. The earliest rules were in manuscript and printed circulars; regulations more in detail, improving the rectangular system, were issued in Manuals of 1855, 1881, 1890, 1894, 1902, 1930, 1947, and 1973.[1]

RESURVEYS

Both the public and the privately owned lands may be resurveyed by the Bureau of Land Management in certain cases, under the following authority:

The act of Congress approved March 3, 1909, as amended by joint resolution approved June 25, 1910, provides:

That the Secretary of the Interior may, in his discretion, cause to be made, as he may deem wise under the rectangular system now provided by law, such resurveys or retracements of the surveys of public lands as, after full investigation, he may deem essential to properly mark the boundaries of the public lands remaining undisposed of (35 Stat. 845; 36 Stat. 884; 43 U. S. C. sec. 772).

The 1909 act is generally invoked where the lands are largely in Federal ownership, and where there may be extensive obligation or other equally unsatisfactory conditions.

[1] Manual of Instruction for the Survey of the Public Lands of the United States, 1973; Superintendent of Documents, Washington, D. C. 20402.

The act of Congress approved September 21, 1918, provides authority for the resurvey by the Government of townships, therefore held to be ineligible for resusrvey by reason of the disposals being in excess of 50 percentum of the total area thereof (40 Stat. 965; 43 U. S. C. sec. 773).

The 1918 act may be invoked where the major portion of the township is in private ownership, where it is shown that the need for retracement and remonumentation is extensive, and especially if the work proposed is beyond the scope of ordinary local practice. The act requires that the proportionate costs be borne by the landowners.

PROTECTION OF BONA FIDE RIGHTS

Under the above laws, and in principle as well, it is required that no resurvey or retracement shall be so executed as to impair the bona fide rights or claims of any claimant, entryman, or owner of land so affected.

Likewise in general practice, the local surveyor should be careful not to exercise unwarranted jurisdiction, nor to apply an arbitrary rule; he should note the distinction between the rules for original surveys and those that relate to retracements. The disregard of these principals, or for acquired property rights, may lead to unfortunate results and prompts the suggestions herein that are intended to help avoid such troubles.

In unusual cases where the evidence of the survey cannot be identified with ample certainty to enable the application of the regular practices, the surveyor may submit his questions to the proper State Office of the Bureau of Land Management, or to the Director.

ORIGINAL SURVEY RECORDS

The township plat furnishes the basic data relating to the survey and the description of all areas in the particular township. All title records within the area of the former public domain are based upon a Government grant or patent, with description referred to an official plat. The lands are identified on the ground through the retracement, restoration, and maintenance of the official lines and corners.

The plats are developed from the field notes; both are permanently filed for reference purposes and are accessible to the public for examination or making of copies in the offices listed on page 4.

Many supplemental plats have been prepared by protraction to show new or revised lottings within one or more sections; these supersede the lottings shown on the original township plat. There are also many plats of the survey of islands or other fragmentary areas of public land which were surveyed after the original survey of the township.

These plats should be referred to as governing the position and description of the subdivisions shown on them.

RESURVEY RECORDS

The plats and field notes or resurveys which become a part of the official record fall into two principal classes according to the type of resurvey, as follows:

The *dependent resurvey* is a restoration of the original survey according to the record of that survey, based upon the identified corners of the original survey and other acceptable points of control, and the restoration of lost corners in accordance with proportional measurement as described herein. Normally, the subdivisions shown on the plat of the original survey are retained on the plat of the dependent resurvey, although new designations and areas for subdivisions still in public ownership at time of the resurvey may be shown to reflect true areas.

The *independent resurvey* is designed to superseded the original survey and creates new subdivisions and lottings of the vacant public lands. Provision is made for the segregation of individual tracts of privately-owned lands, entries, or claims that may be based upon the original plat, when necessary for their protection, or for their conformation, if feasible, to the regular subdivisions of the resurvey.

IMPORTANCE OF PLAT AND FIELD NOTES

The importance, or legal significance, of the plats and field notes is well stated in an opinion by the Department of the Interior (45 L. D. 330, 336) as follows:

> It has been repeatedly held by both State and Federal courts that plats and field notes referred to in patents may be resorted to for the purpose of determining the limits of the area that passed under such patents. In the case of Cragin v. Powell (128 U.S. 691, 696), the Supreme Court said:
>
> "It is a well settled principal that when lands are granted according to an official plat of the survey of such lands, the plat itself, with all its notes, lines, descriptions, and landmarks, becomes as much a part of the grant or deed by which they are conveyed, and controls so far as limits are concerned, as if such descriptive features were written out upon the face of the deed or the grant itself."

RECORDS TRANSFERRED TO STATES

In those states where the public land surveys are considered as having been completed, the field notes, plats, maps, and other papers relating to those surveys have been transferred to an appropriate State Office for safekeeping as public records. No provision has been made for the transfer of the survey records to the State of Oklahoma, but in the other States the records are filed in the following offices where they may be examined and copies made or requested:

Alabama: Secretary of State, Montgomery, Alabama 36104
Arkansas: Department of State Lands, State Capital, Little Rock, Arkansas 72201.
Florida: Board of Trustees of the Internal Improvement Trust Fund, Elliott Building, Tallahassee, Florida 32304.
Illinois: Illinois State Archives, Secretary of State, Springfield, Illinois 62706.
Indiana: Archivist, Indiana State Library, 140 North Senate Avenue, Indianapolis, Indiana 46204.
Iowa: Secretary of State, Des Moines, Iowa 50319.
Kansas: Auditor of State and register of State Lands, Topeka, Kansas 66612.
Louisiana: Register, State Land Office, Baton Rouge, Louisiana 70804.
Michigan: Department of Treasury, Bureau of Local Government Services, Treasury Building, Lansing, Michigan 48922.
Minnesota: Department of Conservation, Division of Lands and Forestry, Centennial Office Building, Saint Paul, Minnesota 55101.
Mississippi: State Land Commissioner, P.O. Box 39, Jackson, Mississippi 39205.
Missouri: State Land Survey Authority, P.O. Box 1158, Rolla, Missouri 65401
Nebraska: State Surveyor, State Capitol Building, P.O. Box 4663, Lincoln, Nebraska 68509.
North Dakota: State Water Conservation Commission, State Office Building, Bismarck, North Dakota 58501.
Ohio: Auditor of State, Columbus, Ohio 43215.
South Dakota: Commissioner of School and Public Lands, State Capitol, Pierre, South Dakota 57501.
Wisconsin: Department of Natural Resources, Box 450, Madison, Wisconsin 53701.

LOCAL OFFICES OF BUREAU OF LAND MANAGEMENT

The surveys are in progress in the other public-land states, where the records may be examined in, or copies procured from, the State Offices of the Bureau of Land Management, as follows:

Arizona: Phoenix.
California: Sacramento.
Colorado: Denver.
Idaho: Boise.
Montana: Billings.
Nevada: Reno.
New Mexico: Santa Fe.
Oregon: Portland.
Utah: Salt Lake City.
Washington: Portland, Oregon.
Wyoming: Cheyenne.
Alaska: Anchorage.

GENERAL PRACTICES

The basic Federal laws from which the rules for the original surveys and for necessary resurveys or retracements have been derived are set out in Revised Statutes, secs. 2395-2397; the acts of Congress approved March 3, 1909 (35 Stat. 845); September 21, 1918 (40 Stat. 965); and April 29, 1950 (64 Stat. 93), the provisions of which are amplified in the 1973 Manual.

The rules for the restoration of lost corners have remained substantially the same since 1883, when first published as such.[1] These rules are in harmony with the leading judicial opinions and the most approved surveying practice. They are applicable to the public land rectangular surveys, within the states listed above and to the retracement of those surveys, as distinguished from the running of property lines that may have legal authority only under State law, court decree, or agreement.

In the New England and Atlantic Coast States, except Florida, and in Pennsylvania, West Virginia, Kentucky, Tennessee, and Texas, jurisdiction over the vacant lands remained in the States. The public land surveys were not extended in these States and it follows that the practices outlined herein are not applicable there, except as they reflect sound surveying methods.

The practices outlined herein are in accord with the related provisions of the Manual; they have been segregated for the convenience of the reader in order to separate them from the instructions pertaining only to the making of original surveys.

For clarity, the practices, as such, are set in bold print. The remainder of the text is to be regarded as explanatory and advisory only, the purpose being to exemplify the best general practice.

In some states, the substance of practices for restoration of lost or obliterated corners and subdivision of sections, as outlined herein, has been enacted into law. It is incumbent on the surveyor engaged in practice of land surveying to become familiar with the provisions of the laws of the State, both legislative and judicial, as affecting his work.

[1] Restoration of Lost or Obliterated Corners, and Subdivision of Sections, March 13, 1883, 1 L.D., 339; 2d edition 1 L.D. 671; revised October 16, 1896, 23 L.D. 361; revised June 1, 1909, 38 L.D. 1; reprinted in 1916 and 1936; revised April 5, 1939; reissued May 8, 1952; reprinted with corrections July 11, 1955; reprinted in 1960: revised June 3, 1963; reprinted 1965 and 1968.

GENERAL RULES

The general rules followed by the Bureau of Land Management, which are controlling upon the location of all public lands, are summarized in the following paragraphs:

First: That the boundaries of the public lands, when approved and accepted, are unchangeable.

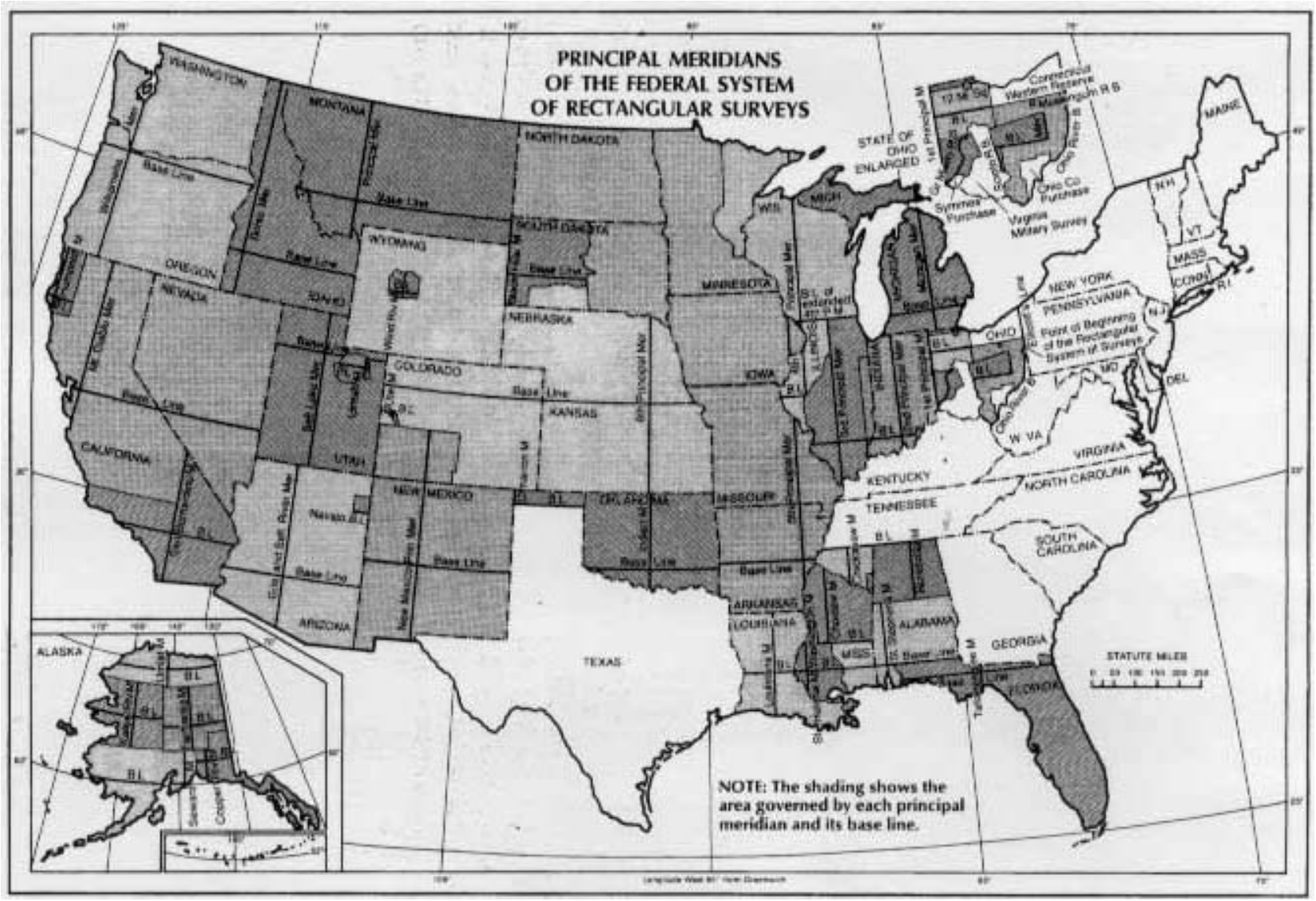
Second: That the original township, section, and quarter-section corners must stand as the true corners which they were intended to represent, whether in the place shown by the field notes or not.

Third: That quarter-quarter-section corners not established in the original survey shall be placed on the line connecting the section and quarter-section corners, and midway between them, except on the last half mile of section lines closing on the north and west boundaries of the township, or on the lines between fractional or irregular sections.

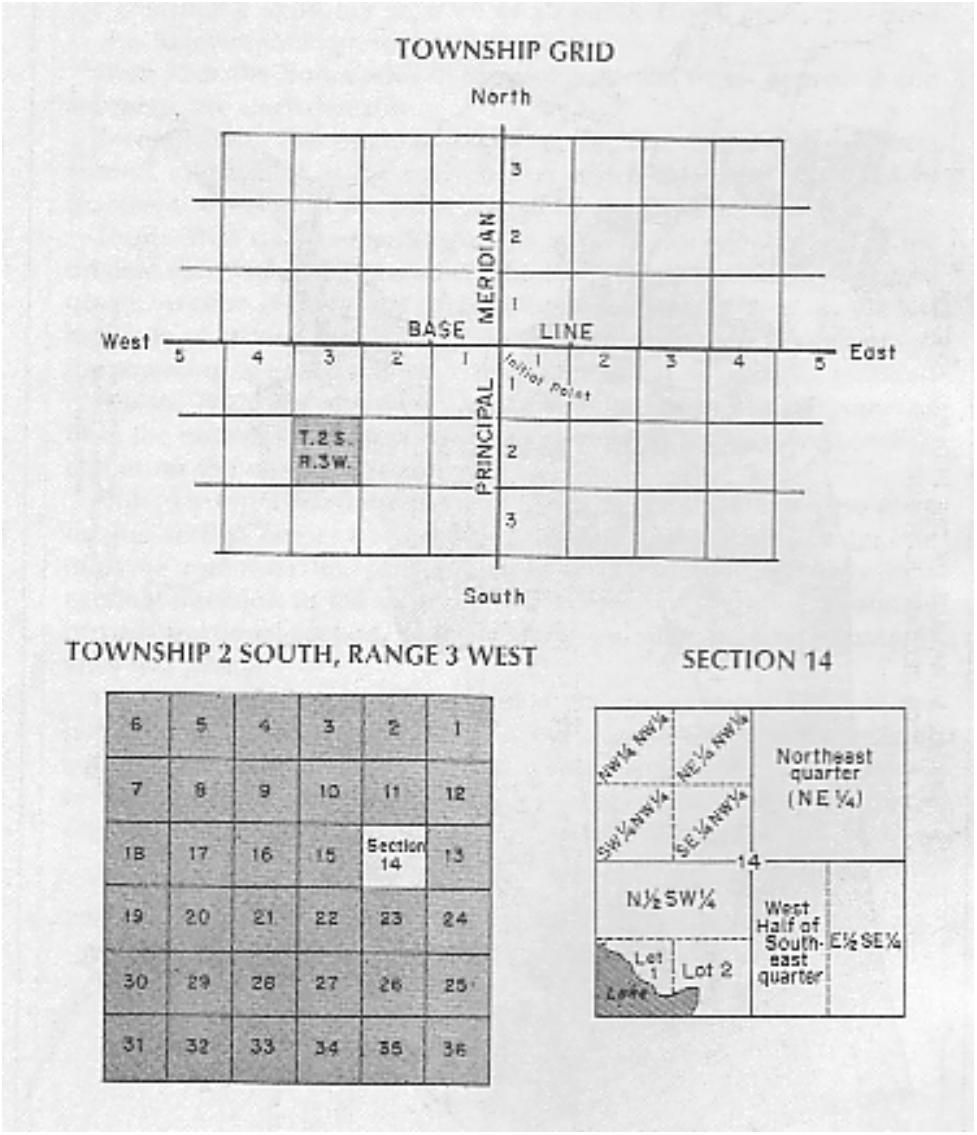
Fourth: That the center lines of a section are to be straight, running from the quarter-section corner on one boundary to the corresponding corner on the opposite boundary.

Fifth: That in a fractional section where no opposite corresponding quarter-section corner has been or can be established, the center line must be run from the proper quarter-section corner as nearly in a cardinal direction to the meander line, reservation, or other boundary of such fractional section, as due parallelism with the section boundaries will permit.

From the foregoing it will be evident that corners established in the public land surveys remain fixed in position and are unchangeable; and that lost or obliterated corners of those surveys must be restored to their original locations from the best available evidence of the official survey in which such corners were established.


PRINCIPAL MERIDIANS
OF THE FEDERAL SYSTEM
OF RECTANGULAR SURVEYS
STATE OF OHIO ENLARGED
Connecticut Western Reserve
Symmes Purchase
Ohio Co Purchase
Virginia Military Survey
Point of Beginning of the Rectangular System of Surveys
WASHINGTON
OREGON
CALIFORNIA
NEVADA
IDAHO
MONTANA
WYOMING
COLORADO
UTAH
ARIZONA
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WIS
MICH
ILL
OHIO
KENTUCKY
TENNESSEE
MISS
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
W VA
PENNSYLVANIA
NEW YORK
MAINE
VT
NH
MASS
CONN
R.I
N.J
DEL
MD
ALASKA
STATUTE MILES
NOTE: The shading shows the area governed by each principal meridian and its base line.

GENERALIZED DIAGRAM OF
THE RECTANGULAR SYSTEM OF SURVEYS



RESTORATION OF LOST OR OBLITERATED CORNERS

The restoration of lost corners should not be undertaken until after all control has been developed; such control includes both original and acceptable collateral evidence. However, the methods of proportionate measurement will be of material aid in the recovery of evidence.

1. An existent corner is one whose position can be identified by verifying the evidence of the monument, or its accessories, by reference to the description that is contained in the field notes, or where the point can be located by an acceptable supplemental survey record, some physical evidence, or testimony.

Even though its physical evidence may have entirely disappeared, a corner will not be regarded as lost if its position can be recovered through the testimony of one or more witnesses who have a dependable knowledge of the original location.

Marks on old stone section corners. The notches or grooves indicate the number of miles from the south and east boundaries of the township, respectively.

2. An obliterated corner is one at whose point there are no remaining traces of the monument, or its accessories, but whose location has been perpetuated, or the point for which may be recovered beyond reasonable doubt, by the acts and testimony of the interested landowners, competent surveyors, or other qualified local authorities, or witnesses, or by some acceptable record evidence.

A position based upon collateral evidence should be duly supported, generally through proper relation to known corners, and agreement with the field notes regarding distances to natural objects, stream crossings, line trees, and off-line tree blazes, etc., or unquestionable testimony.

3. A lost corner is a point of a survey whose position cannot be determined, beyond reasonable doubt, either from traces of the original marks or from acceptable evidence or testimony that bears upon the original position, and whose location can be restored only by reference to one or more interdependent corners.

If there is some acceptable evidence of the original location of the corner, that position will be employed.

Decision that a corner is lost should not be made until every means has been exercised that might aid in identifying its true original position. The retracements, which are usually begun at known corners, and run according to the record of the original survey, will indicate the probable position for the corner, and show what discrepancies may be expected. Any supplemental survey record or testimony should then be considered in the light of the facts thus developed. A line will not be regarded as doubtful if the retracement affords recovery or acceptable evidence.

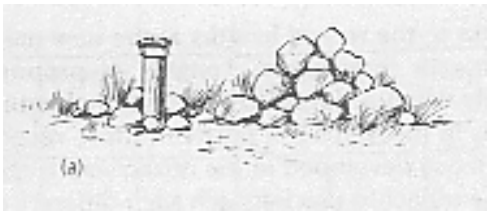
In cases where the probable position for a corner cannot be made to harmonize with some of the calls of the field notes, due to errors in description or to discrepancies in measurement developed in the retracement, it must be ascertained which of the calls for distances along the line are entitled to the greater weight. Aside from the technique of recovering traces of the original marks, the main problem is one that treats with the discrepancies in alinement and measurement. (See p. 33.)

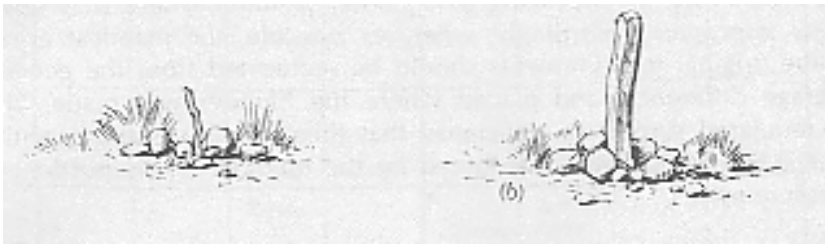
4. Existing original corners cannot be disturbed; consequently, discrepancies between the new and the record measurements will not in any manner affect the measurements beyond the identified corners, but the differences will be distributed proportionately within the several intervals along the line between the corners.

PROPORTIONATE MEASUREMENT

The ordinary field problem consists of distributing the excess or deficiency in measurement between existent corners in such a manner that the amount given to each interval shall bear the same proportion to the whole difference as the record length of the interval bears to the whole record distance. After having applied the proportionate difference to the record length of each interval the sum of the several parts will equal the new measurements of the whole distance.

5. A proportionate measurement is one that gives concordant relation between all parts of the line, i.e.–-the new values given to the several parts, as determined by the remeasurement, shall bear the same relation to the record lengths as the new measurement of the whole line bears to that record. Lengths of proportioned lines are comparable only when reduced to their cardinal equivalents.





Corner monuments of the public land surveys. Reading from top of page: (a) Modern iron post with brass cap, and mound of stone; (b) wooden posts, the one on left not much more than a twig; (c) wooden post, showing decay at ground line; (d) corner monument obliterated, remnants of stone mounds identify corner position; (e) corner monument obliterated, evidence of old pits fixes corner position.

Discrepancies in measurement between those recorded in the original survey and those developed in the retracements should be carefully verified with the object to placing each such difference properly where it belongs. This is quite important at times, because, if disregarded, the result may be fixing of a corner position where it is obviously improper. Accordingly, wherever possible, the manifest errors in the original measurements should be segregated from the general average difference, and placed where the blunder was made. The accumulated surplus or deficiency that then remains is the quantity that is to be uniformly distributed by the methods of proportionate measurement.

SINGLE PROPORTION

6. The term "single proportionate measurement" is applied to a new measurement made on a line to determine one or more positions on that line.

In single proportionate measurement, the position of two identified corners controls the direction of the line between those corners, and intermediate positions on that line are determined by proportionate measurement between those controlling corners. The method is sometimes referred to as a "two-way" proportion. Examples: a quarter-section corner on the line between two section corners; all corners on standard parallels; and all intermediate positions on any township boundary line.

DOUBLE PROPORTION

7. The term "double proportionate measurement" is applied to a new measurement made between four known corners, two each on intersecting meridional and latitudinal lines, for the purpose of relating the intersection to both.

By double proportionate measurement, the lost corner is reestablished on the basis of measurement only, disregarding the record directions. An exception will be found in those cases where there is some acceptable survey record, some physical evidence, or testimony, that may be brought into the control. The method may be referred to as a "four-way" proportion. Examples: a corner common to four townships, or one common to four sections within a township.

The double proportionate measurement is the best example of the principal that existent or known corners to the north and to the south should control any intermediate latitudinal position, and that corners east and west should control any intermediate latitudinal position, and that corners east and west should control the position in longitude.

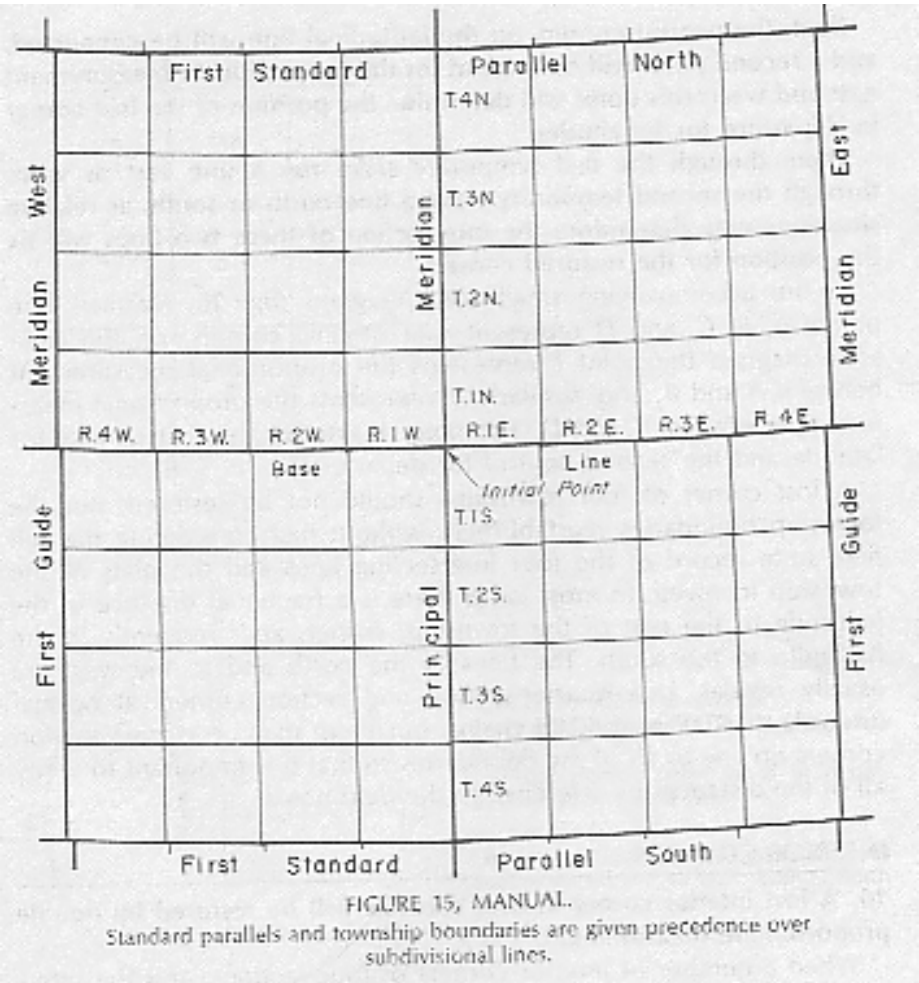


FIGURE 15, MANUAL.
Standard parallels and township boundaries are given precedence over subdivisional lines.

As between single or double proportionate measurement, the principle of precedence of one line over another of less original importance is recognized, in order to harmonize the restoring process with the method followed in the original survey, thus limiting the control.

STANDARD PARALLELS AND TOWNSHIP BOUNDARIES

8. Standard parallels will be given precedence over other township exteriors, and ordinarily the latter will be given precedence over subdivisional lines; section corners will be relocated before the position of lost quarter-section corners can be determined.

9. In order to restore a lost corner of four townships, a retracement will first be made between the nearest known corners on the meridional line, north and south of the missing corners, and upon that line a temporary stake will be placed at the proper proportionate distance; this will determine the latitude of the lost corner.

Next, the nearest corners on the latitudinal line will be connected, and a second point will be marked for the proportionate measurement east and west; this point will determine the position of the lost corner in departure (or longitude).

Then, through the first temporary stake run a line east or west, through the second temporary stake a line north or south, as relative situations may determine; the intersection of these two lines will fix the position for the restored corner.

In the accompanying small scale diagram (fig. 70, Manual), the points A, B, C, and D represent four original corners; on the large scale diagram the point E represents the proportional measurement between A and B; and, similarly, F represents the proportional measurement between C and D. The point X satisfies the first control for latitude and the second control for departure.

A lost corner of four townships should not be restored, nor the township boundaries reestablished, without first considering the full field note record of the four intersecting lines and the plats of the township involved. In most cases there is a fractional distance in the half-mile to the east of the township, corner, and frequently in the half-mile to the south. The lines to the north and to the west are usually regular, i.e. --quarter-section and section corners at normal intervals of 40.00 and 80.00 chains, but there may be closing-section corners on any or all of the boundaries so that it is important to verify all of the distances by reference to the field notes.

INTERIOR CORNERS

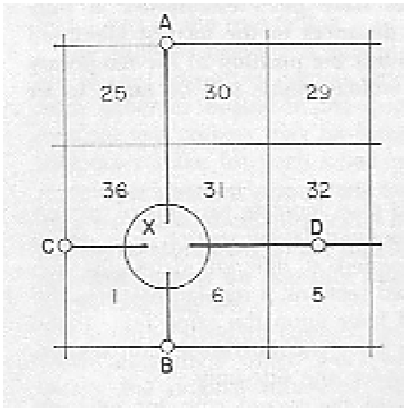
10. A lost interior corner of four sections will be restored by double proportionate measurement.

When a number of interior corners of four sections, and the intermediate quarter-section corners, are missing on all sides of the one sought to be established, the entire distance between the nearest identified corners both north and south, and east and west, must be measured. Lost section corners on the township exteriors, if required for control, should be relocated.

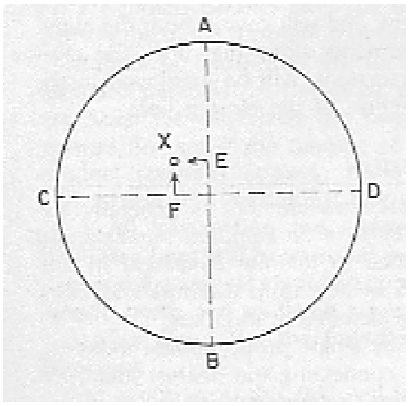
RECORD MEASUREMENT

11. Where the line has not been established in one direction from the missing township or section corner, the record distance will be used to the nearest identified corner in the opposite direction.

Thus, in the same diagram, if the latitudinal line in the direction of the point D has not been established, the position of the point F in departure would have been determined by reference to the record distance from the point C; the point X would then be fixed by cardinal offsets from the points E and F as already explained.

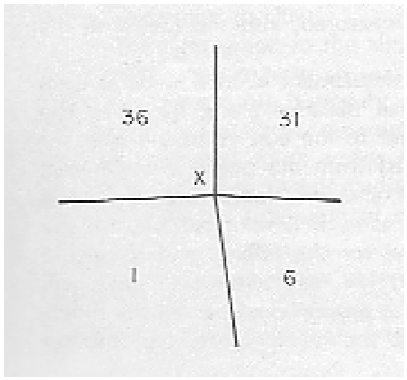


Lost township corner in vicinity of X



A, B, C, D,–Control corners
E–Proportionate point for X in latitude between A and B
F–Proportionate point for X in departure between C and D

Correct position of X is at intersection of lines extended East or West from E, North or South from F.



Restored corner showing true direction of township lines

FIGURE 70, MANUAL

12. Where the intersecting lines have been established in only two of the directions, the record distances to the nearest identified corners on these two lines will control the position of the temporary points; then from the latter the cardinal offsets will be made to fix the desired point of intersection.

TWO SETS OF CORNERS

In many surveys the field notes and plats indicate two sets of corners along township boundaries, and frequently along section lines where parts of the township were subdivided at different dates. In such cases there are usually corners of two sections at regular intervals, and closing section corners established later upon the same line, at the points of intersection of a closing line. The quarter-section corners on such lines usually are controlling for one side only.

In the more recent surveys, where the record calls for two sets of corners, those that are the corners of the two sections first established, and the quarter-section corners relating to the same sections, will be employed for the retracement, and will govern both the alinement and the proportional measurements along that line. The closing section corners, set at the intersections, will be employed in the usual way, i.e.--to govern the direction of the closing lines.

RESTORATION BY SINGLE PROPORTION

The method of single proportionate measurement is generally applicable to the restoration of lost corners on standard parallels and other lines established with reference to definite alinement in one direction only. Intermediate corners on township exteriors and other controlling boundary lines are to be included in this class.

In order to restore a lost corner by single proportionate measurement, a retracement will be made connecting the nearest identified regular corners on the line in question; a temporary stake (or stakes) will be set on the trial line at the original record distance, (or distances); the total distance will be measured, also the falling at the objective corner.

On meridional township lines an adjustment will be made at each temporary stake for the proportional distance along the line. The temporary stake then will be set over to the east or to the west for falling, counting its proportional part from the point of beginning.

On east-and-west township lines and on standard parallels the proper adjustment should be made at each temporary stake for the proportional distance along the line, for the falling, and to secure the latitudinal curve (see Manual[1]); i.e.-—the temporary stake will be either advanced or set back for the proportional part of the difference between the record distance and the new measurement, then set over the curvature of the line, and last corrected for the proportional part of the true falling.

[1] Secs. 2-75 to 2-78, inclusive; the true latitudinal curve. Secs. 3-17 to 3-30, inclusive; the running of township exteriors. The term latitudinal curve as there employed denotes as easterly westerly line properly adjusted to the same mean bearing from each monument to the next one in regular order, as distinguished from the long chord or great circle that would connect the initial and terminal points.

The adjusted position is thus placed on the true line that connects the nearest identified corners, and at the same proportional interval from either as existed in the original survey. Any number of intermediate lost corners may be located on the same plan, by setting a temporary stake for each when making the retracement.

13. Lost standard corners will be restored to their original positions on a base line, standard parallel or correction line, by single proportionate measurement on the true line connecting the nearest identified standard corners on opposite sides of the missing corner or corners, as the case may be.

The term “standard corners”, as used above, will be understood to mean all corners which were established on the standard parallel during the original survey of that line, including, but not limited to, standard township, section, quarter-section, meander, and closing corners. Closing corners, or other corners purported to be established on a standard parallel after the original survey of that line, will not control the initial restoration of lost standard corners.

Corners on base lines are to be regarded the same as those on standard parallels. In the older practice the term “correction line” was used for what later has been called the standard parallel. The corners first set in the running of a correction line will be treated as original standard corners; those that were set afterwards at the intersection of a meridional line will be regarded as closing corners.

14. All lost section and quarter-section corners on the township boundary lines will be restored by single proportionate measurement between the nearest identified corners on opposite sides of the missing corner, north and south on a meridional line, or east and west on a latitudinal line, after the township corners have been identified or relocated.

An exception to this rule will be found in the cae of any exterior the record of which shows deflections in alinement between the township corners (p. 20).

A second exception to the above rule is found in those occasional cases where there may be persuasive proof of a deflection in the alinement of the township boundary, though the record shows the line to be straight. For example, measurements east and west across a range line, or north and south across a latitudinal township line, counting from a straight-line exterior adjustment, may show distances to the nearest identified subdivisional corners to be materially long in one direction and correspondingly short in the opposite direction as compared to the record measurements. This condition, when supported by corroborative collateral evidence as might generally be expected, would warrant an exception to the straight-line or two-way adjustment under the rules for the acceptance of evidence, i.e.—the evidence outweighs the record. See Retracements. The rules for a four-way or double proportionate measurement would then apply, provided there is conclusive proof.

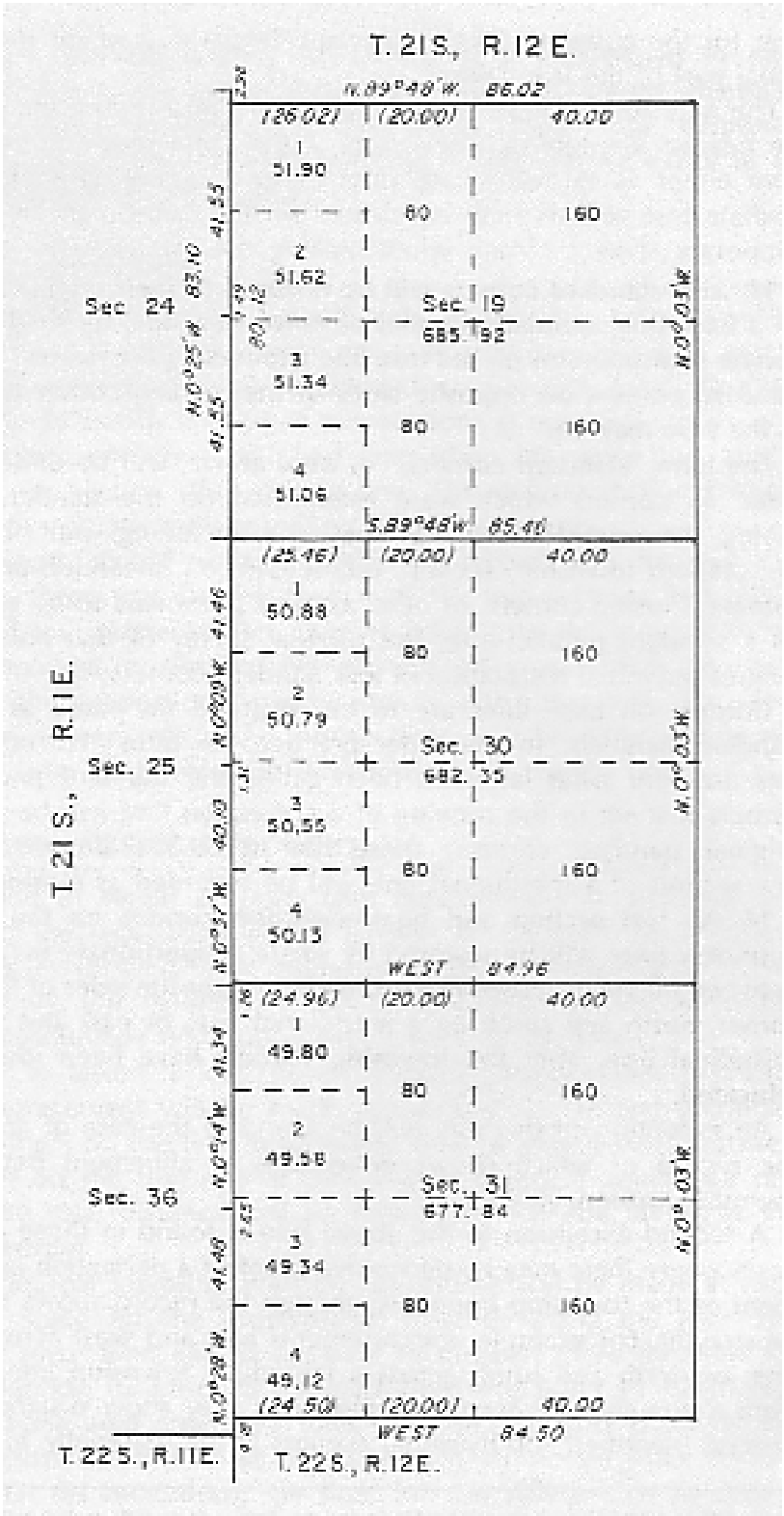


FIGURE 81, MANUAL

Two sets of corners on an irregular township boundary.

15. All lost quarter-section corners on the section boundaries within the township will be restored by single proportionate measurement between the adjoining section corners, after the section corners have been identified or relocated.

This practice is applicable in the majority of the cases. However, in those instances where other corners such as meander corners, sixteenth-section corners, etc., were originally established between the quarter-section and the section corners, such minor corners, when identified, will exercise control in the restoration of lost quarter-section corners.

16. Lost meander corners, originally established on a line projected across the meanderable body of water and marked upon both sides will be relocated by single proportionate measurement, after the section or quarter-section corners upon the opposite sides of the missing meander corner have been duly identified or relocated.

Under ordinary conditions, the actual shore line of a body of water is considered the boundary of lands included in an entry and patent, rather than the meander line returned in the field notes. It follows that the restoration of a lost meander corner would be required only infrequently. Under favorable conditions a lost meander corner may be restored by treating the shoreline as an identified natural feature which controls the measurement to the point for the corner; this is particularly applicable where it is evident that there has been no change in the shore line.

17. A lost closing corner will be reestablished on the true line that was closed upon, and at the proper proportional interval between the nearest regular corners to the right and left.

In order to reestablish a lost closing corner on a standard parallel or other controlling boundary, the line that was closed upon will be retraced, beginning at the corner from which the connecting measurement was originally made, itself properly identified or relocated; a temporary stake will be set at the record connecting distance, and the total distance and falling will be noted at the next regular corner on that line on the opposite side of the missing closing corner; the temporary stake will then be adjusted as in single proportionate measure (p. 33).

A closing corner not actually located on the line that was closed upon will determine the direction of the closing line, but not its legal terminus; the correct position is at the true point of intersection of the two lines.

IRREGULAR EXTERIORS

Some township boundaries, not established as straight lines, are termed “irregular” exteriors. Parts were surveyed from opposite directions, and the intermediate portion was completed later by random and true line, leaving a fractional distance. Such irregularity follows some material departure from the basic rules for the establishment of original surveys. A modified form of single proportionate measurement is used in restoring list corners on such boundaries. This is also applicable to a section line or a township line which has been shown to be irregular by a previous retracement. Figure 71.

In order to restore one or more lost corners or angle points on such irregular exteriors, a retracement between the nearest known corners is made on the record courses and distances to ascertain the direction and length of the closing distance. A temporary stake is set for each missing corner or angle point. The closing distance is then reduced to its equivalent latitude and departure.

On a meridional line the latitude of the closing distance is distributed among the courses in proportion to the latitude of each course. The departure of the closing distance is distributed among the courses in proportion to the length of each course. That is, after the excess or deficiency of latitude is distributed, each temporary stake is moved east or west an amount proportional to the total distance from the starting point.

On a latitudinal line the temporary stakes should be placed to suit the usual adjustments for the curvature. The departure of the closing distance is distributed among the courses in proportion to the departure of each course. Then each temporary stake is moved north or south an amount proportional to the total distance from the starting point.

Angle points and intermediate corners will be treated alike.

ONE-POINT CONTROL

18. Where a line has been terminated with measurement in one direction only, a lost corner will be restored by record bearing and distance, counting from the nearest regular corner, the latter having been duly identified or restored.

Examples will be found where lines have been discontinued at the intersection with large meanderable bodies of water, or at the border of what was classified as impassable ground.

INDEX ERRORS FOR ALINEMENT AND MEASUREMENT

Where the original surveys were faithfully executed, it is to be anticipated that retracement of many miles of the lines in a given township will develop a definite and consistent difference in measurement and in a bearing between original corners, such as to establish a characteristic of the original survey. Under such conditions it is proper that allowance be made for the average differences in the restoration of a lost corner where control is lacking on one direction. The adjustment will be taken care of automatically where there is a suitable basis for proportional measurement.

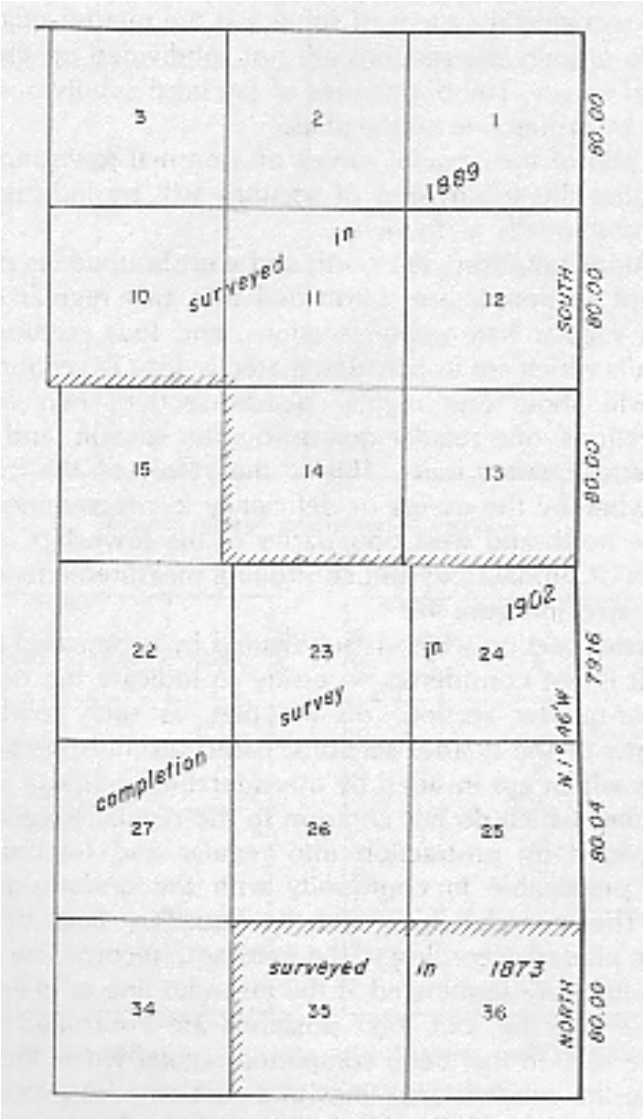


FIGURE 71, MANUAL
Irregular exterior resulting from the piecemeal survey of a township line.

SUBDIVISION OF SECTIONS

The fundamental principles for the subdivision of sections are derived from secs. 2396 and 2397, Revised Statutes (43. U. S. C., secs 752, 753). The ordinary unit of administration of the public lands under the rectangular system of surveys is the quarter-quarter section of 40 acres. Usually the sections are not subdivided on the ground in the original survey. The boundaries of the legal subdivisions generally are shown by protraction on the plats.

On the plat of the original survey of a normal township, it is to be expected that the subdivision of sections will be indicated, by protraction, substantially as follows:

The sections bordering the north and west boundaries of the township, except section 6, are subdivided into two regular quarter-sections, two regular half-quarter sections, and four fractional quarter-quarter units which are usually designated as lots. In section 6, the subdivision will show one regular quarter-section, two regular half-quarter sections, one regular quarter-quarter section, and seven fractional quarter-quarter units. This is a result of the plan of subdivision, whereby the excess or deficiency in measurement is placed against the north and west boundaries of the township.

The plan of subdivisions and controlling measurements employed is well illustrated in figure 46.

In a normal section which is subdivided by protraction into quarter sections, it is not considered necessary to indicate the boundaries of the quarter-quarter sections on the plat, as such subdivisions are aliquot parts of the quarter sections, based on mid-point protraction.

Sections which are invaded by meanderable bodies of water, or by private claims which do not conform to the regular legal subdivisions, are subdivided by protraction into regular and fractional parts as nearly as practicable in conformity with the uniform plan already outlined. The meander lines, and boundary lines of the private claims, are platted according to the field note record. The subdivision-of-section lines are terminated at the meander line or claim boundary, as the case may be, but their positions are controlled precisely as though the section had been completed regularly. For the purpose of protracting the subdivisional lines in a section whose boundary lines are partly within the limits of a meanderable body of water, or private claim, the fractional section boundaries are completed in theory; the protracted position of the subdivision-of-section lines is controlled by the theoretical points so determined. (See fig. 47.)

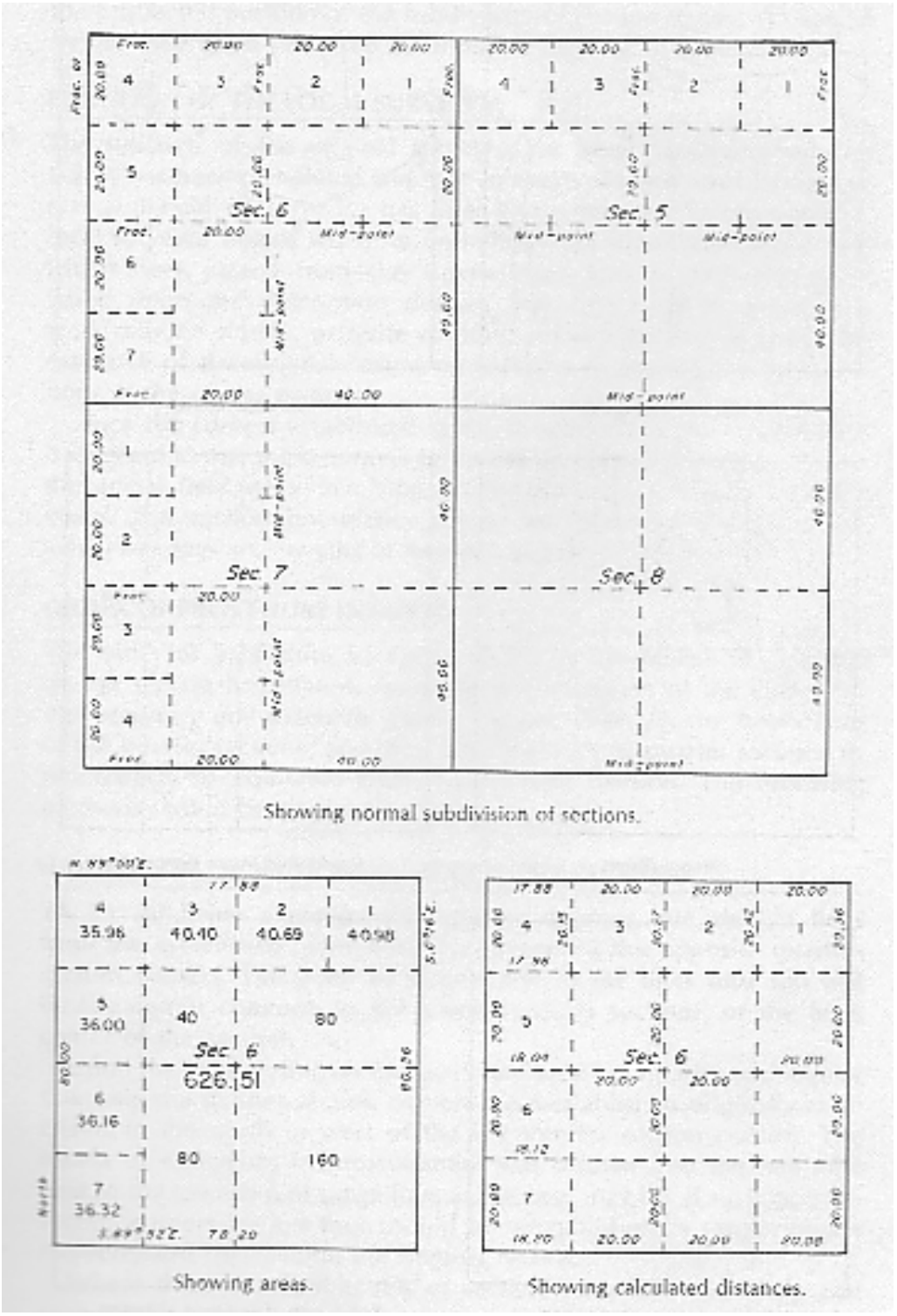


FIGURE 46, MANUAL
Examples of subdivision by protraction

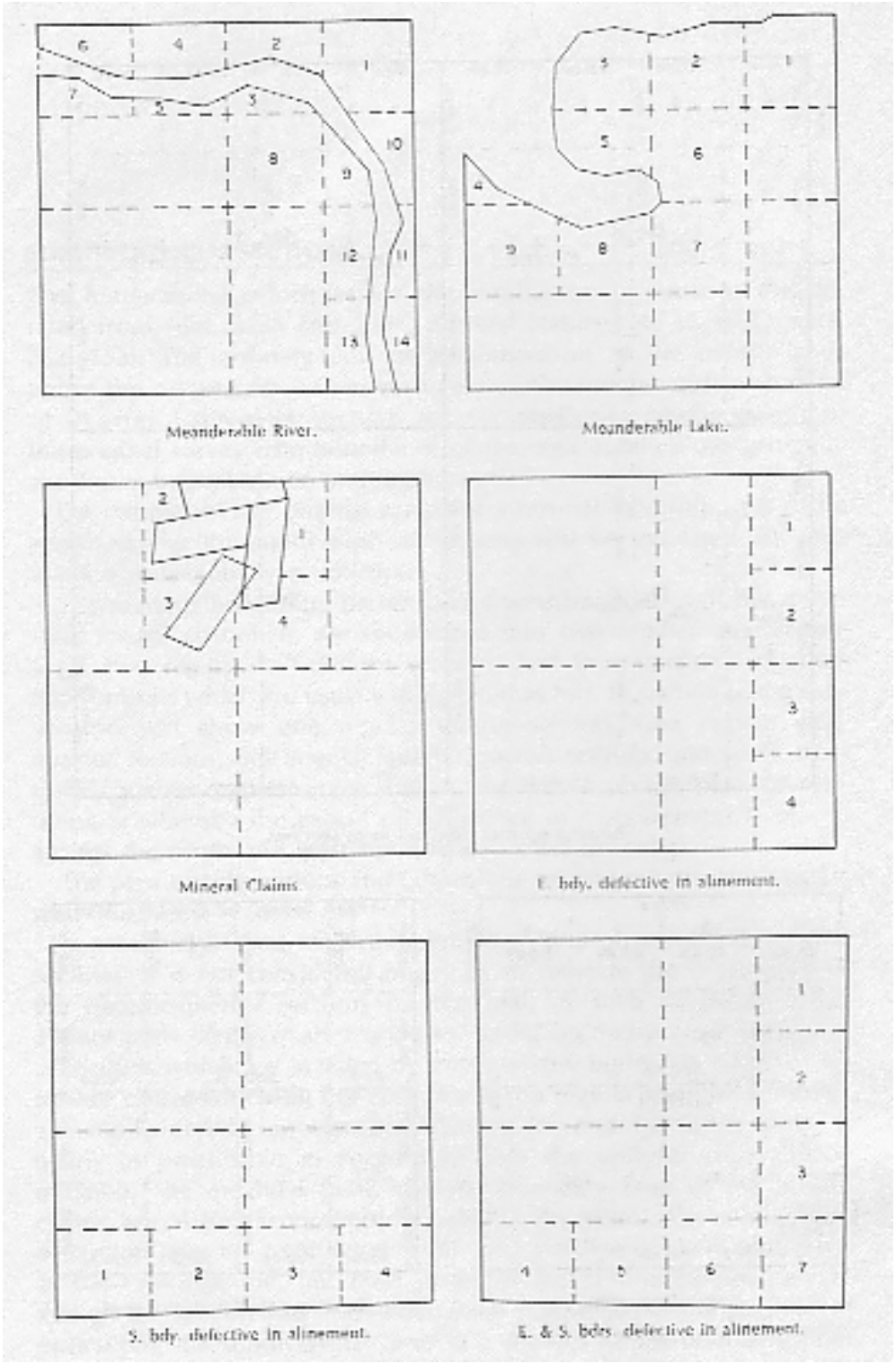


FIGURE 47,

MANUAL
Examples of subdivision of fractional sections

FUNCTION OF THE LOCAL SURVEYOR

The function of the original surveyor has been fulfilled when the survey has been completed and monumented properly, and the official plat and field note record has been prepared. The function of the local surveyor begins when he undertakes the identification of lands which have passed from the Government into private ownership, based upon the description derived from the original survey. His work may be simple, or quite complex, depending largely upon the existence of the original corner monuments or acceptable perpetuations of the corner positions.

Since the corners established in the original survey are controlling, it is essential that these corners be found, or properly restored, before the actual field work involving the subdivision-of-section is undertaken. The section boundaries should be retraced to develop the actual bearings and lengths of the lines between the corners.

ORDER OF PROCEDURE IN SURVEY

The order of procedure is: First, identify or reestablish the corners on the section boundaries, including determination of the points for the necessary one-sixteenth section corners. Next, fix the boundaries of the quarter sections; and then form the quarter-quarter sections or small tracts by equitable and proportionate division. The following methods should be employed:

SUBDIVISION OF SECTIONS INTO QUARTER SECTIONS

19. To subdivide a section into quarter sections, run straight lines from the established quarter-section corners to the opposite quarter-section corners. The point of intersection of the lines thus run will be the corner common to the several quarter sections, or the legal center of the section.

Upon the lines closing on the north and west boundaries of a regular township the quarter-section corners were established originally at 40 chains to the north or west of the last interior section corners. The excess or deficiency in measurement was thrown into the half-mile next to the township or range line, as the case may be. If such quarter-section corners are lost, they should be reestablished by proportionate measurement based upon the original record.

Where there are double sets of section corners on the township and range lines, the quarter-section corners for the sections south of the township line and east of the range line usually were not established in the original surveys. In subdividing such sections, new quarter-section corners are required, so placed as to suit the calculations of the areas that adjoin the township boundary, as indicated upon the official plat, adopting proportional measurements where the new measurements of the north or west boundaries of the section differ from the record distances (pp. 16 and 30).

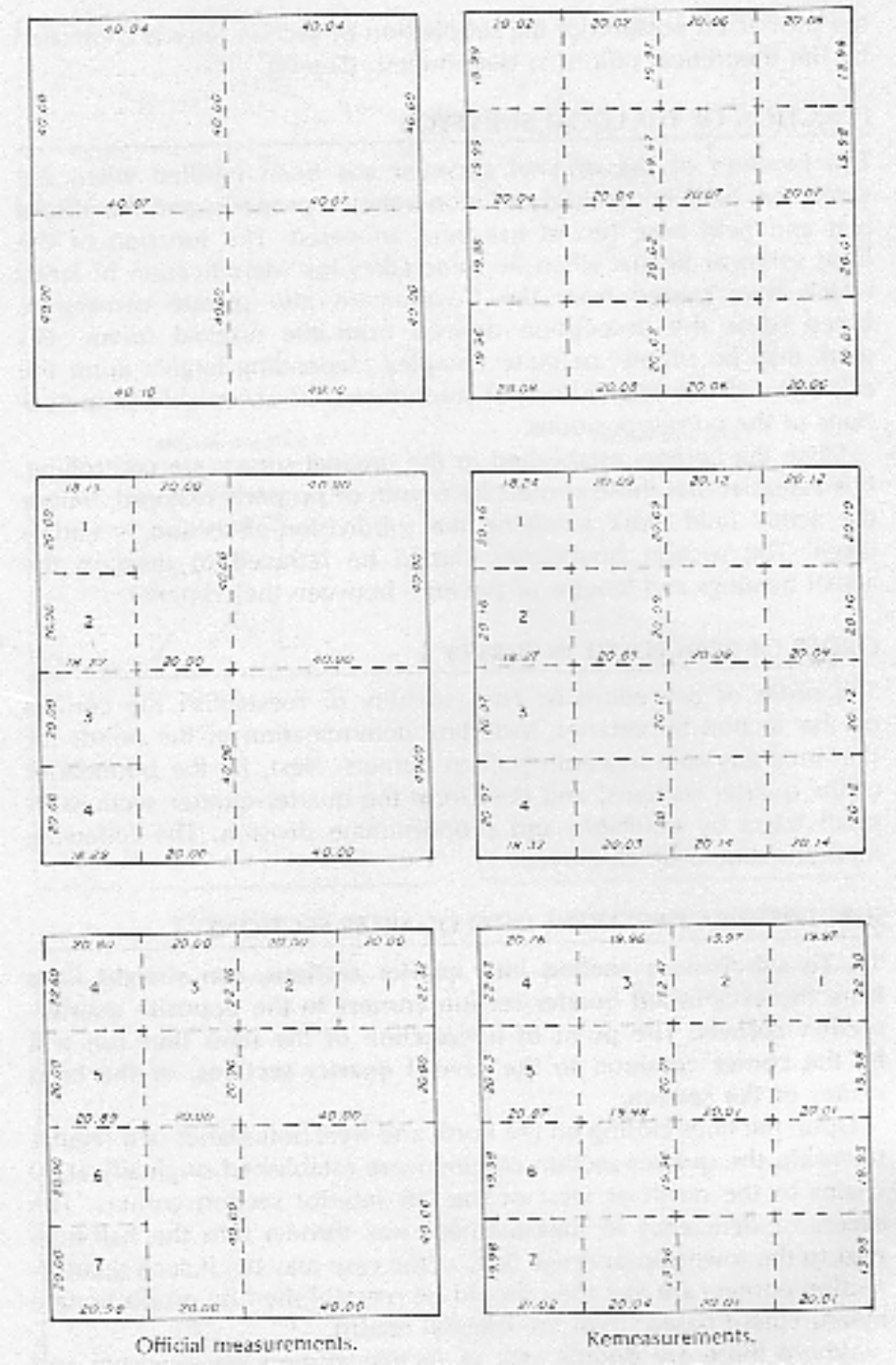


FIGURE 50, MANUAL
Examples of subdivision by survey showing relation of official measurements and calculated distances to remeasurements, and indicating proportional distribution of differences.

SUBDIVISION OF FRACTIONAL SECTIONS

20. The law provides that where opposite corresponding quarter-section corners have not been or cannot be fixed, the subdivision-of-section lines shall be ascertained by running from the established corners north, south, east, or west, as the case may be, to the water course, reservation line, or other boundary of such fractional sections represented upon the official plat.

In this, the law presumes that the section lines are due north and south, or east and west lines, but usually this is not the case. Hence, in order to carry out the spirit of the law, it will be necessary in running the center lines through fractional sections to adopt mean courses, where the section lines are not on due cardinal, or to run parallel to the east, south, west, or north boundary of the section, as conditions may require, where there is no opposite section line.

SUBDIVISION OF QUARTER SECTIONS

21. Preliminary to the subdivision of quarter sections, the quarter-quarter, or sixteenth-section corners will be established at points midway between the section and quarter-section corners, and the center of the section, except on the last half mile of the lines closing on township boundaries, where they should be placed at 20 chains, proportionate measurement, counting from the regular quarter-section corner.

The quarter-quarter, or sixteenth-section corners having been established as directed above, the center lines of the quarter section will be run straight between opposite corresponding quarter-quarter, sixteenth section corners on the quarter-section boundaries. The intersection of the lines thus run will determine the legal center of a quarter section. (See fig. 50.)

SUBDIVISION OF FRACTIONAL QUARTER SECTIONS

22. The subdivisional lines of fractional quarter sections will be run from properly established quarter-quarter, or sixteenth-section corners, with courses governed by the conditions represented upon the official plat, to the lake, water-course, reservation, or other irregular boundary which renders such sections fractional.

What has been written on the subject of subdivision of sections relates to the procedure contemplated by law, and refers to the methods to be followed in the initial subdivision of the areas, prior to development and improvement. It must be borne in mind that care should be exercised to avoid disturbing, satisfactory conditions as to roads, fences, or other improvements marking subdivision-of-section lines and which may define the extent of property rights.

RETRACEMENTS

Where the surveyor is called upon to retrace the lines of the rectangular public land surveys, the problem requires a careful study of the record data. The first step is to assemble copies of the field notes and plats, and determine the names of the owners who will be concerned in the retracement and survey. A thorough search and inquiry with regard to the record of any additional surveys that have been made since the approval of the original survey should be made. The county surveyor, county clerk, register of deeds, practicing engineers and surveyors, landowners, and others who may furnish useful information should be consulted as to such features.

The matter of boundary disputes should be carefully reviewed, particularly as to whether claimants have based their locations upon evidence of the original survey and a proper application of surveying rules. If there has been a boundary suit, the record testimony and the court's opinion and decree should be carefully examined insofar as these may have a bearing upon the problem in hand.

The law requires that the position of original corners shall not be changed. There is a penalty for defacing corner marks, and for changing or removing a corner. (See inside front cover.) The corner monuments afford the principal means for identification of the survey, and accordingly, the courts attach the greatest weight to the evidence of their location. Discrepancies that may be developed in the directions and length of lines, as compared with the original record, do not warrant any alteration of a corner position (p. 10).

Obviously, on account of roadways or other improvements, it is necessary frequently to reconstruct a monument in some manner in order to preserve its position. Alterations of that kind are not regarded as changes in willful violation of the law, but rather as being in complete accord with the legal intent to safeguard the evidence (p. 37).

Therefore, whatever the purpose of the retracement may be–-if it calls for the recovery of the true lines of the original survey, or for the running of the subdivisional lines of a section, the practices outlined require some or all of certain definite steps, as follows:

a. Secure a copy of the original plat and field notes;
b. Secure all available data regarding subsequent surveys;
c. Secure the names and contact the owners of the property adjacent to the lines that are involved in the retracement
d. Find the corners that may be required:
    First: By the remaining physical evidence;
    Second: By collateral evidence, supplemental survey records, or testimony, if the original monument is regarded as obliterated, but not lost, or;
    Third: By application of the rules for proportionate measurement, if lost;
e. Reconstruct the monuments as required, including the placing of reference markers where improvements of any kind might interfere, or if the site is such as to suggest the need for supplemental monumentation;
f. Note the procedure for the subdivision of sections where these lines are to be run and

g. Prepare and file[1] a suitable record of what was found, the supplemental data that was employed, a description of the methods used, the direction and length of lines, the new markers, and any other facts regarded as important.

A knowledge of the practices and instructions in effect at the time of the original survey will be helpful. These should indicate what was required and how it was intended that the original survey should be made.

The data used in connection with the retracements should not be limited to the section or sections under immediate consideration. It should also embrace the areas adjacent to those sections. The plats should be studied carefully; fractional parts of sections should be located on the ground as indicated on the plats.

DOUBLE SETS OF CORNERS

The technique of making field astronomical observations for determinations of the true meridian, and methods for establishment of the true latitudinal curve, were not developed so as to be generally applied for many years after the inception of the rectangular survey system. Without these refinements, and lacking accuracy in the measurement of lines, accumulated discrepancies were bound to develop.

As a result, in order to maintain rectangularity in some of the older surveys, two sets of corners were established on the township boundaries. The section and quarter-section corners established in the survey of the boundary itself are the corners to be adopted in retracement and for control of proportionate measurements. These corners control the subdivisions on one side only of the township boundary. The second set of corners on these boundaries are the closing section corners for the subdivisional surveys on the opposite side of the boundary. The descriptions of these closing corners, and the connecting distances to the regular township boundary corners, will be found in the field notes of the subdivisional survey in which they were established. These closing section corners should be considered and evaluated as evidence in the solution of the whole problem.

[1] In many of the states there is a well established practice for the filing of field notes and plats of surveys, usually in one of the county offices. Otherwise, the record ordinarily would be filed as an exhibit with a deed, or agreement, or court decree, etc.

Where the section corners on the township boundaries are of minimum control, the quarter-section corners have the same status for the same side of the boundary. In the older surveys, quarter-section corners usually were not established for the opposite side of the boundary. Subsequent to 1919 it has been the practice to establish the second set of quarter-section corners. These are at midpoint for distances between the closing section corners, except where the plan of subdivision dictates otherwise, in which event the quarter-section corner is placed at 40.00 chains from the controlling closing corner.

These conditions merit careful study of the plats to the end that the subdivisions shown on the plats be given proper protection. The plats will indicate whether these quarter-section corners should be at mid-point between the closing corners, or if they should be located with regard to a fractional distance. The surveyor should make sure that the position is determined for all corners necessary for control in his work.

There is nothing especially different or complicated in the matter of one or two sets of corners on the township boundary lines. It is merely a question of assembling the complete data and of making a proper interpretation of the status of each monument.

The same principles should be applied in the consideration of the data of the subdivisional surveys, where for any of several causes there may be two sets of interior corners.

THE NEEDLE COMPASS AND SOLAR COMPASS

It should be noted that very simple needle-compass equipment in the hands of men skilled as surveyors, coupled with natural woodcraft and faithfulness in doing their work, satisfied the requirements of the colonial and early public-land surveys.

From the start of the public-land surveys, it was intended that the directions of lines be referred to the true meridian. In the early days, there was a general lack of familiarity with exact methods necessary to attain that purpose. The solar compass was designed by William A. Burt, United States Surveyor of Michigan and Iowa, and introduced in 1836. The instrument was an outstanding improvement over the needle compass, and gave accurate determinations of the meridian in the hands of Burt and others closely associated with him. The solar compass did not come into general use for nearly 50 years. Beginning with the Manual of 1890, the use of the magnetic needle was prohibited except for subdividing and meandering, and then only in localities that were supposed to be free from local attraction. Beginning with the Manual of 1894, the needle compass was entirely discontinued on all public land surveys. Most surveys are now being made with the improved solar transit. Where it is practicable, even more modern instruments such as one-second theodolites, gyroscopic compasses, and electronic distance measuring devices are employed, often in combination with photogrammetry.

It is not the purpose here to supply instructions for the use of the needle compass, but rather to point out what may be expected regarding the directions of the

lines of the early needle-compass surveys when compared with the more dependable modern methods. A large proportion of surveys made prior to 1890 are of the needle compass type. It should be noted that retracements may be made, i.e.,–the evidence of the marks can be developed by needle-compass methods if properly employed. Some surveyors maintain that you can "follow the steps" of the original surveyor more closely by use of the needle compass than by more precise methods.

In addition to the uncertainties of local attraction and temporary magnetic disturbances, the use of the needle compass is exceedingly unreliable in the vicinity of power lines, pipelines, steel rails, steel framed structures of all kinds, and wire fences, etc. Its use is now much more restricted on account of these improvements. The needle compass is rapidly becoming obsolete as it fails to satisfy the present need for more exact retracements.

EXCESSIVE DISTORTION

The needle-compass surveys, before being discontinued, had extended into the region of magnetic ore deposits of the Lake Superior watershed in northern Michigan, Wisconsin, and Minnesota. Here many townships were surveyed, and the lands patented, in which the section boundaries are now found to be grossly distorted. There is no way in which to correct these lines, nor to make an estimate (except by retracement), of the extent of the irregularities, which involve excessive discrepancies both in the directions and lengths of lines.

Considerable experience is required in retracing and successfully developing the evidence of the lines and corners in these areas of excessive distortion. However, the procedure for restoration of lost corners and for the subdivision of sections is the same as in areas of more regularity.

Another feature to be considered in connection with the retracements is that the record may show that one surveyor ran the south boundary, a second the east boundary, and others the remaining exteriors and subdivisional lines. All of these lines may be reported on cardinal, but may not be exactly comparable, i. e. -- the east boundary may not be truly normal to the south boundary, etc. It was customary to retrace one or more miles of the east boundary of the township to determine the "variation" of the needle. This value was then adopted in the subdivision of the township. It follows that the meridional section lines should be found to be reasonably parallel with the east boundary. Under that plan of operation, it should be anticipated that the latitudinal section lines will be reasonably parallel with the south boundary; however, discrepancies in measurement on the meridional lines frequently affect such parallelism. For these reasons, the index corrections for bearings may not be the same for the east and west as for the north and south lines. The two classes should be considered separately in this respect.

Until after 1900, most of the lines were measured with the Gunter's link chain. The present surveyor must realize the difficulties of keeping that chain at standard length, and the inaccuracy of measuring steep slopes by this method. It is to be expected that the retracements will show various degrees of accuracy in the recorded

measurements which were intended to reflect true horizontal distances.

It is well to call attention, at this time, to the need for segregation of the manifest errors or blunders in the original measurements in order to minimize the effect of such errors in the restoration of lost corners. (See p. 10.) If the original field note record contains sufficient references to natural topographic items encountered along the line(s) being retraced such data frequently will be adequate for localizing the error.

INDEX ERRORS

Where the original surveys were faithfully made, generally there will be considerable uniformity in the directions and lengths of the lines. Frequently this uniformity is so definite as to indicate "index errors" which, if applied, to the record bearings and distances, will place the trial lines in close proximity to the true positions and aid materially in the search for evidence. With experience, the present surveyor will become familiar with the work of the original surveyor and know about what to expect in the way of such differences.

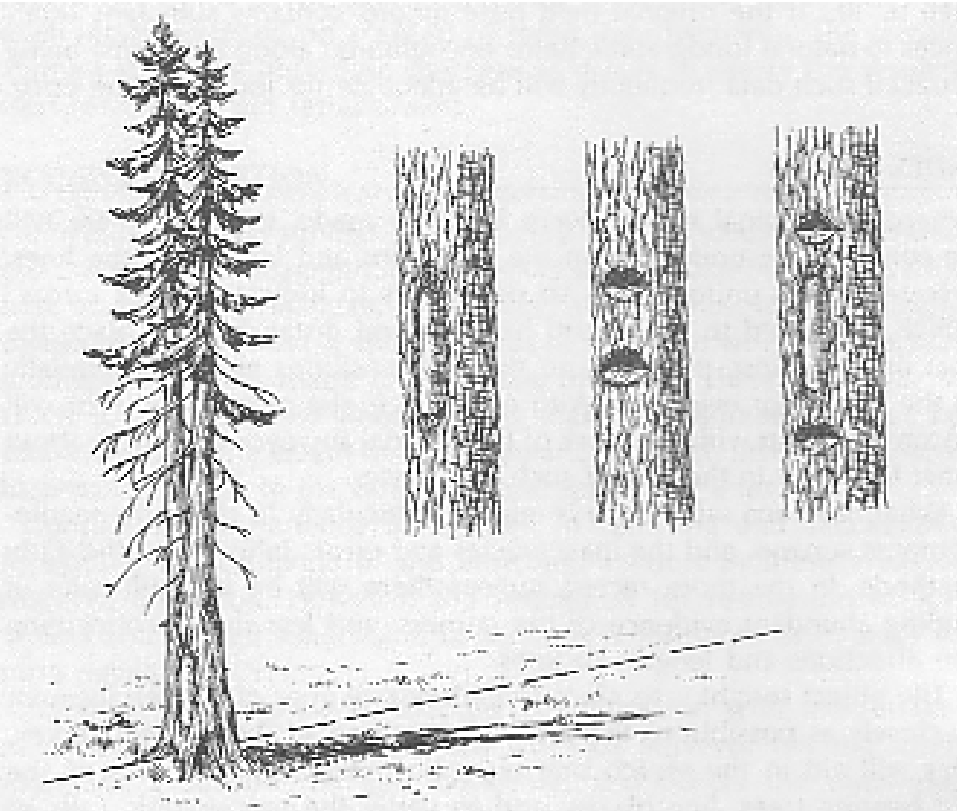
What has been said above is related particularly to the early needle-compass surveys, and the inaccuracies and errors inherent to the early methods. In the more recent surveys there will be less difficulty in finding abundant evidence of the corners, and less doubt concerning the directions and lengths of lines.

The object sought is to place the temporary lines of the retracement as closely as possible to the probable position of the original survey. This will aid in the search that must be made for the marks of the old bearing trees, line blazes, and to verify the topographic calls of the field notes. It must be emphasized that often there is no hope of finding obscure marks of the very old surveys except by experienced, intelligent search in the immediate vicinity of the lines.

COLLATERAL EVIDENCE

The identified corners of the original survey constitute the main control for the surveys to follow. After those corners have been located, and before resorting to proportionate measurement for restoration of lost corners, the other calls of the field notes should be considered. The recorded distances to stream crossings or to other natural objects which can now be identified often lead to the position for a missing corner. At this stage, the question of acceptance of later survey marks and records, the location of roads and property fences, and the reliability of testimony are to be considered.

A line tree, or a connection to some natural object, or to an improvement recorded in the original field notes, any of which can be identified, may fix a point of the original survey. The calls of the field notes for the various items of topography may assist materially in the recovery of the lines. The mean position of a blazed line, when identified as the original line, will place a meridional line for departure, or a latitudinal line for latitude. These are matters which require the exercise of considerable judgment.



The marks found on a line tree may be a blaze, a hack, or both.

ORIGINAL MARKS

Original line-tree marks, off-line tree blazes, and scribe marks on bearing trees and tree corner-monuments whose age exceeds 100 years, are found occasionally. Such marks of later surveys are recovered in much greater number. Different surveyors used distinctive marks.

Some surveyors used hacks instead of blazes, and some used hacks over and under the blazes; some employed distinctive forms of letters and figures. All these will be recognized while retracing the lines of the same survey and will serve to verify the identification of the work of a particular surveyor.

The field notes give the species and the diameter of the bearing trees and line trees. Some of the smooth-barked trees were marked on the surface, but most of the marks were made on a flat smoothed surface of the live wood tissue. The marks remain as long as the tree is sound. The blaze and marks will be covered by a gradual overgrowth, showing a scar for many years. The overgrowth will have a lamination similar to the annual rings of the tree, which may be counted in order to verify the date of making, and to distinguish the original marks from later marks and blazes. On the more recent surveys, it is to be expected that the complete quota of marks should be found, clear cut and plainly legible. This cannot be expected in the older surveys.

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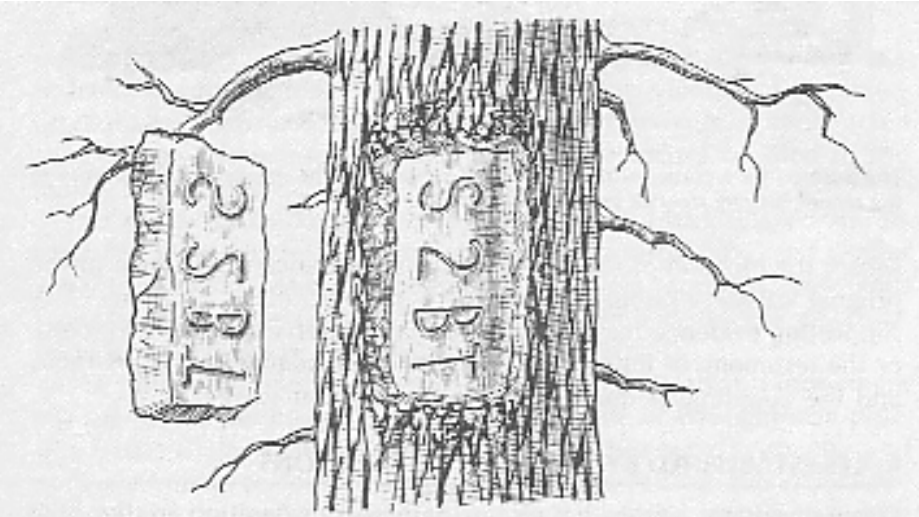
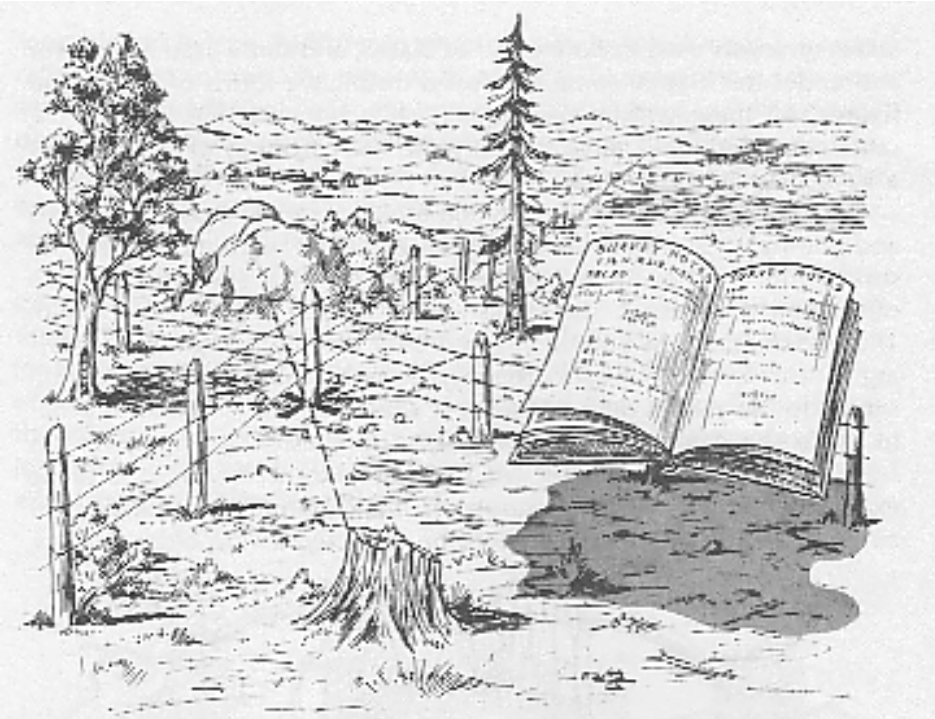


Old bearing tree with overgrowth removed. The original marks are preserved and appear in reverse and relief on the overgrowth.

It is advisable not to cut into a marked tree excepting as necessary to secure proof. The evidence is frequently so abundant, especially in the later surveys, that the proof is conclusive without inflicting an additional injury that would hasten the destruction of the tree.

The finding of the original scribe marks, line-tree hacks, and off-line tree blazes, furnishes the most convincing identification that can be desired.

It is not intended to disturb satisfactory local conditions with respect to roads and fences. The surveyor has no authority to change a property right that has been acquired legally. On the other hand, he should not accept the location of roads and fences as evidence prima facie of the original survey without something to support these locations. This supporting evidence may be found in some intervening survey record, or the testimony of individuals who may be acquainted with the facts, and the coupling of these things to the original survey.



The position for a corner of the public land surveys may be recovered by reference to the record bearing trees or bearing objects.

RULES ESTABLISHED BY STATE LAW OR DECISIONS

Other important factors that require careful consideration are the rules of the State law and State court decisions, as distinguished from the methods followed by the Bureau of Land Management. Under State law, property boundaries may be fixed by agreement between owners, acquiescence, or adverse possession. Such boundaries may be defined by roads, fences, or survey marks, disregarding exact conformation with the original section lines. The rights of adjoining owners may be limited to such boundaries.

In many cases, due care has been exercised to place the property fences on the lines of legal subdivision. It has been the general practice in the prairie states to locate the public roads on the section lines. These are matters of particular interest to the adjoining owners. It is reasonable to presume that care and good faith were exercised in placing such improvements with regard to the evidence of the original survey in existence at the time. Obviously, the burden of proof to the contrary must be borne by the party claiming differently. In many cases, at the time of construction of a road, the positions for the corners were preserved by subsurface deposits of marked stones or other durable material. These are to be considered as exceptionally important evidence of the position of the corner, when duly recovered and verified.

The replacement of those corners that are regarded as obliterated, but not lost, should be based on such collateral evidence as has been found acceptable. All lost corners can be restored only by reference to one or more interdependent corners.

ADEQUATE MONUMENTATION ESSENTIAL

The surveyor will appreciate the great extent to which his successful retracements has depended upon an available record of the previous surveys, and upon the markers that were established by those who preceded him. The same will apply in subsequent retracements. It is essential to the protection of the integrity and accuracy of the work in hand, the reputation of the surveyor, and the security of the interested property owners, that durable new corner markers be constructed in all places where required, and that a good record be filed of the survey as executed.

The preferred markers are of stone, concrete block, glazed sewer-tile filled with concrete, cast-iron or galvanized-iron pipe, and similar durable material. Many engineers and surveyors, counties, and landowners employ specially designed markers with distinctive lettering, including various cast-iron plates or bronze tablets.

The Bureau of Land Management has adopted a standard monument for use on the public-land surveys. This is made of wrought iron pipe, zinc coated, 2 ½ inches diameter and 28 inches long, with one end split and spread to form flanges or foot plates. A brass cap is securely attached to the top, on which appropriate markings for the particular corner are inscribed by use of steel dies.

Frequently, on account of roadway or other improvements, it is advisable to set a subsurface marker and in addition to place a reference monument where it may be found readily, selecting a site that is not likely to be disturbed.

MEANDER LINES AND RIPARIAN RIGHTS

The traverse run by a survey along the bank of a stream or lake is termed a meander line. The meander line is not generally a boundary in the usual sense, as ordinarily the bank itself marks the limits of the survey.[1] All navigable bodies of water are meandered in the public-land surveying practice, as well as many other important streams and lakes that have not been regarded as navigable in the broader sense. All navigable rivers, within the territory occupied by the public lands, remain, and are deemed to be public highways. Unless otherwise reserved for Federal purposes, the beds of these waters vested in the States at time of statehood.[2] Under Federal law, in all cases where the opposite banks of any stream not navigable belong to different persons, the stream and the bed thereof become common to both (R.S. 2476; 43 U.S.C. sec. 931).

Grants by the United States of its public lands, including lands bounded by streams or other waters, are construed as to their effect according to Federal law. This includes lands added to the grants by accretion.[3]

The Government conveyance of title to a fractional subdivision fronting upon a nonnavigable stream, unless specific reservations are indicated in the patent from the Federal Government, carries ownership to the middle to the stream.[4]

Where surveys purport to meander a body of water where no such body exists or the meanders may be considered grossly erroneous, the United States may have a continuing public land interest in the lands within the segregated areas.[5] Where partition

lines are to be run across accretions, the ordinary Federal rule is to apportion the new frontage along the water boundary in the same ratio as the frontage along the line of the record meander courses. This principle is derived from the opinion of the Supreme Court of the United States in the case of *Johnston v. Jones* (66 U.S. 117, 121). There are many variations to this rule where local conditions prevail and the added lands are not of great width or extent. The application of any rule, when surveying private lands, should, of course, be brought into harmony with the State law.

Where there is occasion to define the partition lines within the beds of nonnavigable streams, the usual rule is to begin at the property line at its intersection with the bank. From that point, run a normal to the medial line of that stream that is located midway between the banks. Where the normals to the medial lines are deflecting rapidly, owing to abrupt changes in the course of the stream, suitable locations are selected above and below the doubtful positions, where acceptable normals may be placed. The several intervals along the medial line are then apportioned in the same ratio as the frontage along the bank.

The partition of the bed of nonnavigable lakes, whether water-covered or relicted, presents a more difficult problem because of the wide range of shapes of lake beds. In the simplest case of a circular bed, the partition lines can be run to the centroid thus creating pie-shaped tracts fronting the individual holdings at the edge of the lake bed. Where odd shaped beds are concerned, ingenuity will be required to divide the lake bed in such a manner that each shore proprietor will receive an equitable share of land in front of his holding. Any consideration of riparian rights inuring to private lands should be brought into line with appropriate State laws or decisions.

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[1] Hardin v. Jordan (140 U.S. 371). Meander lines, as shown by Government surveys of land bounded by a lake or river, are merely for the purpose of ascertaining the quantity of land to be conveyed, and do not constitute its boundary. The water is the real boundary.

[2] United States v. Stotts, et al. (49 Fed. (2d.) 619). United States, while holding land before admission of State, could grant, for appropriate purposes, titles or rights in land below high-water mark or tidewater.

[3] Hughes v. State of Washington (389 U.S. 290). Held that the ownership of accretion gradually deposited by the ocean on adjoining upland property conveyed by the United States is governed by federal, not state, law, and under federal law the plaintiff is the owner of the accretions.

[4] Hardin v. Jordan, supra.

[5] Lee Wilson & Company v. United States (245 U.S. 24). If, in the making of a survey of public lands, an area is through fraud or mistake, meandered as a body of water or lake where no such body of water exists, riparian rights do not accrue to the surrounding lands, and the Land Department, upon discovering the error, has power to deal with the meandered area, to cause it to be surveyed and lawfully dispose of it.

CONCLUSION

It is not to be inferred that this discussion does more than bring out the fundamentals of the subject, and with reference only to the United States rectangular surveys. These practices and explanations are broadly applicable where the United States is the owner of the lands, in whole or in part. They also have been made applicable in many States by State law to privately owned lands within the area of the former public domain, except where specifically in conflict with the State law.

Many additional factors enter into the treatment of exceptional or controversial situations, such as where the conditions on the ground are found to be seriously at variance with the record field notes and plats, or if there is extensive obliteration. Such factors are altogether too numerous to be brought within the scope of this pamphlet. The explanations need to be suited to the specific problem, and in some cases the treatment may come within the practices herein outlined. Letters of inquiry, if addressed to the Bureau of Land Management, should include a description of the lines in question and the facts as developed by the retracement.

In all cases where no public lands are involved, the surveying procedure must necessarily be brought into harmony with the State law and court opinion. In such cases, the methods and explanations of the Bureau of Land Management must be regarded as advisory only, as that Bureau is without jurisdiction unless Federal lands are involved.

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