Certified Federal Surveyors Certification Program

Course 6

Subdivision of Sections

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Course 6: Subdivision of Sections Study Guide

COURSE DESCRIPTION:	This course focuses on the subdivision of sections. It addresses subdivision of normal sections, lotted closing sections, elongated and fractional sections, as well as the unique method known as the "three mile method" on many Indian Reservations and some private lands.
COURSE OBJECTIVES:	Upon completion of this course, students will be able to: • Learn to properly subdivide regular sections • Identify exceptions to section subdivision rules • Demonstrate an understanding of area relationships on GLO/BLM plats • Identify and deal with fractional sections
COURSE INSTRUCTOR(S):	Ron Scherler, Bureau of Land Management Dennis Mouland, Bureau of Land Management
VIDEO LECTURE TITLE:	Regular Section Subdivisions (61 minutes)

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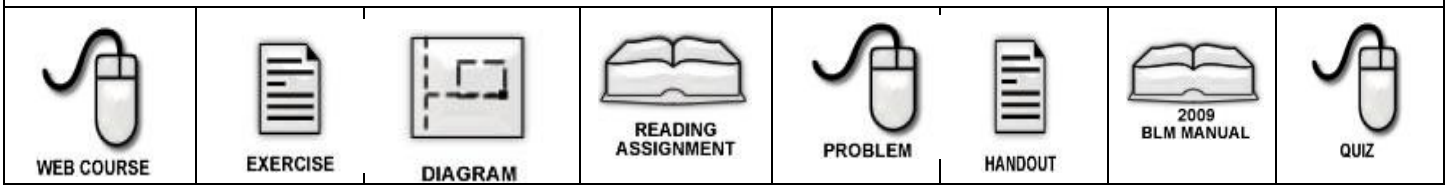

REGULAR SECTION SUBDIVISIONS

Before you begin this topic, read the following sections in your 2009 BLM Manual.

Read:

Sections 3-99 thru 3-130

Sections 4-41 thru 4-47

Sections 10-5 thru 10-10

Introduction

Hello again and welcome to our next course which is subdivision of sections. In this course we're going to cover a wide range of topic that all come back to the proper way to subdivide the section.

Initially the subdivision of sections process was a pretty simple process as we begin to explore some of the unique aspects of certain sections we'll find that it can take on some fairly complicated situations and we're going to look at those and learn how to resolve those.

Subdivision

of

Sections

So, let's start by looking at what we're going to talk about first, subdivision of regular sections. And to do that, the first thing you have to do is recognize what's a regular section and what is not a regular section so by the time we're finished with this class you're going to be able to look at an original survey plat, look at the notes and from that information determine if this is a regular section and if it should be surveyed and subdivided in accordance with the rules for the subdivision of regular sections.

- The subdivision of regular sections
- Subdivision of sections against N. and W. bdy.
- Area Relationships
- Subdivision of fractional sections (Sec. 3-120)

Next we're going to look at the subdivision of sections along the north and west boundary. Now many times these sections are very nearly the same as regular sections however because of our method of surveying we have placed the excess or deficiency along the north and west boundaries of the township.

We normally would have lots along the west boundary of the

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township and as you'll see as we go along, these sections need to be subdivided with a slightly different manner. And you will be able when we're finished to identify how those sections should be subdivided, where the parenthetical distances or protracted distances are going to come from and that's a term you may not be familiar with but we'll define that as we go along. And you'll begin to see how the subdivision of a section against a boundary is going to differ from the subdivision of a regular section.

Next we're going to area relationships and this is really a close look at the original cadastral plats and all of the information that's conveyed there. Because when you think about it the original plat is the document that defines how each parcel of land on that plat is to be defined.

It tells us what the patent is supposed to convey, it defines what the patented land is, what that parcel is. And if we don't learn to interpret the plat properly then we're not going to subdivide the section properly and we're not going to protect that original patent. So this is going to be a really important one and I think you'll find it interesting.

Some of the unique aspects of the original cadastral plats and all of the information that we can get off of that plat that's going to help us decide how to subdivide the section properly. I think that will be a interesting session. And then we're going to talk about the subdivision of fractional sections.

Probably the most important thing in deciding how to subdivide a fractional section is actually deciding what's fractional. We'll look at several sections and when I've done this in person in the past almost every section that we'll put up on the screen half of the class will say its fractional and half of the class will say it is regular. So, were going to look at some methods to really decide, is it fractional or is it not?

And then what method should we use to subdivide the section? So that when we completed this session you should be able to tell what is a regular section, what is not. How to subdivide sections along the boundaries, you'll understand the information on that original plat and be able to use the area, the bearings and distances, the lotting all of that to interpret how that section should

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be subdivided. And then last you'll have a good understanding and be able to determine what sections are fractionally and what sections are not and then from that how those sections should be subdivided.

The Law

Let's get started. First of all just briefly our statute law that tells us how sections should be subdivided comes from two places.

The Act February 11th 1805 and at the time it was passed it was really not talking about subdivision of section but it talked about establishing corners at intersection. The Act of April 24th 1820 then referred back to that previous Act to tell us how to subdivide sections.

Just briefly, those are in your **reading assignments** so you should've read that, if you missed it go back and look through that and see where it defines how we are supposed to subdivide section because that's where our basic law comes from.

Act of February 11, 1805, 2 Stat. 313

Act of April 24, 1820, 3 Stat. 566

Definitions

Now I want to do a couple of definitions and these are my definitions these are not necessarily what you'll find in the glossary, what you'll find in the Manual. This is kind of a working definition for me.

Regular Section: A section that contains 640 acres with no lots. A regular section is divided into sixteen 40 acre aliquot parts.

Fractional Section: 1) Any section that is not regular. This will include sections with greater than or less than 640 acres and will generally contain at least one lot. 2) As defined by Sec. 120 of the Manual.

A regular section is a section that contains 640 acres with no lots, 640 acres with no lots. A regular section is divided into sixteen

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forty acre aliquot parts. That's a regular section. We'll look at some other things that may be close or whatever but that's regular section. Working definition.

Fractional section gets a little more difficult because there are really two kinds of fractional sections talked about in the Manual. One is a section that's not regular this will include sections with greater than or less than 640 acres.

Now some people out there are going to say "Wait a minute Ron, wait a minute. How could something with more than 640 acres be fractional?" Well in the older Manuals in older correspondence you'll see that sections that were greater than 640 acres were called anomalous sections.

Sections with less than 640 acres were called fractional but that anomalous terminology is kind of gone away and really anything that is not regular is fractional section now. And a fractional section will generally contain at least one lot, usually more. Now that's the first kind, the second kind is as defined in section 3-88 in the Manual and when we get to the portion of this class where we talked about the subdivision of fractional sections we'll look at section 3-120 and see exactly what that is.

I want to say right now though that the first type of fractional section that does not have a special method of subdividing. And we'll talk about this in quite a bit of detail as we get to that subdivision of fractional sections. Just a couple of brief definitions kind of to get us started so we're on the same page and these are just my working definitions.

Regular Section

Lets look at this section to start with, a regular section notice that on the two boundaries the north south lines these lines have no bearings or distances.

It is inferred that they're eighty chains because that's the distance they are supposed to be. If they're eighty chains there is no need to report that distance so its inferred that they're eighty chains.

Notice also that there is no area, often the area will be shown

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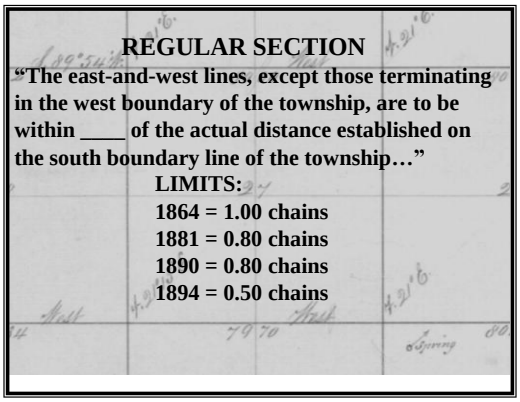
along with the section under the section number. Here there is no area. If there is no area shown again it's inferred that its 640 acres because that's how many acres are in a regular section.

If there are more or less than 640 then we're going to see a number there. Notice also that there are no areas in the quarters often times you'll see on a plat that there are acreage in the quarters there are none here. Again it inferred that they are 160 each they're regular aliquot parts there is no need show that information here. Another thing, this a little interesting too I think you'll find and that is 79.70 for the South boundary.

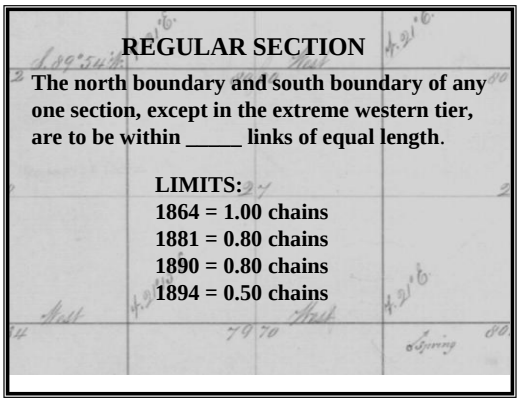
Now that's not a mile, it's supposed to be a mile its 79.70. So how can this be a regular section with 640 acres when 640 acres is one mile by one mile by one mile by one mile, a mile square. This South boundary is less than one mile, how can this be 640 acres?

Well let's look at that. There is something called limits, alright? And in the older Manuals let's look at the different Manuals 1864 the limits were one chain, 1881 the limits were eighty links in 1890 eighty links and in 1894 they were fifty links, half a chain fifty links.



What these limits tell us is, if the mile in 1864 was within one chain of eighty chains for area purposes we would count it as a regular mile or eighty chains. So if it was seventy-nine chains or it was eighty-one chains for area purposes we would say that's a regular section were treating that boundary just as if its exactly a mile.

Later on we shorten that up a little bit to eighty links or 8/10 of a chain and then down to half a chain or fifty links. So often times you're going to see sections that are regular sections that contain 640 acres officially but if you calculate the area based on the bearings and distances around them they'll contain slightly more or slightly less.



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When you think about the land that was out there the time frame, the value of land at the time you can see why this may have been done. There was no need to report exact acreage. Now a couple of other things about the limits.

First of all the North boundary and the South boundary of any one section except in this extreme West here, that's the ones against the boundaries, are to be within; fill in the blank here, one chain, eighty links, 8/10 of a chain, 5/10 of a chain of equal length. So the North and South boundary had to be within the limits at the time.

So if the limits were one chain we couldn't have a North boundary that's eighty-one chains and a South boundary that's seventy-nine chains, cause the North and South boundaries are two chains difference even though they're both within a chain of being one mile. So there's two elements here it had to be within a chain of one mile it also had to be within a chain of the distance of the opposite boundary. So that kept our sections a little more regular they didn't get too skewed.

The other thing was the East and West lines except those terminating on the West boundary of the township are to be within; again fill in the number of the actual distance established for the South boundary line of township which is eighty chains.

Once in a while it's going to be something different but normally its going to be eighty chains. So what this is saying that to a regular section the North and South boundary had to be within limits and the North and South boundaries could not be greater distance from eighty links or a chain or fifty links from being a mile.

So this kept us from creating all these sections that were not quite regular and maybe had to subdivided separately or had lotting in them or something. There was no need to do that, these are regular, they create officially 640 acre sections officially 40 acre aliquot parts through the whole thing, they can be subdivided normally and we'll talk about what that normal subdivision process is. Just wanted to touch on those limits and we may talk about that a few other times as we go along when we get area

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relationships and some of the other issues.

Subdivision of a Regular Section

Let's talk first about a regular section. Here's what the Manual says about a regular section it says "To subdivide a section in to 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 corner sections or the legal center of the section." Pretty straight forward, pretty straight forward. You run straight lines between opposite quarter corners and the point intersection is the center of the section or the center quarter. Pretty straight forward there's not a lot to that.

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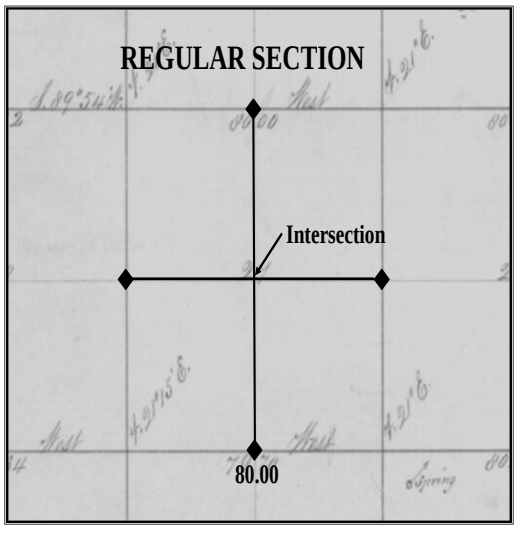
Sec. 3-114. To subdivide a section into quarter sections, run straight lines from the established quarter-section corners to the opposite quarter-section corners. The point of intersection of the lines thus run will be the corner common to the several quarter sections, or the legal center of the section.

Let's look at what that does, first of all what do we need to establish the center quarter?

First of all we need find the four quarter corners, the original four quarter corners. North, East, South and West quarter corners, those have to be found. If we have missing corners then the first step is going to be reestablishing those corners and we talked about reestablished corners in a previous session. So the first step is we have to reestablish or recover those original quarter corners.



Step two what did it say? Run straight lines, straight lines between corners. Straight lines North-South, straight lines East-West the point of intersection is the center quarter corner of the section. Pretty straight forward there's not a lot of to that.

And you'll notice I have eighty chains down there around the South boundary. The measured distance was 79.70 if you'll look in the field notes you'll find that the quarter corner is at midpoint however for calculations purpose of area it was eighty chains and we can look at it and treat it as eighty chains when we're subdividing the section as far as dividing the section.

Each one of those aliquot parts along the South boundary is getting an equal portion of that line. Quarter corners at midpoint, the sixteenth corners which divide into forty acre parcels are at midpoint again and we'll talk about that a little more in a minute.

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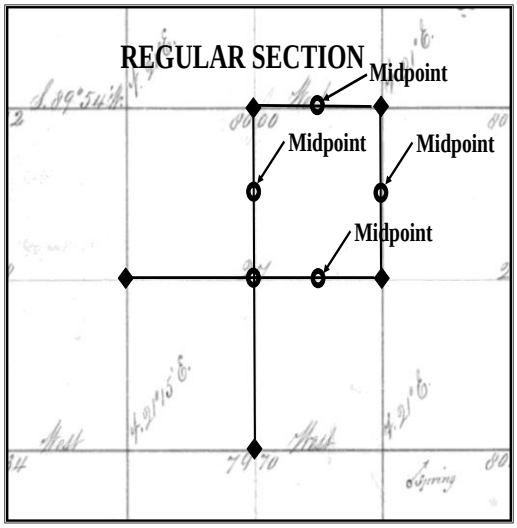
So this is pretty straight forward there's not a lot to it but as we'll see things can get complicated as we go along.

Well let's see what the next step is, what do we do if we want to divide it further? The Manual says "preliminary to the subdivision of quarter sections, the quarter-quarter corner or sixteenth section corners will be established at points midway between the section and quarter-section corners and between the quarter-section corners and the center of the section. Except on the last half mile of the line closing on the township boundaries where they should be placed at twenty chains proportionate measurement counting from the regular quarter-section corner."

> Sec. 3-117. 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 between the 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.

Alright that's kind of a mouth full let's look at what that really said. Lets say we've established the center of the section and now we want to subdivide the northeast quarter. Well what did it tell us was the first step? It said the first step once we got the center quarter in there we have to establish the sixteenth corners. And that would be these four corners.
Now how do we do that? What did it tell us? It told us we establish them at midpoints so let's talk first about the north sixteenth between sections twenty-six and twenty-seven.



It is midpoint between the quarter corner and let me give you one warning here though. Remember when we talked about controlling intermediate monuments there can be an intermediate monument here that could effect this sixteenth corner position, a line tree, a witness corner, some kind of an angle point.

Something may be there that might effect that corner position may not end up at midpoint, keep that in mind. When we do not have some kind of controlling intermediate monument though these are going to be at midpoint. Even when there is a controlling intermediate monument there are going to be calculated based on a midpoint position and you'll remember when we talked about controlling intermediate monuments we talked about this very situation. So the sixteenth corner goes at midpoint then let's go to the center East sixteenth midpoint between the quarter corner and the center of the section.

The center North sixteenth midpoint between the center corner and this quarter corner on the north boundary. The East sixteenth on

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the North boundary of section midpoint between the quarter corner of the section. Those are all midpoint situations and once they've been established we can then proceed to subdividing the quarter, all midpoints.

Now if this is not a regular section that's not going to happen but since it's a regular section that's the way we're going to do it. Let's look at how we apply this, look at how we apply this to the section. Now if we're going to subdivide the Northeast quarter of this section, what does it say the first thing that we need to do? We need to establish the sixteenth corner.

So let's look at how we do that. What did it say? It said we put the center North sixteenth, it used that word at the center North sixteenth, between the center quarter and the quarter corner. The center East sixteenth between the center quarter and the quarter corner. Midpoint, the North sixteenth on the West boundary where does it say between the quarter corner and the section corner at midpoint.

All these sixteenth corners go at midpoint because this is a regular section. These are forty acre aliquot parts within there we can't see them but they're there that's 160 acre quarter forty acre aliquot parts these all go at midpoint.

Now let me caution remember when we talked about controlling intermediate monuments that they may effect the position of sixteenth corners. They could have an effect where a sixteenth corner is not exactly at midpoint so just keep that in mind and remember what we've talked about there because we explained it in that session.

But keep that in mind as we're subdividing here. It's important for you to look at the field notes to know "Are there any original line trees that I need to look for? Are there any other controlling intermediate monuments that may be there that may influence how I subdivide this section?" So keep that in mind.

Once we've established these, what do we do next?

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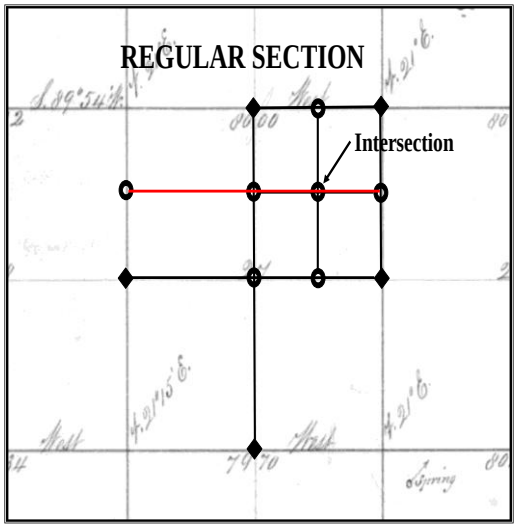
Well the Manual tells us "the quarter-quarter corner or sixteenth section corners have been established as directed above the center lines of the quarter section will be run straight between opposite corresponding quarter corner or sixteenth section corners on the quarter section boundaries.

The intersection of the lines thus run will determine the legal center of the quarter section." Basically the same thing we did with the section, once we got the sixteenth corners around the exterior of the quarter, what do we do?

> Sec. 3-117
>
> 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 or sixteenth-section corners on the quarter-section boundaries. The intersection of the lines thus run will determine the legal center of a quarter section.

We run straight lines. Straight lines to intersection and the center where they intersect is the center of that quarter, in this case this would be the Northeast sixteenth corner it's the center of the quarter.



We've now identified the four forty acre aliquot parts in the Northeast corner of the section. Again this is pretty elementary it's pretty straightforward there's not a lot to go wrong with this but you know that may change as we go along.

One point I want to make here is that each of the quarters is subdivided individually in other words this line across the North half of the section that's not necessarily going to end up a straight line. In fact most of the time it will not be a straight line. The point I want to make is you can not subdivide this section or the North half of this section by running a straight line between the North sixteenth on the East boundary and the North sixteenth on the West boundary.

That's not going to work there is almost always going to be a bend at the center north sixteenth which is right here. Almost always because the original section when we begin to retrace it is not going to be perfect. There is going to be bends at the quarter corners, the bearings and distances are not going to be what was recorded originally.

Even in very good sections there are going to be some slight differences, so there is almost always going to be bends at those center north, center east, center south, center west sixteenth

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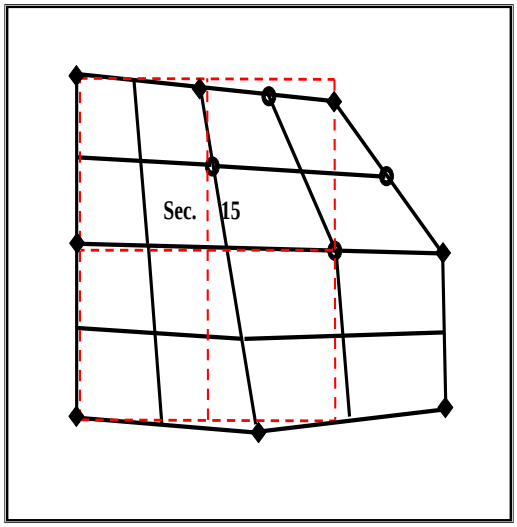
corners. However if you use the procedure outlined in the Manual you're not going to have a problem because you established those corners always before you subdivide the quarter that's the point to keep in mind. Do it in the right order and you're going to get that taken care of properly.

Lets at another situation, now this is a drawing that I traced this from an actually plat. And on the original plat this section was shown normal, eighty chains by basically eighty chains, and a nice square section.



This was resurveyed, this section was resurveyed I believe in the 50's and so I traced the same section from the 1950 plat, let me show you what it looks like.

Different, some major discrepancies in fact discrepancies on the neighborhood of quarter of a mile or more bearings that are grossly distorted, distances that have considerable error. So how does this effect our subdivision of section? What is this going to do to our method for subdividing the section?

Well, its not going to change at all because we're not talking about what the section looks like now we want to see, what did the section look like originally? And if I went back to the original plat I would find that it was a regular section, 640 acres so its going be subdivided normally.

So let's look at what we would do? What would we do? We would survey the North south center line, the East west center line, straight lines between quarter corners and at the intersection establish the center corner. Then if we're going go to subdivide that northeast corner, what are going to do? Put the sixteenths at midpoint between the quarter corner and the section corner and between the quarter corners and the center quarters, all at midpoints.

Then what are going to do? Straight lines between the sixteenth corners that's the how the section will be subdivided. Now watch what happens when we subdivide do the same thing to the Southeast quarter. Notice that there's a considerably bend right here at the center east sixteenth, why is that?

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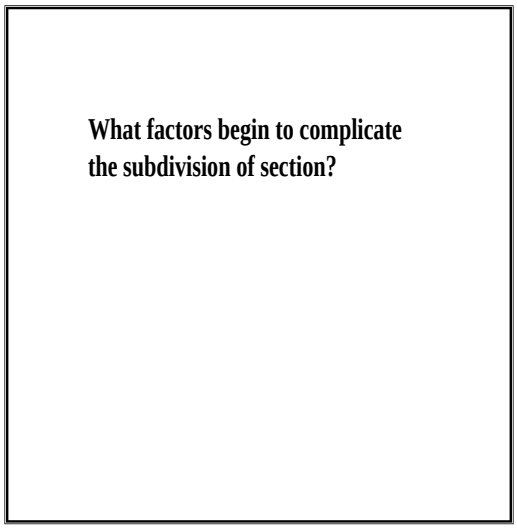
Because of the distortion in the section when we actually retrace it and find the monuments on the ground. There was error in the original measurement, error in the original bearings so we're going to get some bends on some of the interior lines.

When we continue to subdivide there's also a bend you'll notice right down here at the center south sixteenth because there's errors in the boundaries.

It doesn't change our method of subdividing though we still use exactly the same method and it gives us an equitable division of the section based on the original plat and each patent gets an equitable portion gets the portion that the original plat gave them on this section.

Factors that Complicate the Subdivision of Section

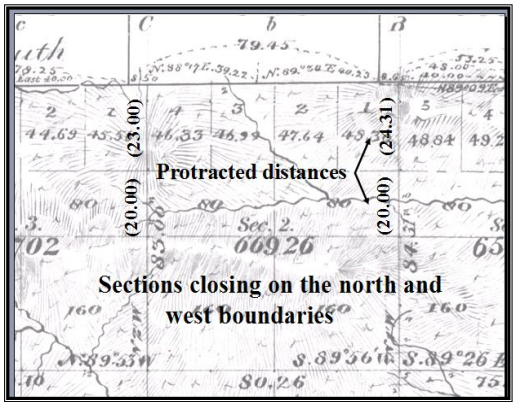
Let's begin to look at some factors that can begin to complicate the process. The first is a section closing on the North or West boundary.



You can just visually look at this plat and what can we tell? We can look at the areas of lots one, two, three and four and its clear that the sixteenth corner over here at the North sixteenth between sections one and two is not supposed to go at midpoint.

Visually we can see that, we can look at the areas and tell that. Why is that? Because the excess or deficiency was placed against the north boundary.

In this case it was an excess and all of the excess in that section is placed in that North tier of lots, lots one through four. So we're



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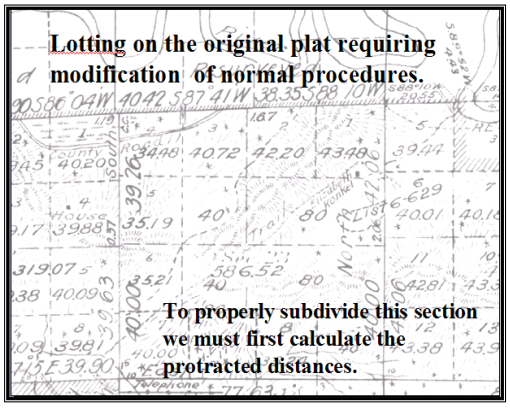
going to have to come up with a different method to subdivide the section to protect those lots. And we'll talk about that a little bit later. But basically we have to come up with the distances one the plat that was used to identity the bearing or the dimensions of the lots. So in this case we would have on the East boundary we would have twenty chains and 24.31 chains and that is simply taking the total distance for the mile of 84.31 and subtracting sixty chains for the first three quarters of a mile.

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

And we're going to talk about that in great detail later when we get to area relationships so don't worry about it a lot. But I just want to mention the fact that we need to get those distances here we also would get them for the other side and not only that we would compute these distances for all sides of each of those lots, we need that before we can actually subdivide the section properly.

So we're going to compute distances for every side of each of those lots one through four and when we get to area relationships we're going to talk about how you do that and we'll actually get some experience doing that.

Well another that may complicate the subdivision of sections are sections that are lotted on the original plat in such a way that they require modification of the normal procedures.



If you look at this section, you'll notice that down here at the center south sixteenth there's two of them, look at that. There are two center south sixteenths in this section that tells you right away that we can't subdivide this section normally. We are not going to have a straight North south center line, we are not going to have a normal subdivision of section.

We look at all these areas and we can tell right away points are not going to be at midpoint this going to be a special situation and to subdivide this section we're going to need to work through all of those areas to determine the distances around each one of those lots and then develop a subdivision procedure that will protect all those lots.

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

We'll talk about those again in the area relationship part. So we're going to look at those in more detail but I just want to kind of go

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through some of the things that began to complicate the subdivision of sections procedures.

The next situation may tend to confuse things are portions of sections that are surveyed in separate surveys. In this situation here, this plat you're looking at right now the Northwest quarter was surveyed in one survey one plat and then later the section was completed.

And if you'll look at the center quarter you'll notice that there are two maybe three positions for the center of that section. Clearly this section will not be subdivided normally.

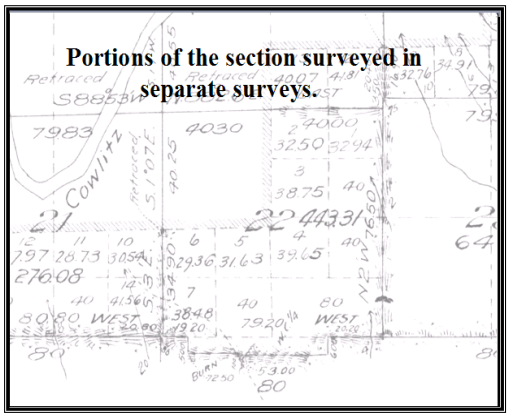
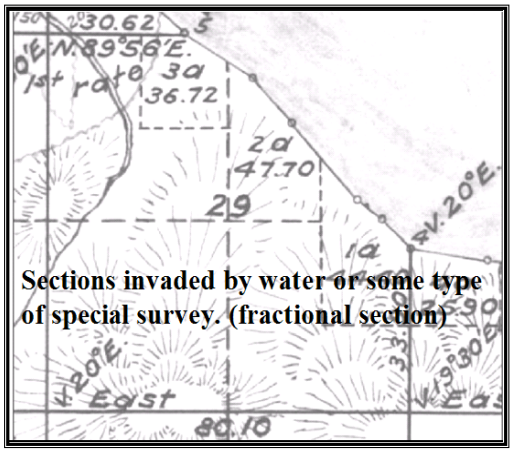


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

The next is subdivision of sections that are invaded by water any kind of special surveys such as mineral surveys, homestead entry's, reservation boundaries, grant boundaries those sections normally are going to have some kind of lotting some kind of situation that is going to require special subdivision procedures.

And it is important that we can recognize those, identify them, and work through the process figure out what the plats telling us so that we can subdivide those properly.



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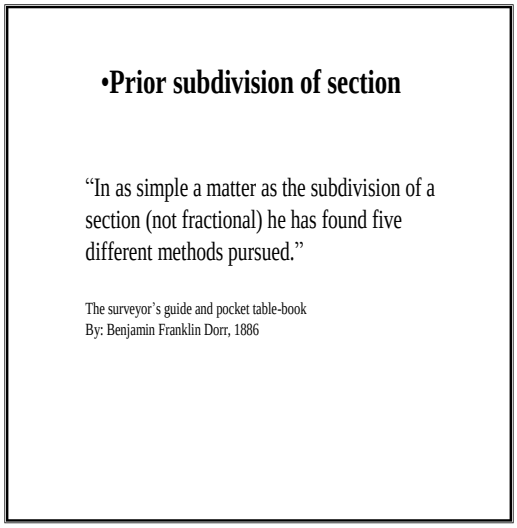
Let's continue along, prior subdivision of section. Now you might say "Ron, that's kind of a strange one, what do you mean prior subdivision of section?" well, this is kind of an interesting little quote from a little book I have on my shelf, *The Surveyors Guide and Pocket Tablet* book by Benjamin Door in 1886.



And here's a quote from it he says, in as simple a matter as the subdivision of a section not fractional he has found five different methods pursued. So in a regular section in 1886 Benjamin Door had found five different methods for subdividing the section, well those methods are still out there those sections that were subdivided in 1886 some have been perpetuated to the present time.

Some were subdivided later, you're all familiar with situations were there are more than one center quarter there may be more than six or seven monuments at a corner position, there may be differences in measurement, differences in procedure all of those things can tend to complicate our process of subdividing the section.

If we're the first one there it's a regular section all of the quarter corners and section corners are existent, it's a pretty simple process but that's not the general case.

REGULAR SECTION SUBDIVISIONS

Three Mile Method

Three mile method of subdivision. This is unique to Indian land many of you have probably never seen this method of subdivision and its not a method that we use now but this was an appropriate place to talk about it because we are talking about the subdivision of section and as it turns out about the only time that the General Land Office subdivided sections was when they were subdividing Indian land.

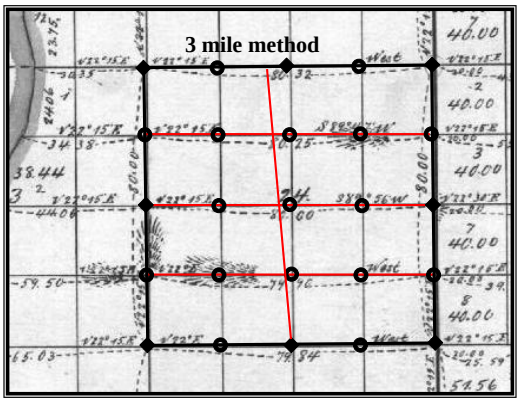


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

So here we have a special method for subdividing sections and it was used almost exclusively on the Indian land and it was used by the General Land Office. Even though the General Land Office had prescribed methods for subdividing sections at the time that said sections should be subdivided by running intersections of straight lines on the center lines. They chose to use a different method for surveying land that was still federal land prior to any conveyance.

Now this is Indian land that was going to be conveyed for allotment and this was a method for subdividing the section that was a little less expensive probably was fairly equitable in subdividing the sections but does not give us the same result as a normal subdivision of section. Let me show you how we did this.

First of all the exteriors of the section were generally resurveyed or if this was an original survey of this land when the exterior was surveyed not only were the section corners and quarter corners established but the sixteenth corners were also established. And sometimes even sixty-fourth corners depending on the size of the allotments. Once these corners have been established remember what our procedure was on a regular section?

We're going to run the center lines of the section, straight lines

REGULAR SECTION SUBDIVISIONS

between quarter corners with the center quarter at intersection that's not the process here. Here were going to survey a straight line between the North sixteenth on the East boundary and the North sixteenth on the West boundary and place the sixteenth corners at equal distance.

So we're going to divide that total measurement by four and that's the distance we're going place those. That was the method that the General Land Office used when subdividing sections in the Indian land not always but often the generally took place turn of the century, 1890's maybe up to 1915 maybe into the 1920's. But mostly around the turn of the century when a lot of the allotment we're being made this was the method that was used.

No North south line was run for the east west center line same thing. The East west center line was surveyed between quarter corners, straight line but the sixteenth corners and the center of the section were established at point's equal distance.

That line was divided by four and those positions were at equal distance the center quarter was not at the intersection of east west center line and the north south center line, same thing with that South sixteenth line you can see that by this method we're surveying half as many miles that's almost certainly the reason that this was chosen. We wanted to get all of these monuments set, monumented if you look at the plat here you'll notice that there are no lot numbers created we still calling all of these aliquot parts.

If you were to look at the patents for these they would describe them all as aliquot parts however we have subdivided the section in a new manner, in a different manner than we use any place else and actually different than the law specifies. How can we do that? Why could we do that? Remember it was all federal land; this was still federal land this was not disposed of.

We are surveying for the first time we are setting all these monuments we're establishing them on the ground and if you actually look at some of the correspondence that the allotment agent actually took each individual out on to the ground and showed him his monuments. So it was very clear that the conveyance of these aliquot parts was based on these monuments and based on these surveys.

REGULAR SECTION SUBDIVISIONS

So, we are not going to subdivide sections this way today. Sections that were not on Indian land should not have been subdivided this way at anytime but it happened. And what do we do today about it?

Well if its an official GLO survey and we're resurveying this we're in here to subdivide this section first of all we need to look at the record to make sure that there is no subdivision of the land first. We've got to look. We need to find out, did GLO already subdivide this? Is there a subdivision in the record that subdivided by a three mile method?

I'm familiar with a specific section in the state of Washington on a reservation that was surveyed by three mile method and there are probably fifteen surveys of record in the county of surveyors who have tried to establish corners within that section by normal subdivision methods, straight line intersections. They have not properly reestablished the original corners set in the original survey by the three mile method. And obviously we end up with different positions.

So what we're talking about here is not really how we should subdivide sections but I want to make you aware that when you're called upon to subdivide a section you may find that it's already been subdivided by GLO and that at the time they did it they used this special method. Therefore we're going to have to reestablish corners based on a special method.

Think about it, how would we reestablish a lost corner here? Let's say that center North sixteenth is lost, how would we reestablish that corner? If you look at the record I think it's pretty clear that at least the initial idea would be single proportion between the corners to the East and the West. There was a never a north-south line run, there would never be any reason to use a north-south distance it was simply an east-west line.

It probably would be reestablished at single proportion. Think about the center quarter, if the center quarter was lost, how are we going to reestablish it? No north south center line was run, how are we going to do it? Probably single proportioning east west.

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So I want to bring that to your attention right now so that you're aware that this happened, these were GLO surveys, they're of record there is going to be an official plat there are official notes and the patents the trust patents for these allotments are going to be based on this survey.

Now of course there is another place that this happened and that's in the allotment surveys and those the U.S Indian service and we're going to talk about that in the history I think you've heard about that some. They also used this method so be aware that the three mile method can show up in a couple of places. Again we're not going to use this method today but it is something that happened historically in that short time frame and you need to be away of it and we need to be sure that if we're called upon to subdivide a section it has not already been done this way.

If it has its going to alter what we do reestablish the section corners and subdivide that section. That's another thing that may complicate the situation.

Think about if you came into a section that had been subdivided originally, by this three mile method, and you proceeded to subdivide it normally look what might happen if that north quarter-quarter corner was out of position slightly. Look what might happen. You're going to establish a center corner that does not reflect the position of that original center quarter established by the three mile method. And remember that's the corner that the patents were based on, that's the corner of record that the latest survey that was done when it was still all federal land.

And that's the corner that should mark the boundaries of the patent and if you come in and subdivide it normally you're going to create problems for yourself and for the landowners. And you're going be to wrong. We need to protect that survey that's there, that official GLO survey that has already done it that way. Keep that in mind and we may talk about that some a little bit later.

REGULAR SECTION SUBDIVISIONS

I want to just to just point out a couple of things to you in this section. Again a three mile subdivision, you look at this you can notice that we've got a bearing, a distance here a distance here a distance here those lines were all surveyed but there are no north-south survey lines. There are no distances; there are no bearings those were not surveyed and if we look at the field notes it becomes clear only the east-west lines were surveyed. This is against the boundary of the section, the west boundary, and I want you to notice that.

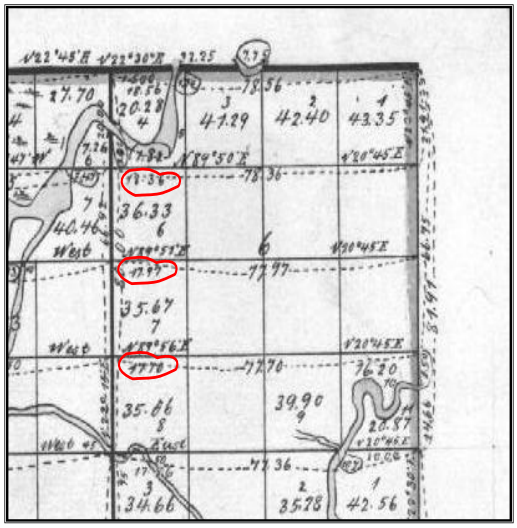

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

Let's look at the east-west center line and the distance here is 72.97 ok, they did not divide the 72.97 by four and put the corners at equal distance because the excess or deficiency goes against the west boundary. You'll notice that this last distance over here is 17.97, so what happened?

The quarter corner, the center quarter, the sixteenth corners were put at twenty chains, forty chains, sixty chains and then the deficiency the 17.97 what was left was put against the boundary. So those are not equal distance all the deficiency or excess was pushed against that west boundary of the section because that's were we put the deficiency in the last tier of sections against that boundary.

So I just wanted to make that point again with the three mile method. If we're against the boundary then they're not going to be at equal distance they're going to be at twenty chains, forty chains, sixty chains with the excess or deficiency against the boundary.

REGULAR SECTION SUBDIVISIONS

Sections Against the Township Boundary

Let's look at another section that's against the boundary again. I want to cover a couple more points here before we go on for sections closing on the West or the North boundary for that matter.

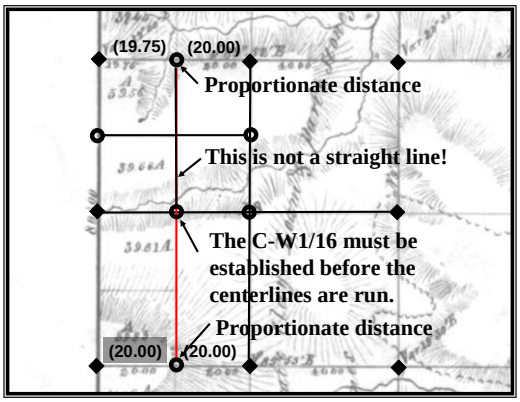

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

First of all we're going to subdivide the center lines are going to be normal. Because they are straight lines between quarter corners and if we look at the plat that's clear it protects the acreage and the lotting is not affected by this. So the center of the section is established normally. Intersection of straight lines between the quarter corners but let's look at what happens next.

If we look at the North boundary we can see that the distances for the north boundary closing into the west boundary of the section are twenty and 19.75 that sixteenth corner is not at midpoint and the plat tells us that. We can also look at the South boundary and find the same thing and I'll show you that in a minute.

So, how are we going to establish this sixteenth? We're going to have to establish it at proportionate distance not at midpoint, alright? South boundary we have the same thing, in this particular section it's at twenty chains and twenty chains which happens to be midpoint. Its still a proportionate position situation it comes out midpoint here but closing into the boundary always check those lots to see, is it midpoint, is it not? It's always a proportionate situation, its not automatically midpoint because we have lots around there and they have areas.

Again I want to make this point because I've made it before I want to make it again. It's not a straight line between sixteenth corners remember we subdivide the section, established the center quarter its at intersection from that point we established the sixteenth corner around quarter that we're going to subdivide and then run straight lines between the sixteenth corners.

There were almost certainly be breaks at the center-east, center-west, center-north and center-south sixteenth corner almost certainly.

So if we're going to subdivide this section there's going to be a bend here, a bend here, a bend here, a bend here and a bend here

REGULAR SECTION SUBDIVISIONS

when we start surveying the center lines of quarters. The center west sixteenth must be established before the center lines are run, remember do that first.

Let's look at Section 3-117 of the Manual now we looked at this before but let's look at it again because there were some points that we didn't make before.

"Preliminary to the subdivision of a quarter section the quarter-quarter corner or sixteenth section corners will be established at points midway between the section and quarter-section corners and between the quarter-section corner and the center of the section."

Sec. 3-117

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 or sixteenth-section corners on the quarter-section boundaries. The intersection of the lines thus run will determine the legal center of a quarter section.

Now here is the point I want to make, except on the last half mile of the lines closing on the township boundaries where they should be placed at twenty chains proportionate measurement counting from the regular quarter-section corner.

So this in the Manual it makes it very clear that closing into the boundaries were going to go at twenty chains with the excess of deficiency against the boundary, that sixteenth corner is at proportionate position its not at a midpoint position.

So that's going affect how we subdivide a section against the north or west boundary of the township. And we're going to talk about those in more detail when we get to the portion of out lesson where we talk about area relationships because there we will actually develop all of the distances around each one of those lots and we'll look at how the those sections should be subdivided and how we proportioned those numbers.

So, what are going to do? We're going to set all the sixteenths around the quarter first step, and then we run straight lines between the sixteenth corners and the intersection is the center of that quarter.

Remember we're going to proportion along that north boundary and also the center west sixteenth, right here. That corner also has to be proportioned because it's not a midpoint situation because we have the excess or deficiency against the boundary.

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When we get into the area relationship portion of this lesson that's where we're going to discuss, how do you find what that proportion is? How do you get the distance so we know what to proportion and how to come up with that corner position?

We're going to look at that in great detail when we get to that point for now I just want you to understand that its not a midpoint situation when we're against the boundary, the west boundary or the north boundary. Its going to a proportion situation and we have to figure out what numbers there are to proportion that's what we find out in area relationships later.

Elongated Sections

Now we're going to look at elongated sections because they are again a unique situation. There are not a lot of elongated sections out there but when you run into one you know things are looking a little different so we want to make sure we cover that and how those are supposed to be subdivided.

So first of all let's look at this section seven and we'll notice that it's almost ¾ of a mile long in a east west direction and 135 chains along that north boundary, so this is exceptionally long section.

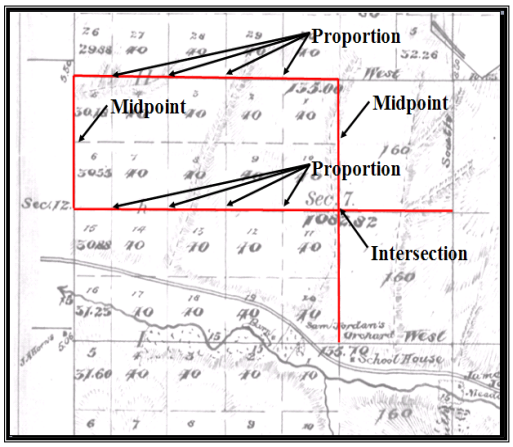

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

You'll notice that there are lot numbers for the entire western portion and we would call this the west half even though it's considerably more that half but everything west of the north south center line. And this is the north south center line of the section.

I know it's not in the center of the section but it is still the north south center line. So, let's think a little bit about how this might be

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subdivided. First of all there isn't anything going to be exceptionally different because we have the quarter corners, right?

The quarter corners are there so let's look at this a little bit and see what we might do. Makes sense that to get the center of the section we could run straight lines between the quarter corners, right? That's what we do. And at the intersection is the center of the section. Now again no its not at the center of the section but that's the called the center-quarter corner that's the center of the section and that's the name of that corner.

We've created four quarters; we have a northeast, a, southeast, a southwest and a northwest. Now the northwest quarter contains ten lots and contains considerably more than 160 acres but its still the northwest quarter.

So the first thing we want to do once we have surveyed the center lines, straight lines between quarter corners. Determine the intersection center of the section that's going to be marked as the center quarter, wer'e not going to give it some special name it's the center of the section.

And if you were to look in the Manual, Chapter 4 in the Manual we can find a diagram that tells us how to mark these corners for elongated sections. See Chapter 4, Figures 4-5 and 4-6 tell us the names of those sections and how to mark those corners so keep that in mind.

Now once we have surveyed the center lines, got the center of the section, what are the first things we're going to do if we want to subdivide the northwest quarter? What do we need to do? We need to establish the boundaries of that northwest quarter, right? And then remember what did the Manual tells us to do in a regular section? It tells us, "establish the sixteenth corners around the exterior of that quarter." Same thing, here, we're going to establish those sixteenth corners.

Now here this center-north sixteenth and north sixteenth on the west boundary those are both midpoint situations, now how do I know that? Well a couple of things, first of all the northeast quarter is shown as a regular quarter, its 160 acres.

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The acreage of lots one through four and lots seven through ten those acreages are all forty acres that indicates that the sixteenth corner should be placed at midpoint because that's going to protect those areas and when we get into area relationships again we'll look at developing the numbers to go with each of these areas and you'll see how that works.

But midpoint situations in both of those, so what are we going to do on the North boundary and the east-west center line? Well each of those sixteenth corners on the north boundary and on the east-west center line are going to have to be at proportionate positions because look what we have over here -- we have areas that are considerably less than forty acres, those are not anywhere close to forty acres that tells us that we've got some deficiency up against that boundary in those lots.

So, we're going to have to compute what that last distance to the boundary is for north boundary of lot five, for the south boundary of lot six we're going to need to know what that distance is so we can proportion against that. We're going to figure out how to do that when we get to area relationships.

What I want you to see now is that those are proportionate positions situations there not midpoints, there not equal distance there proportionate position situations. That's what we want to see. Once we've established the corners on the exterior now, how do we establish the corners of those lots?

Well, we might think were going to do something really confusing but it isn't, it's pretty easy. Straight line between sixteenth corners that's what we do. We have one east west center line all the way across between those sixteenth corners; we have north-south center lines that intersect.

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At the intersection of each of those lines that's were the sixteenth corners go. And if you look at the section in the Manual at 4-44, see Figures 4-5 and 4-6 at the diagram you can see what those sixteenth corners are called and you can see how each of those should be marked.

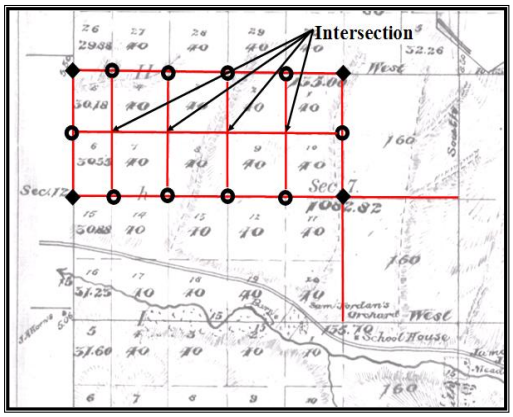

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

So an elongated section really isn't that confusing we really approach it very similarly to how we approach a regular section against the boundary or even a regular section.

We look at the areas we look at the lots we develop the distances for those lots we develop the proportions and we figure out how to subdivide it, what do we do? We run the center lines first get the center of the section, we run around the quarter, we establish the sixteenth around the quarter corner and then run straight lines between them.

So it's basically the same process it's really looking at the original plat and determining, what is it telling us how to subdivide the section. Same process, the plats just giving us a little different information and when we get into the area relationship part you're going to see how we develop all those numbers and I think this will come together for you. So elongated sections is pretty straight forward.

Corner Markings

Now if you look at section 4-41 figure 67 in the Manual that's where you'll find those proper corner markings and the names and that's important.

See Sec. 4-41 and figure 67 of the Manual for the proper corner designation and correct cap markings.

Let me just say a couple of things about that because I think it's important that we get used to calling corner by their proper name. Not the sixteenth corner, north of the quarter corner, it is the north sixteenth corner of sections fifteen and sixteen. The northwest sixteenth corner of section fifteen and the center west sixteenth the center quarter.

Get use to calling corners by their proper name and marking them properly so that we can communicate to everybody we communicate much better in our records are much clearer for everyone else to use. If we're dealing with elongated sections its

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important to look at the Manual, find out how those corners are supposed to be marked, mark them properly look at the Manual and find out what those corners are supposed to be called what's their designation and make sure we get that right.

Conclusion

Final thing. As we've talked about all this we've really gone through subdivision of section pretty quickly haven't we? I mean subdivision of section is maybe a much more difficult subject than we've covered here but what we've done is just look so far at the basic principle of subdividing a section.

Our next two sessions where going to start getting into really the nitty gritty of what the plat tell us.

- How do we subdivide sections that aren't quite regular?
- How do we get all that information out of the plat that tells us what we're going to do and how we're going to do it?

So, for this point the thing I want to emphasize is read that section is the Manual carefully and when you're subdividing a section follow it don't just think that you understand the procedure but actually follow it and do it in the order that the Manual tells us to do it in and we'll get those sections subdivided properly.

Second, make sure you've examined the record thoroughly. Make sure you can determine how the section should be subdivided that includes reading the field notes because we may have controlling intermediate monuments. Make sure you have all the records so that we know, has this section been subdivided by GLO previously? Was there a three mile subdivision of this section sometime?

Make sure you have the proper controlling plat because sometimes sections are subdivided and a survey is suspended or cancelled we have a new survey. Make sure you have the proper survey plat, the proper field notes and that you've read them thoroughly so that we don't have any surprises along the way and we really are subdividing the section the way that the plat tells us to and the way that the field notes tell
us to.

•Make sure you have examined the record thoroughly and have determined how the section should be subdivided.

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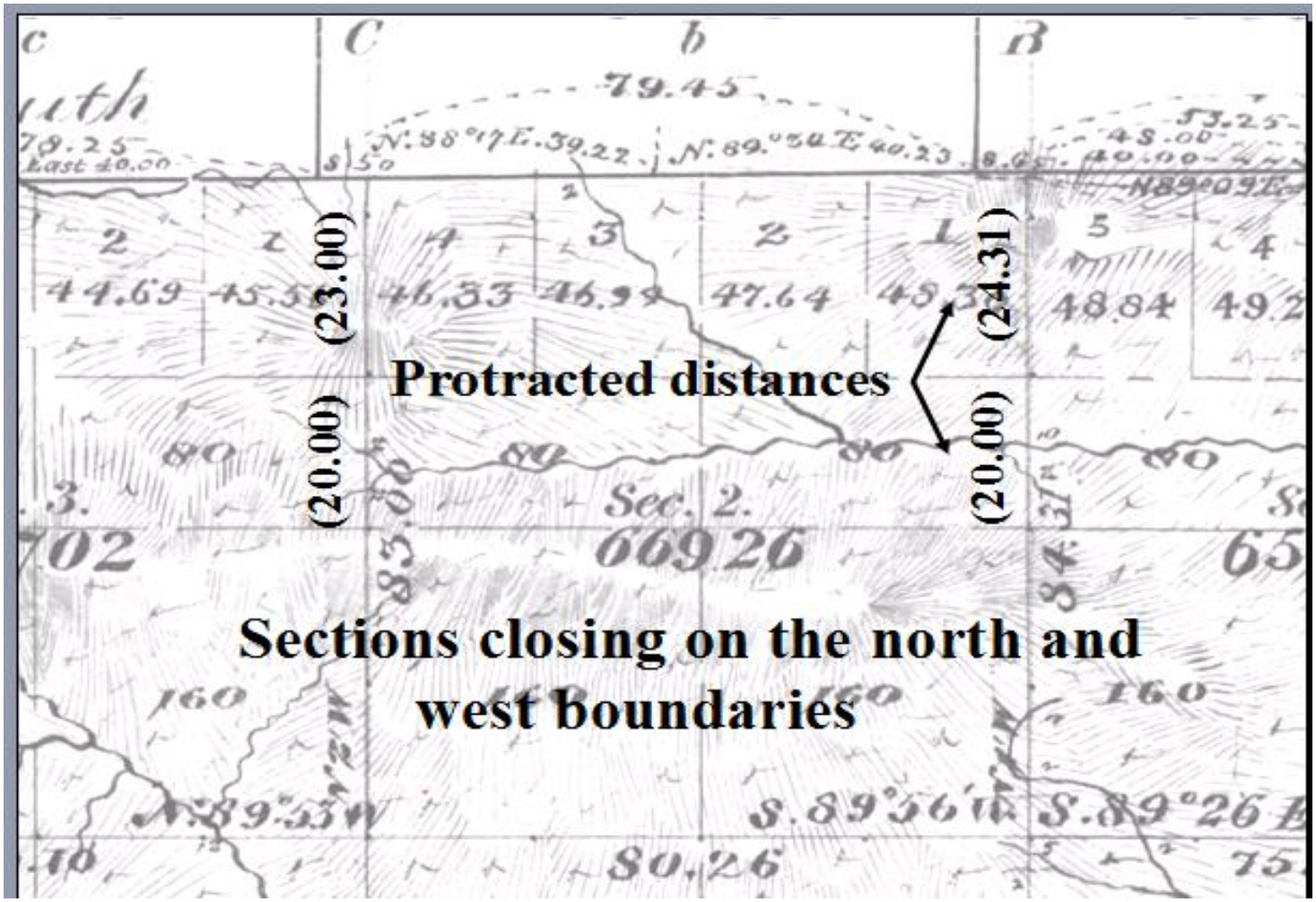
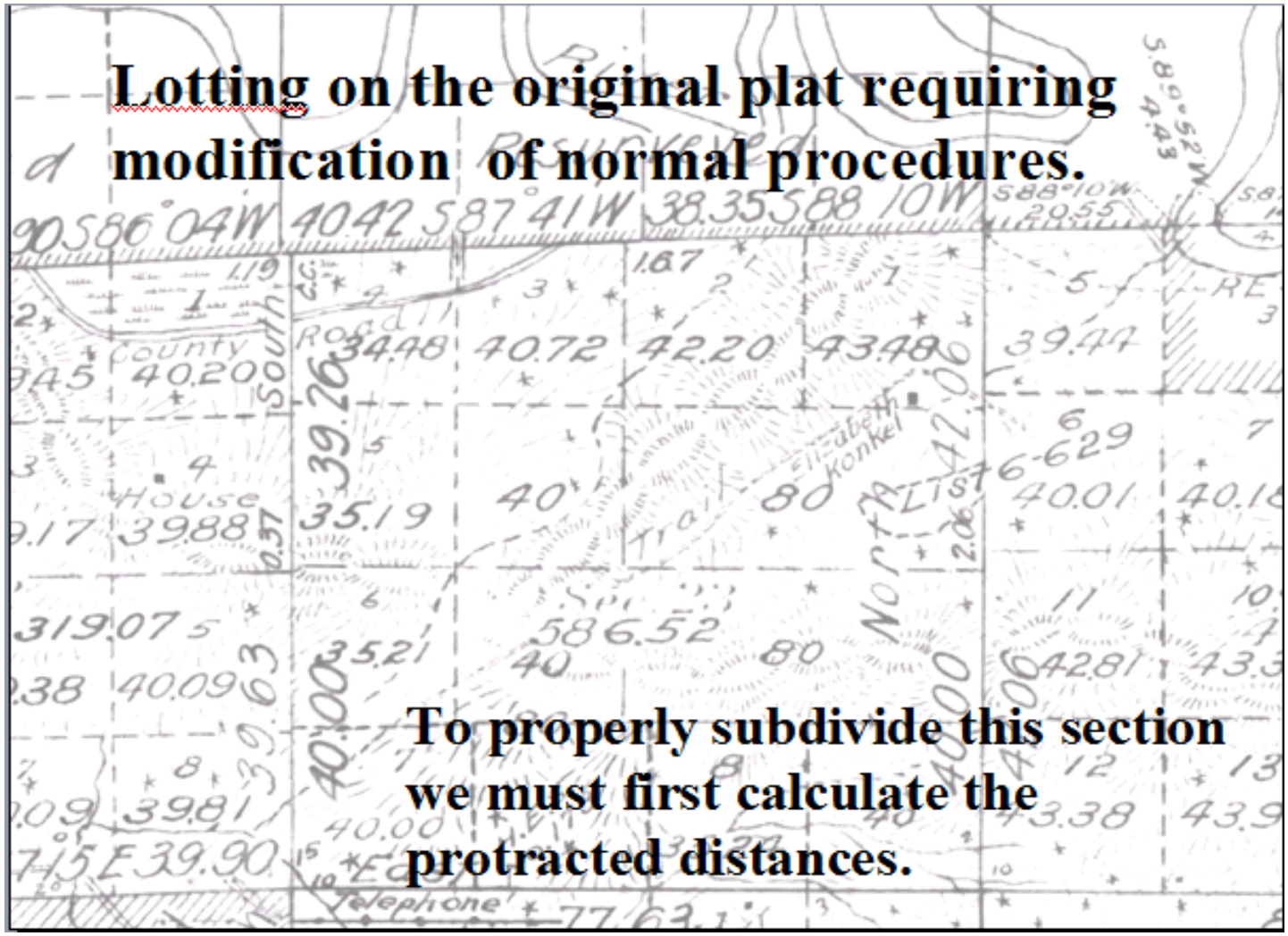
That's going to complete this portion. Next we're going to take some time and look at the area relationships. And again I think you're going to find that interesting, in that session we'll look at some information we found in the archives and we'll look at some things that the draftsmen did in coming up with their areas and I think it will begin to shed light on some of these sections that are not regular and how we're going to begin to subdivide those. So, that will be our next session.

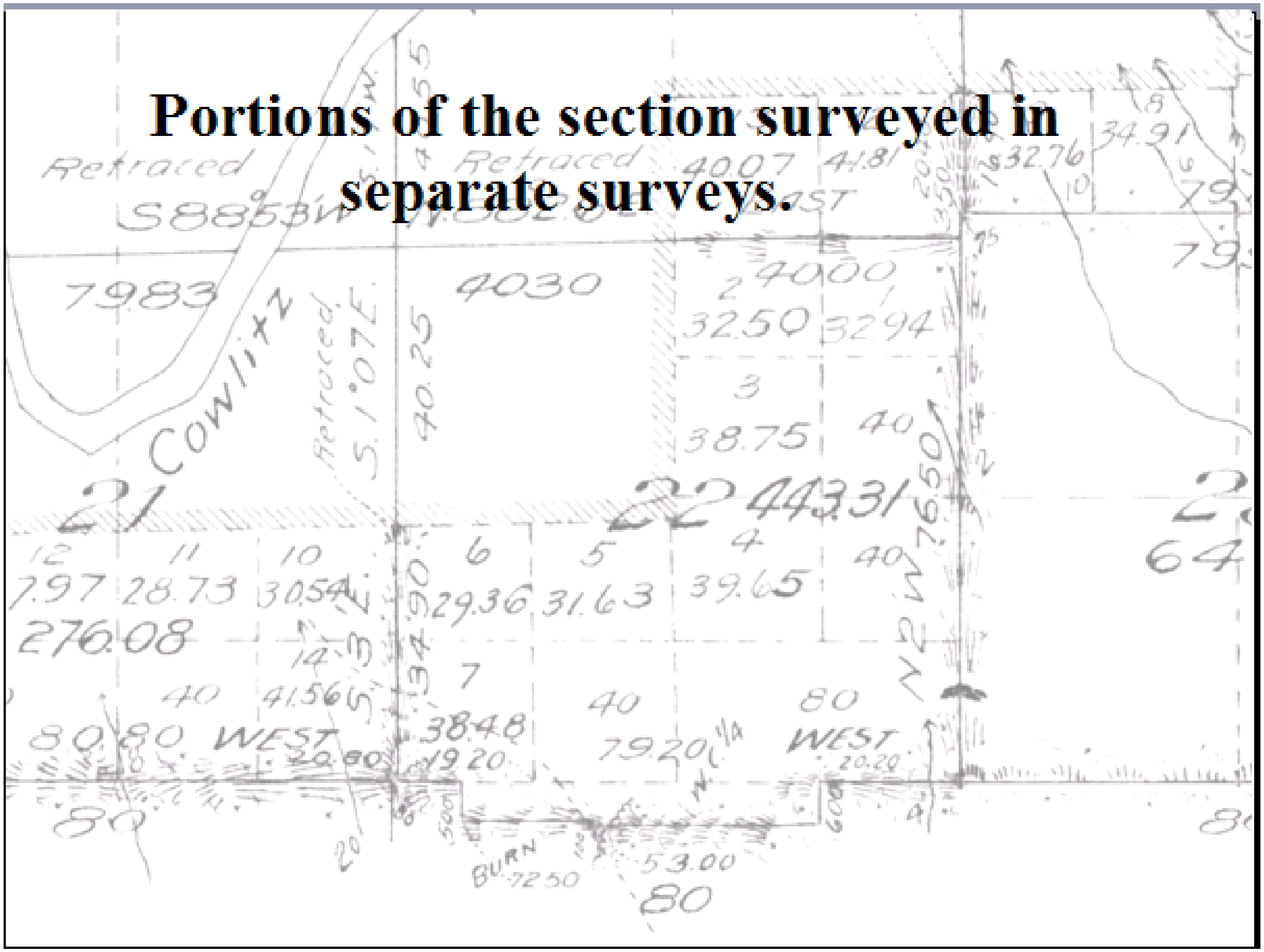
Before moving on to the next topic complete the "Calculate Coordinates for Missing Corners" problem which you can access from the course description page.

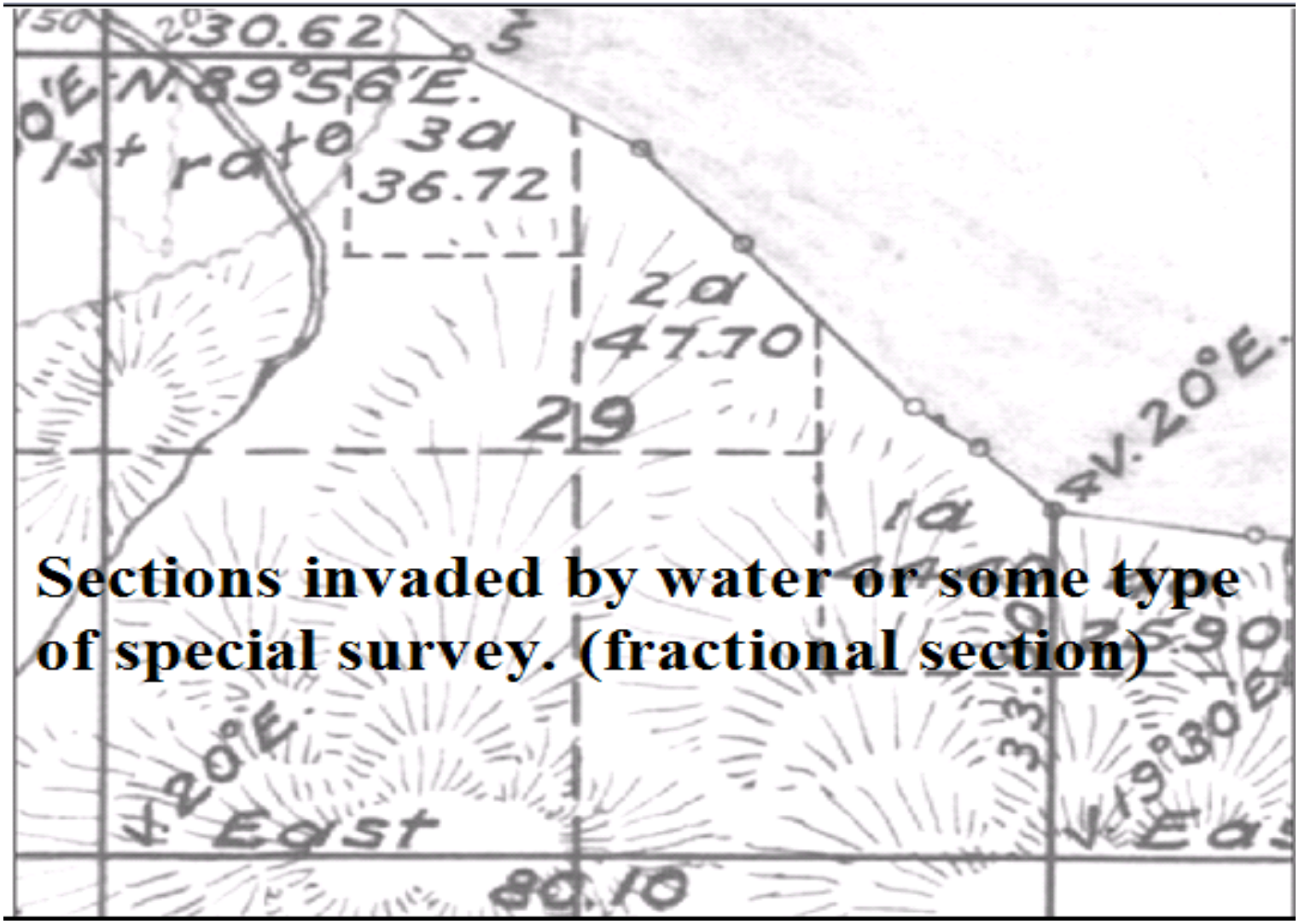
DIAGRAM


Protracted distances
(23.00)
(20.00)
(24.31)
(20.00)
Sections closing on the north and west boundaries
Sec. 2.
79.45
N. 88° 17 E. 39.22
N. 89° 54 E. 40.23
44.69
46.33
47.64
48.84
49.2
669.26
80.26
N. 89° 53 W
S. 89° 56' W
S. 89° 26 E

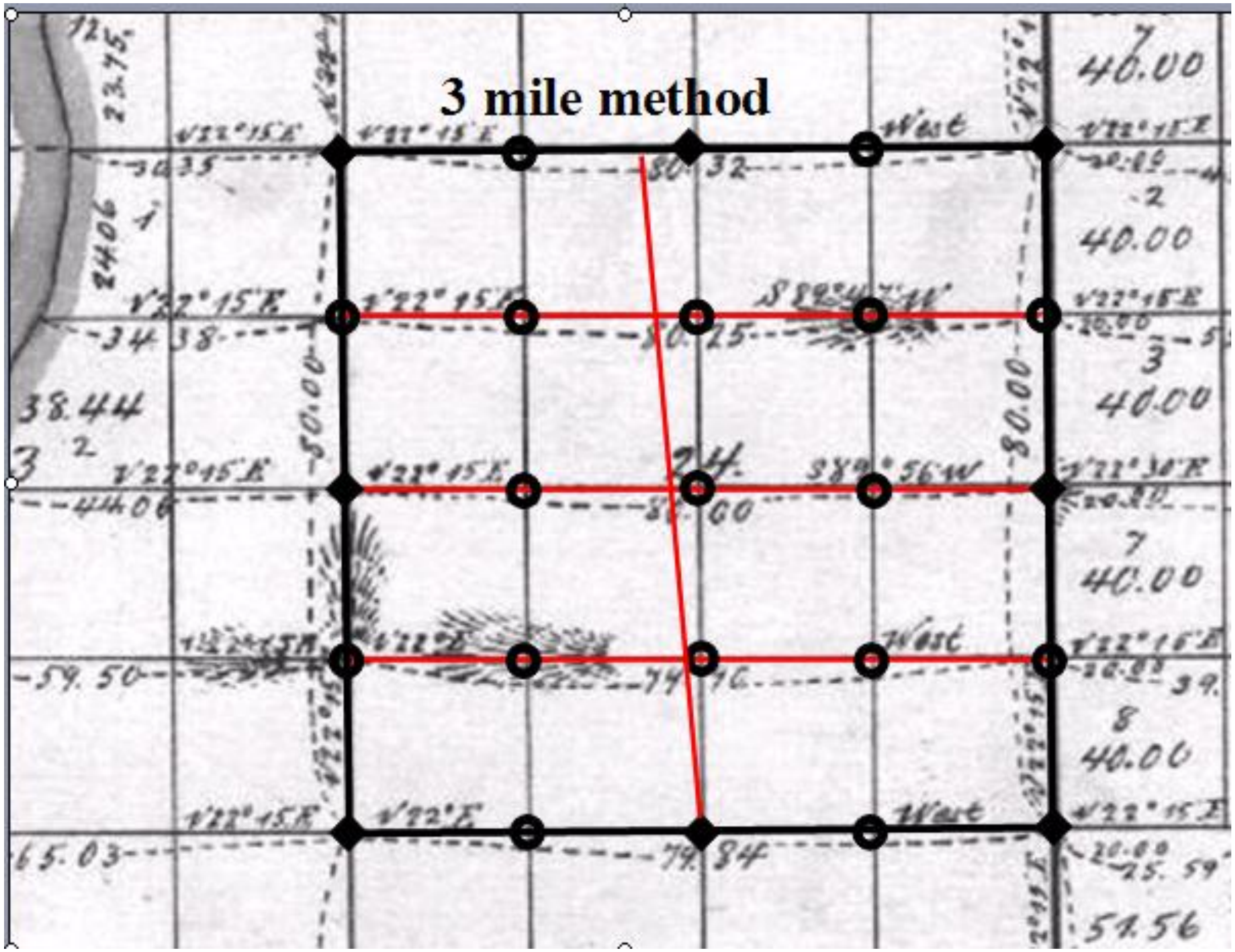

Lotting on the original plat requiring modification of normal procedures.
To properly subdivide this section we must first calculate the protracted distances.

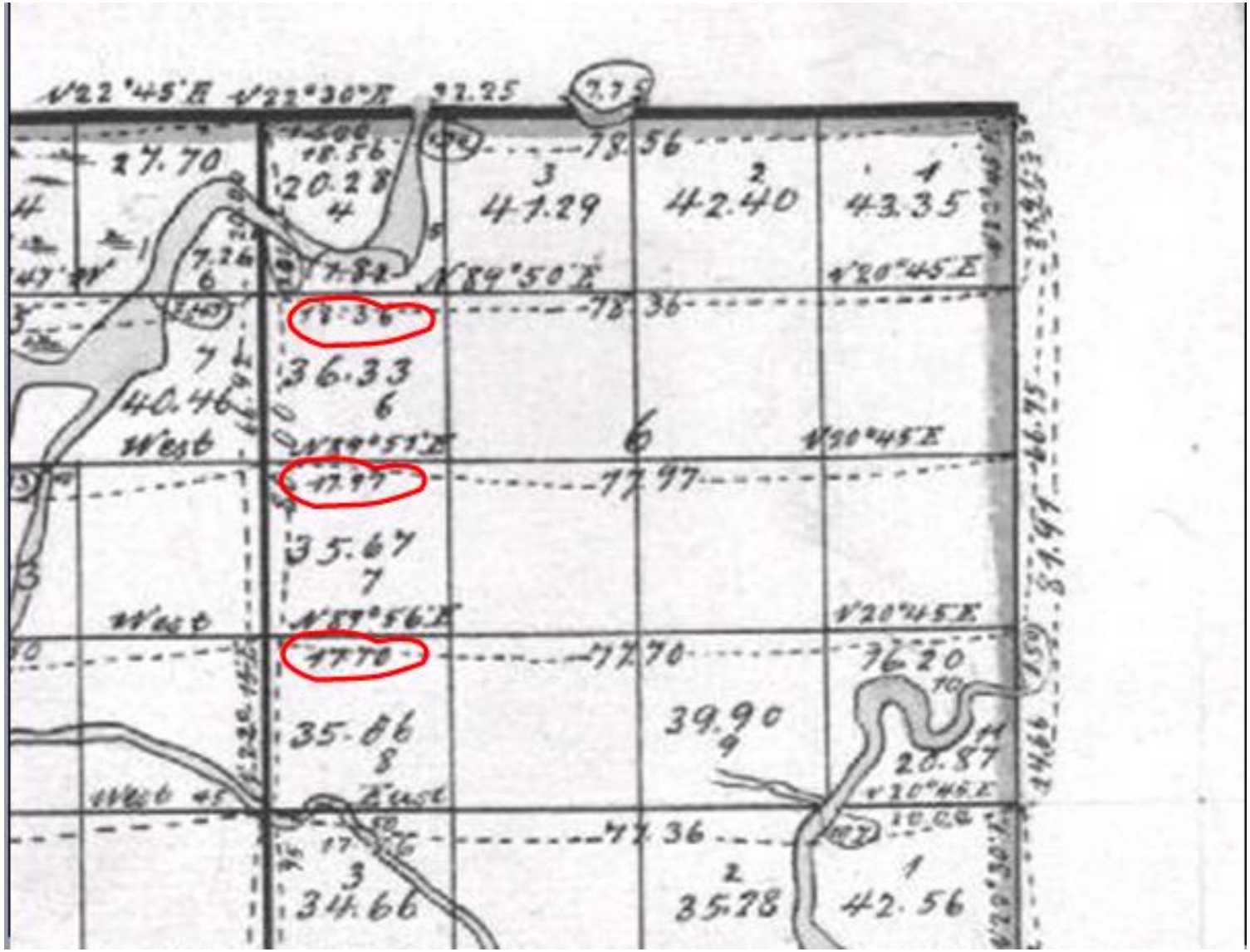
Portions of the section surveyed in separate surveys.





Sections invaded by water or some type of special survey. (fractional section)


3 mile method
West
West
West
40.00
40.00
40.00
40.00
40.00
80.00
80.00


N22°45'E
N22°30'E
27.70
20.28
41.29
42.40
43.35
N89°50'E
N20°45'E
36.33
40.46
West
N89°51'E
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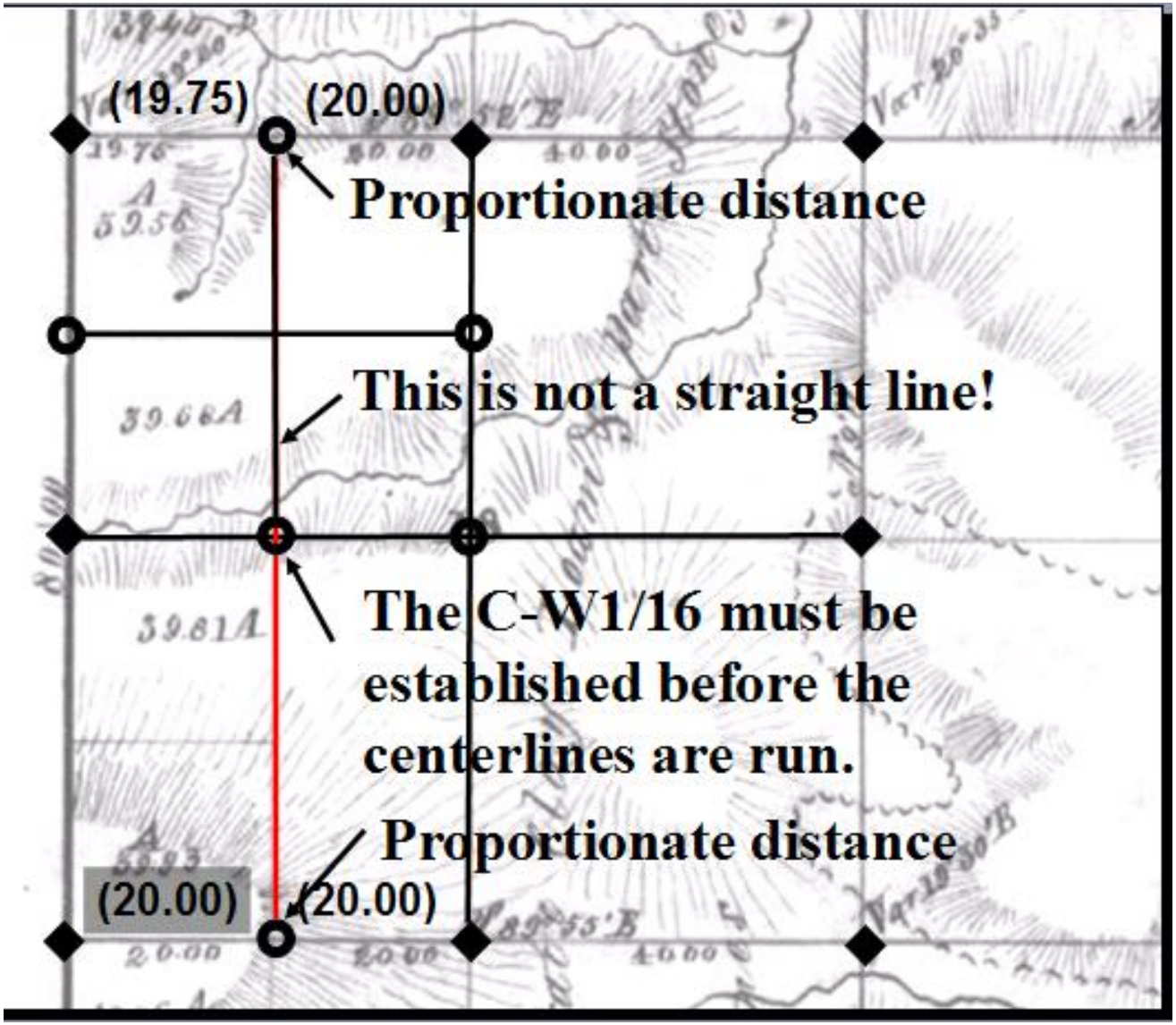
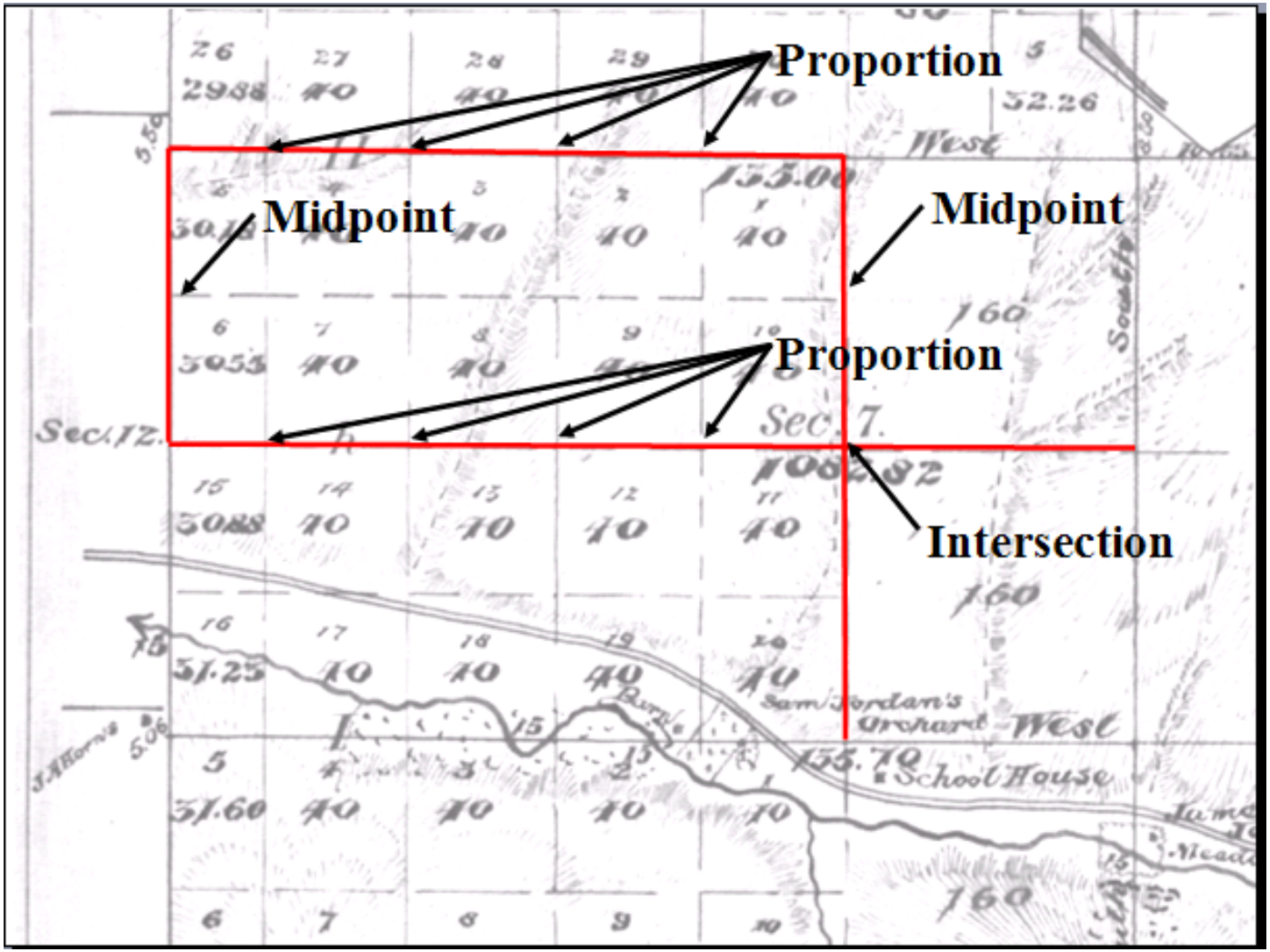
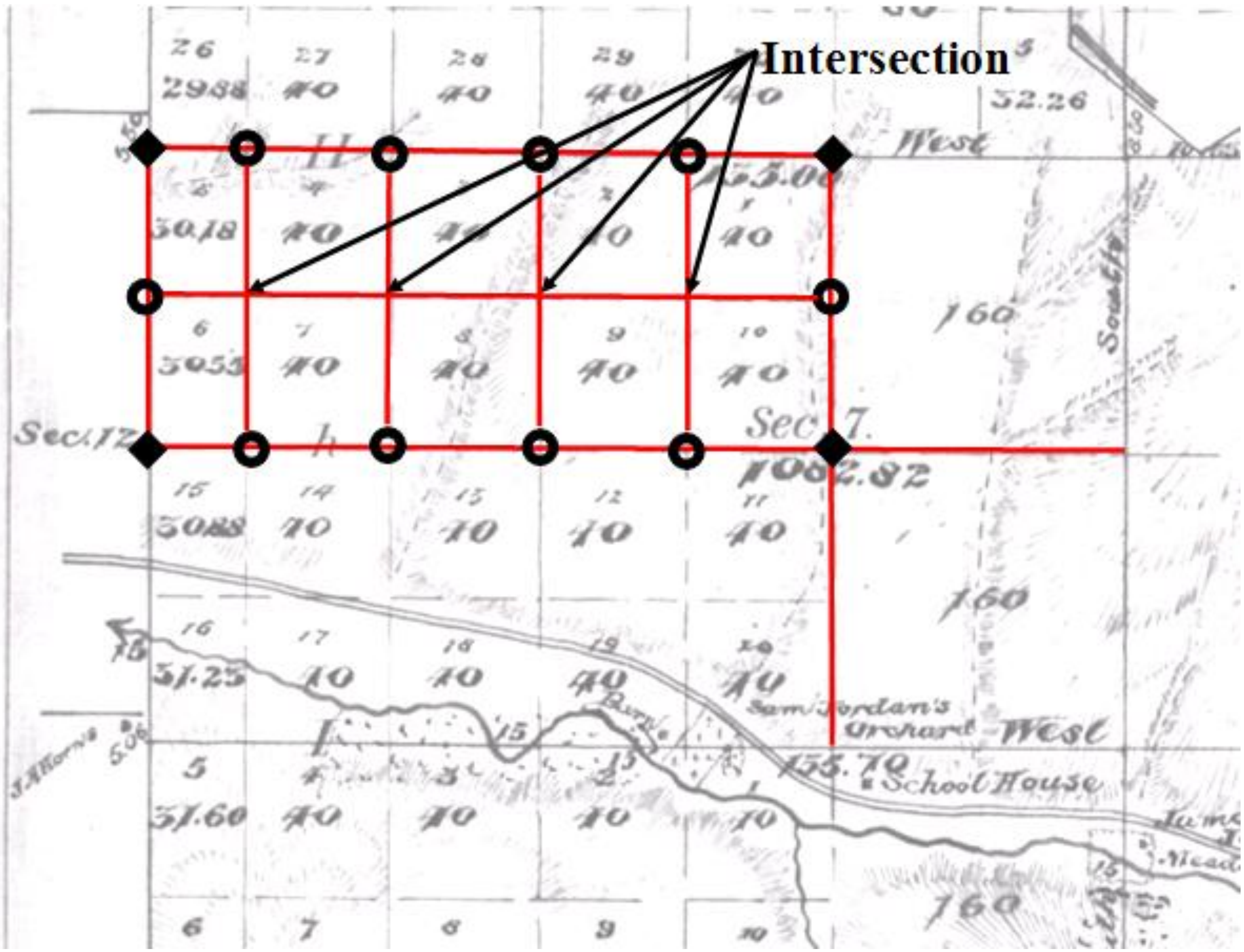
20.87
N30°46'E
34.66
35.78
42.56


(19.75)
(20.00)
Proportionate distance
This is not a straight line!
The C-W1/16 must be established before the centerlines are run.
Proportionate distance
(20.00)
(20.00)

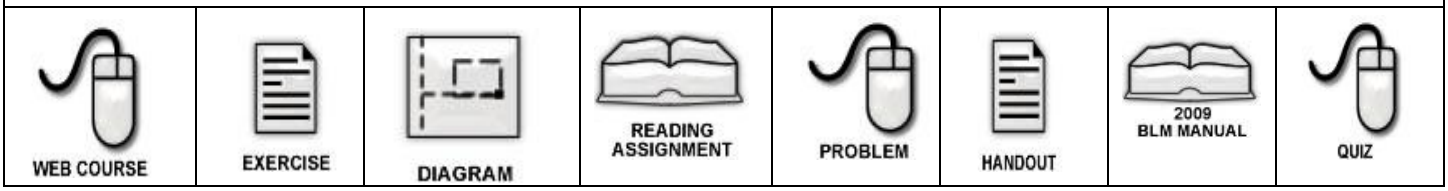

Proportion
Midpoint
Midpoint
Proportion
Intersection
Sec. 7.
West
160
160
160
Sam Jordan's Orchard
School House


Intersection
Sec. 7.
West
School House

Course 6: Subdivision of Sections Study Guide

COURSE DESCRIPTION:	This course focuses on the subdivision of sections. It addresses subdivision of normal sections, lotted closing sections, elongated and fractional sections, as well as the unique method known as the "three mile method" on many Indian Reservations and some private lands.
COURSE OBJECTIVES:	Upon completion of this course, students will be able to: • Learn to properly subdivide regular sections • Identify exceptions to section subdivision rules • Demonstrate an understanding of area relationships on GLO/BLM plats • Identify and deal with fractional sections
COURSE INSTRUCTOR(S):	Ron Scherler, Bureau of Land Management Dennis Mouland, Bureau of Land Management
VIDEO LECTURE TITLE:	Area Relationships – Part 1 (45 minutes)

ICON LEGEND



AREA RELATIONSHIPS – PART 1

Introduction

Hello again. The next segment of our subdivision of section course is going to cover area relationships and this is a really interesting portion of the course I believe because we're talking about the information that the plat gives us. All that data that's shown on the plat and how we use it to subdivide the section and learn to do it correctly.

Information Reported on the Official Plat

First of all lets look at a couple plats. I like this one; this is about 1851 survey plat and just look at all the information that's on here it's covered with data.

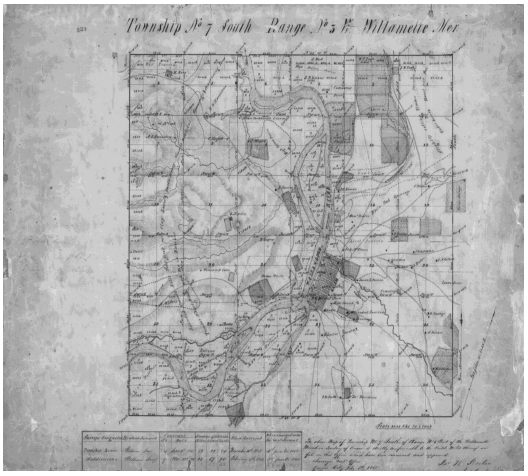


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

If we look closer here in Section 15 we'll see that there are names of some of the settlers that were out there.

We'll see that there are roads. We'll notice that there are bearings, distances; there are parcel identifiers, lot numbers, several lot numbers. The area of each parcel is shown on this plat we have meanders shown on this plat. We even have the type of land that is; here we've got low bottom land.

Over here it shows where there is a field where land is being developed, so the plat give us all kinds of information and mixed in with all that information is that data that we need to subdivide

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the section properly and that data is the bearings and distances, the lot numbers and most importantly the areas.

So let's go on and look at another portion of this plat.

If we look up at section 6 we can see that in this portion there are no lot numbers. Notice that we have areas against the north and west boundaries, we have an area reported for each of the lots on the north boundary.

We have an area reported for each of the lots along the west boundary but they do not have lot numbers. One of the things that we need to realize is that this giant cadastral system that we've developed, this Public Land Survey System took over a hundred years to develop and as we were working our way across the country we were creating this Public Land Survey System methods changed, ideas changed, procedures changed. It evolved.

And in one part of the country we may have plat that have certain characteristics, in another part of the country we may have plats with a different characteristic. Even in the same part of the country over time the characteristics, the information, the data shown on the plat and the way it's shown will change. So we need to be aware of that. However the key data that needs to be on there pretty much has been consistent.

It shows us, it tells us how to subdivide a section and it does have bearings and distances around the exterior and more importantly the areas that are shown on that plat. Today we're going to look at the way we interpret that area to subdivide sections.

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

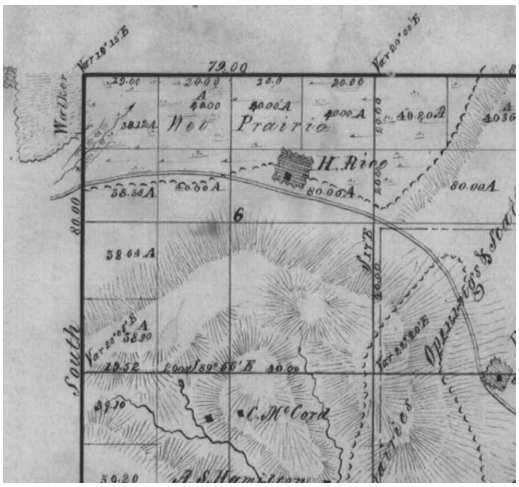

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

AREA RELATIONSHIPS – PART 1

Now let's look at another plat and you'll notice there are some different characteristics on this plat.

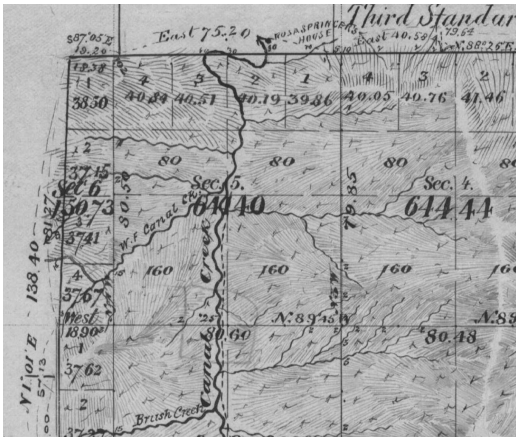

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

On the plat we looked at before there were no lot numbers along the north and west boundary, here there are lot numbers. Again there areas, we'll notice this plat gives a total area for the section it also gives areas for each quarter section and areas for each half quarter section. So this is a little different time frame, a little different information we'll also notice that over here Section 6 is less than a quarter of a mile wide.

We had for some reason something about this section was smaller. We'll also notice if you'll look at the north boundary there are several different bearings along that north boundary. The majority of it is east but we also have this bearing up here that's 87° 05' so we don't have a straight north boundary so there are some interesting things about this plat.

As go along we will examine the way these different plats will be used but when all is said and done what we are going to be doing is working with those areas to determine how to properly subdivide the section.

Lesson Objectives

So area relationship, exactly what are we going to talk about today? We're going to learn to calculate the protracted or parenthetical distances (and I'm going to define that for you just right away) by several of the most common methods so there are various ways to work back from the areas to get those parenthetical or protracted distance and we're going to look at those.

AREA RELATIONSHIPS

- Learn to calculate protracted (parenthetical) distances by several of the most common methods.
- We will examine how the areas are used to determine corner positions and what to look for to determine if corners are common or corners of minimum control (one side of the line only)
- Discuss briefly, how bona fide rights may affect the platted corner positions

Next we're going to examine how the areas are used to determine the corner position and what to look for to determine if corners are common or if corners are for minimum control. And by common corners I mean that the corner is for both sides of the line, sometimes we have offset corners often the areas on the plat tell us where those offset corners are.

So we're going to look at that and then thirdly we're going to discuss briefly how bona fide rights may affect the platted corner

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positions and I think you might find that an interesting portion too.

Understanding the Areas

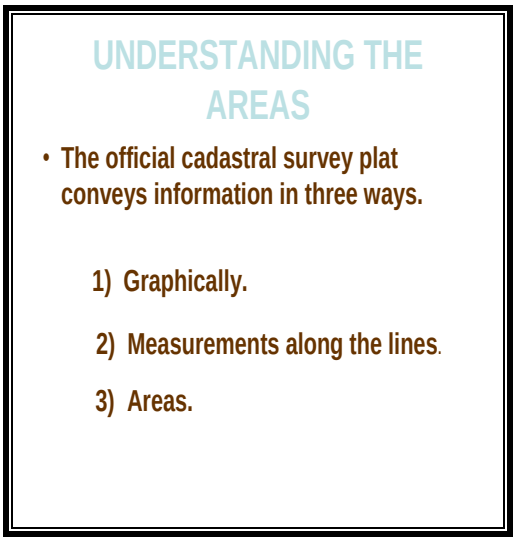
So understanding the areas, that's what we want to talk about first. The official cadastral survey plat conveys information in three ways, three basic ways it conveys information.

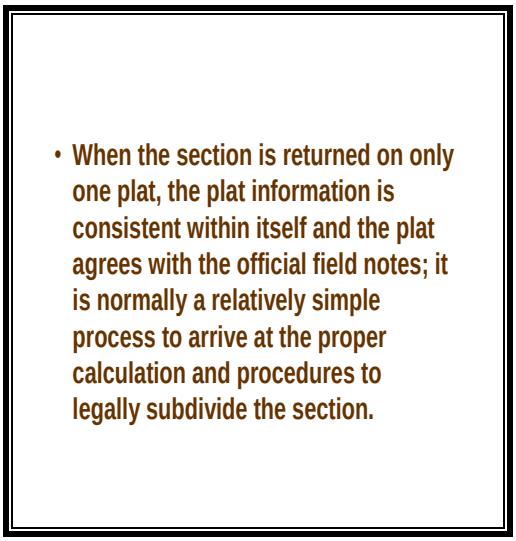
First, graphically, there is a picture we can see if lines are offset sometimes. We can see if there may be common corners or offset corners. So there is a picture there, graphically it gives us information.

Number two, measurements along the line, we're given bearings and distances along the line and those are shown both on the plat and in the field notes, that's the second thing. And number three are the areas. And the areas in many ways may be some of the most important information that is shown on the plat because they tell us how that section is supposed to be subdivided.

When a section is returned on only one plat, the plat information is consistent within itself and the plat agrees with the official field notes.

It is normally a relatively simple process to derive at the proper calculations and procedures to legally subdivide the section. However that's not always the case.





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A relatively large percentage of sections contain one or more conditions which begin to complicate the situation. So lets look at a few of those.

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First, a retracement that creates bearing breaks on the boundaries.

1) A retracement that creates bearing breaks on the boundaries.

2) Sections made fractional by water or special surveys.

3) Completion surveys.

If we look at the north boundary of this Section 2, we'll notice that's not a straight line. Over here we have a bearing of 89° 50', on the other side we have a bearing 88° 17' there is a bearing break there and that can complicate how we subdivide the section and we'll look at that in a little more detail as we go along. The second thing is sections made fractional by water or special surveys.

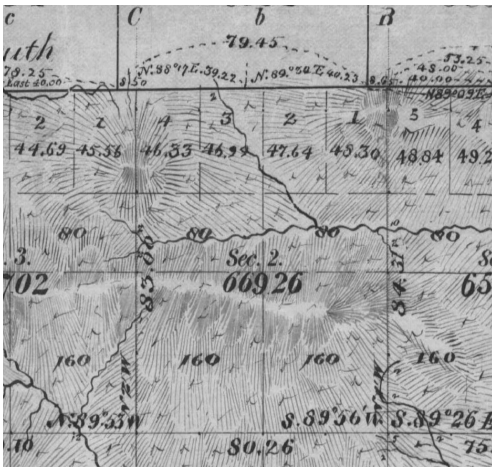

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

AREA RELATIONSHIPS – PART 1

Anytime we have a section that's invaded either by a mineral survey, a homestead entry survey, a reservation, a land grant, water, something invades determining how that section should be subdivided becomes more complicated.

Number three, completion surveys. Portions of the country have very few completion surveys. If you're in the Midwest some of the earlier states that were surveyed there are very few completion surveys there. Townships were pretty much surveyed as a whole, the land was pretty much all valuable land, farmable and therefore there are very few completion surveys in some parts of the country.

As you get closer to the mountains though we start having more completion surveys.

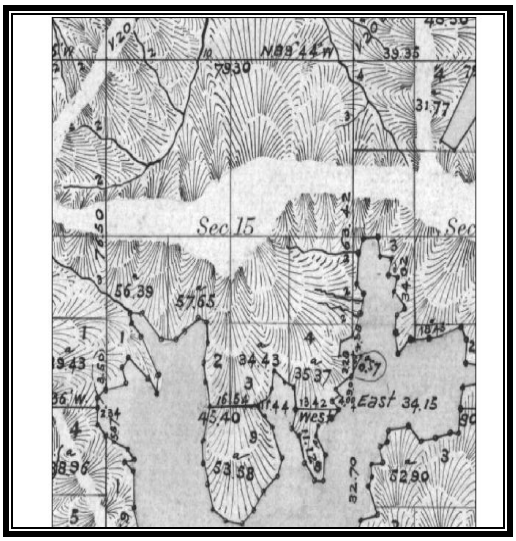

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

Here's a completion survey where the northwest quarter was surveyed first on a previous survey several years later the remainder of the section was completed and when you look at this you can notice that right there at the center quarter there are maybe more than one corner, maybe there are two may be there are three positions in there where those lines come together.

So that's a pretty good indicator that there is going to be some different procedures used to subdivide this section. Lets talk a little bit about what I mean when I say protracted distances or parenthetical distances I'll kind of use that term interchangeably but lets think a little bit about what I mean.

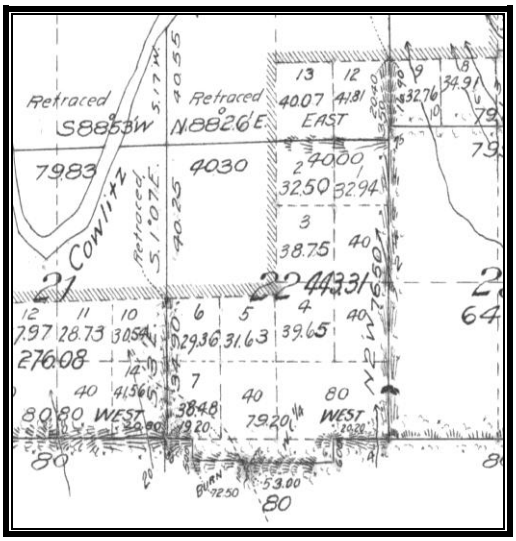

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

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If we look at this section right here against a north boundary of the township, Section 2, and let's look at that area in the northeast quarter with an area of 39.94 acres. Well what do we know about the distances around that?

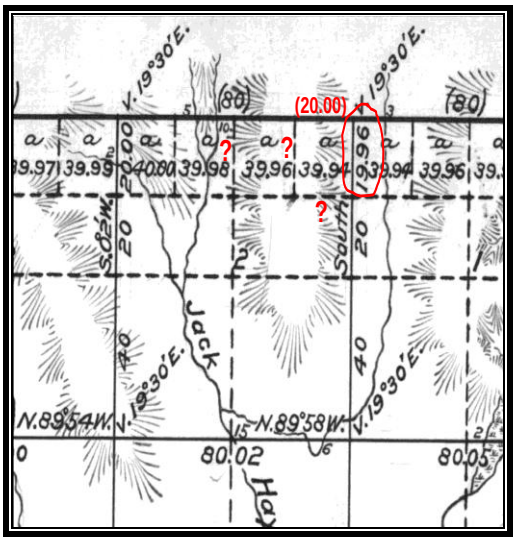

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

To start with we know that the east boundary of that parcel is 19.96 chains. We know that north boundary is 20 chains, how do we know that? The total north boundary is 80 chains we divide it by 4 its 20. But what about the south boundary of that parcel? How do we get that number? What about the west boundary of that parcel? What about the west boundary of that next parcel that distance on the north-south center line?

How do we get those distances? And that distance on the north-south center line that's one of the most important ones because that's the distance that we use to determine where the center-north sixteenth goes. We need that distance to determine where this center north sixteenth goes. So, what we're going to do is talk about how to calculate these distances. How do we use the area to work back to get those distances? Those are what we refer to as protracted distances or parenthetical distances.

We use the term protracted because these are protracted lines they're not surveyed lines or sometimes we use the word parenthetical because on our survey plats we show distances that are not actually measured, we show them in parenthesis. So you'll hear that term used interchangeably. So that's what a protracted distance or a parenthetical distance is.

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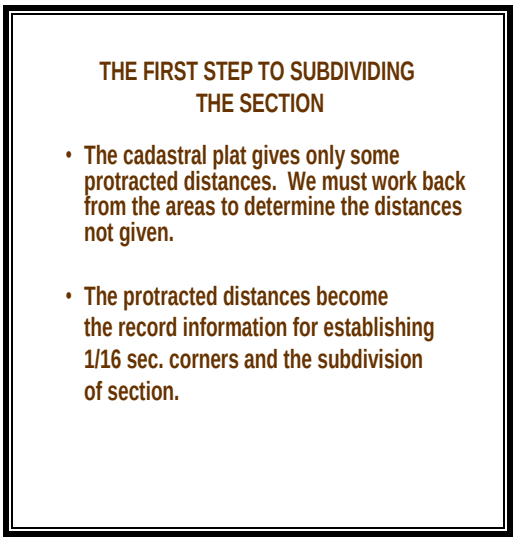
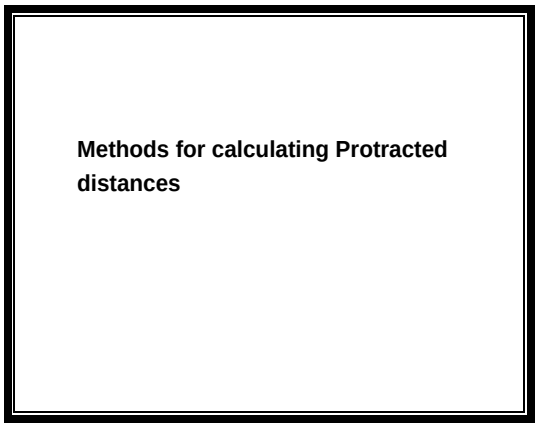
And the first step to properly subdividing a section is the cadastral plat gives only some protracted distances we must work back from the areas to determine the distances not given. First step. We've got to work back from those areas to determine what are the distances around each of those parcels so that we can determine the position for the corners.

The protracted distances become the record information for establishing the sixteenth corners on the boundary of the section and the subdivision of the section so those protracted distances tell us where to put the sixteenths on the boundary they also tell us how to subdivide the section properly. So we need to determine what those distances are.



How the Draftsman Calculated Areas

So there are several methods for calculating these protracted distances and we're going to look at a few of those.



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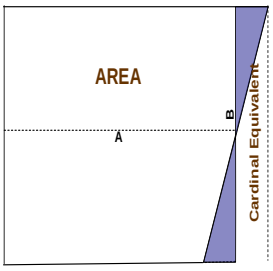
The draftsmen was supposed to use the cardinal equivalents to compute area and we've talked about cardinal equivalence earlier and we're going to over that a little as we go along.

- **The draftsman was supposed to use the cardinal equivalents to compute area.**
- **The cardinal equivalents of :**
  N. 87° 15' W., 40.00 chains
  North: 39.954 (sin x 40 chains)
  West: 1.919 (cos x 40 chains)

Basically the cardinal equivalents of a line is the northing of the line if we have a bearing of say north 10 degrees east for 40 chains, the northing component of that line is the cardinal equivalent and the eastern component of that line is a cardinal equivalent. There are always the north component and the east or west equivalent. So we're supposed to use cardinal equivalence for computing our areas and we'll show you a little about why that is.

The cardinal equivalent of N. 87° 15' W for 40 chains is 1.919 chains northing that's the northing. We get that by taking the co-sine of the angle times 40, the westing of that is 39.954 that's the other cardinal equivalent we get that by taking the co-sine times 40 chains. So those are the cardinal equivalents of that line and that's the numbers that we'll be using when we work on the areas and I'll show you how that works as we go along.

Let's assume that we want to determine the area of a parcel that's shaped like this and I've exaggerated a little bit so it's easier to see how we do that.



But in using cardinal equivalence to do this, the first thing that we do is we mean the north and south boundary. Ok, we know that the north and south boundaries are at different distances we can see it visually so we want to get a mean of that. And that will be line A, we've meaned the north and south boundary that's the distance A.

Then we notice that this east boundary is on a really strong bearing a heavy bearing so we know that north component of that is not the same as the total distance of the line so we want to find the cardinal equivalent of that the north component of that. Then we want to move it. We're going to use that for the north-south line distance we're going to use the line A as the east-west component of this area and all we need to do is multiply the A times B, right?

What does that gives us? That gives us the total number of square chains, right? Then we divide that by 10 because ten square chains equal an acre. We want to find acreage. This method you can see that the excess little triangle up there to the top that we left out is

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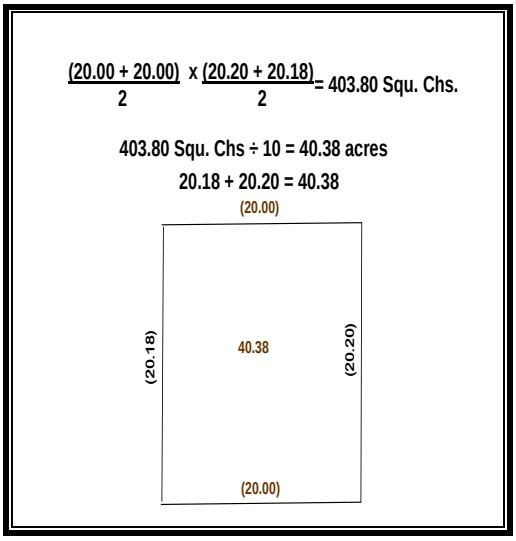
made up by the triangle down below. So the area of this triangle up here is equal to this triangle down here.

Total area ends up being correct. As we begin to look at how we compute these areas its really important to understand that we're always using cardinal lines. There are no angles that we're working with. We're always using cardinal lines and it makes it very easy to determine what the bearings and what the distances are that we're supposed to use.

That's just a couple of things because we're using cardinal equivalents and because we're using chains and 10 square chains equals an acre there are certain things that we can do that make it very simple. And most of our calculations that you'll see are going to be addition, subtraction a little bit of multiplying, dividing but not much else thing are pretty simple. Lets look at this.

Here's a simple lot. We have an area and we have a distance on each side so what can we learn about this in calculating areas in a cadastral plat or public land survey plat?



Here's the formula, we take the north boundary and the south boundary we add them together and divide by 2. Alright, we've done that right here. Then we take the east boundary and the west boundary and we add them together and divide by 2, we've done that right here. We multiply them and that gives us square chains, right over here, ok? Pretty simple procedure, there are no angles involved because these are cardinal equivalents they're all north/south, east/west lines.

So then we've got square chains divided by 10 because we have 10 square chains equal an acre. We end up with 40.38 acres, ok? No problem. But look at what you can also do, we don't have to do all that calculating, you can add the east boundary and the west boundary and you end up with 40.38 acres.

Anytime with the north boundary and south boundary of a lot are 20 chains of those distances are 20 we can add east boundary and west boundary to get the area. Anytime that the east and west boundary are both 20 we can add the north and south boundary that gives us the area. And we'll use that we'll see and we'll see that quite a bit. It's a very simply way to do it all we have to do is

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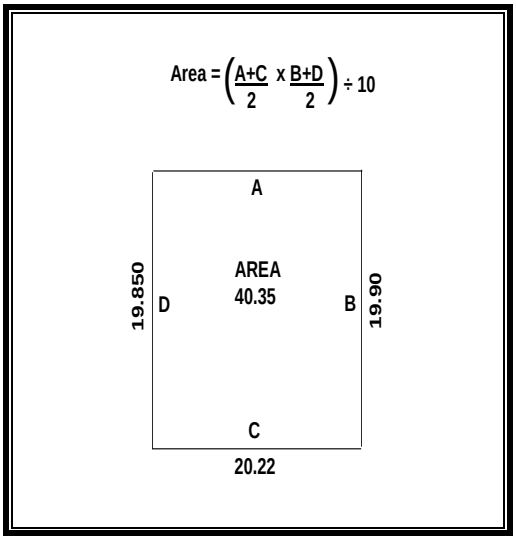
add 20.20, 20.18 we get 40.38 it's just addition. Anytime that two boundaries are 20.

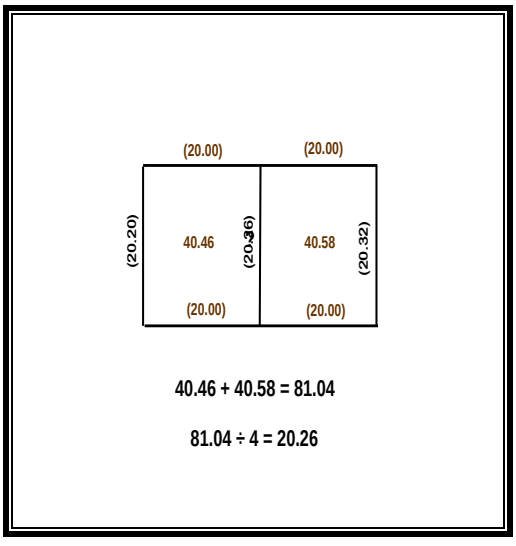
A couple of other little hints, sometimes we're going to have three sides of a lot and the fourth one is not there. The formula at the top of the page, it's a very straight forward formula because these are all cardinal lines in the end, they're all 90 degree angles so can always get the fourth side when have three sides.



Very simple procedure. Now this one's a little more interesting and we'll see this in one of our examples later today but sometimes you will have two lots side by side and you've got a section with a lot of lotting and you can't figure out a place to start. You can't figure out really where there is a distance that you're really sure about and you can start working your way through the procedure.

Sometime you have lots side by side and both of them have 20 for the north, two lots side by side and each lot has 20 for the north and 20 for the south. If we want to determine the distance of the line between these two lots, all we have to do is add the two lots together, 40.46 plus 40.58 equals 81.04 and divide by 4. That's all we have to do. And gives us 20.26 for that line.

Now because the north boundary of each lot and the south boundary of each lot they are all 20 all we have to do is subtract across to get the other area. So all we do is take 40.58 minus 20.26 we get 20.32, that's the distance of the east boundary of that lot.



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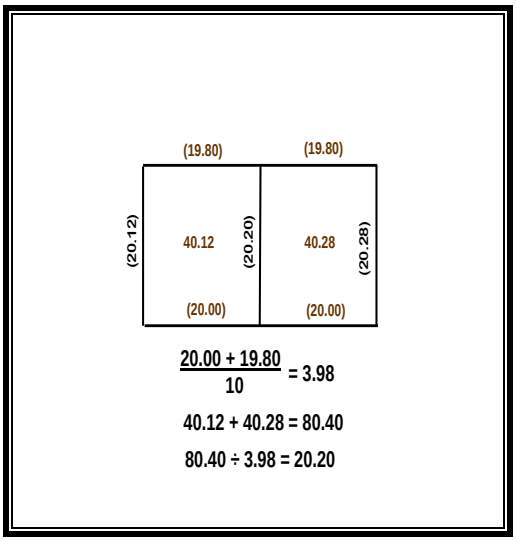
Likewise we can take 40.46 minus 20.26 and we get 20.20 which is the distance of the west boundary of the other lot.

Again this is because we're dealing with chains and 10 square chains equals an acre and we're dealing with cardinal equivalents so that all of these lines are cardinal so they are all 90 degree angles.

We have no other angles or bearings to deal with they are all perfect squares.

We can also use this same method as long as both distances along the south side of these two lots are the same and both distances along the north are the same we can still use this same process and here's what we do.



We take the north boundary of one lot and the south boundary of the same lot, add them together divide by ten that gives us 3.98. So this time instead of adding the lots together and dividing by 4 we're going to add those two areas together and divide by 3.98. Watch what happens, 40.12 plus 40.28 equals 80.40 divided by 3.98 equals 20.20. The distance between the lots is 20.20.

Now we can't just subtract across this time though because the north boundary and the south boundary are not both 20 so we're going to have use that formula from that previous example to find the other two distances. The west boundary ends up 20.12, I'm not going to work through it now but you'll do some of that later, and the east boundary ends up being 20.28.

If you calculate through those you'll see that's the number. So that's another little method we can use to come up with areas.

Calculating the Protracted/Parenthetical Distances For Sections Along the North and West Boundaries

Now, we're going to change gears a little bit here and we're actually going to look at some sections, we're going to work through the numbers, come up with what those protracted or parenthetical distances are and then begin to look at how you subdivide the sections based on the information you've learned.

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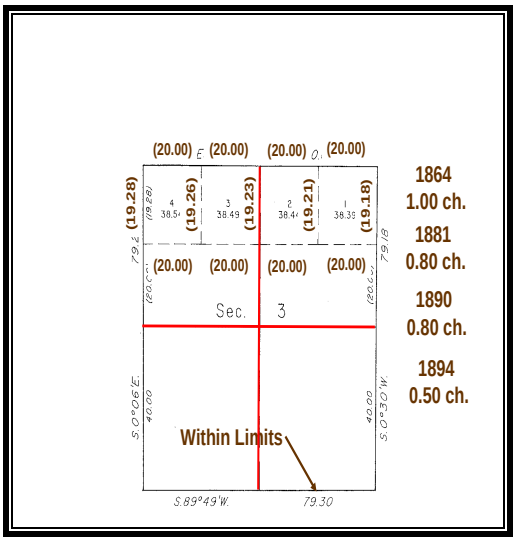

So lets look at Section 3. So what do we know about Section 3 as we look at it.

First of all we can see that the distance over on the east boundary of lot 1 is 19.18 chains we know to start with. Lets look at the south boundary it's within limits now I've talked about limits before and you've heard it a couple of other places, you may hear me talk about it several more times because its really important to remember. It's going to help you solve a lot of problems.

Again the limits, 1864 where a chain and 1881; 80 links, 1890 Manual 80 links, 1894; Manual 50 links. So this boundary down here is within limits because its within limits for area calculations its treated as 80 chains so because of that, what else do we know? We know that each of these distances across the south boundary of these lots 1-4 each distance is going to be 20 chains. We know that because that south boundary is within limits. How bout the north boundary well it was 80 chains so we know that its going be 4 20-chain distances they are all within limits.

So now, we've got 4 lots here and the north and south boundary of each lot is 20 chains, so what can we do to get our areas? We can subtract across, let's look at how we do that. And I'll get my calculator out I hope maybe you have your calculators there with you too. Simple stuff, its math, adding and subtracting but at times it helps to have our calculator to do that.

So lets look at this, 38.39, that's the area of lot one, minus 19.18 and what does that give us? It gives us 19.73, whoops. I punched a number wrong, let me try this again. When we're doing this, if you do punch a number wrong and you get something wrong you're going to figure that out right away cause it going to be numbers that don't work. So let's try this again, 38.39 and we're going to subtract 19.18 and we get 19.21 this time. Now to get the next one we subtract 19.21 from 38.44 let's see what we get, 19.23, ok?

We just keep working our way across. 38.49 subtract 19.23 and we get 19.26, keep working our way across. We do that last one and see if it matches the distance on the far side that's going to tell us if we've done it right. So the last one 38.54 minus 19.26 and we get 19.28 that agrees with that last distance over there. Another thing to look at is the differences in these distances. From 1918 to

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1921 three links, from 19.21 to 19.23 two links, from 19.23 to 19.26 three links, from 19.26 to 19.28 two links, the difference is because of rounding.

It should be an even progression across there, if it's not an even progression something is probably wrong in your calculations, something's different in there. So, that's something to keep in mind once you've done this. Now, we've got these distances, we've got these protracted distances around each of the lots, how do we subdivide the section? Well if you look at the procedure we've talked about earlier, the first thing we do is survey the center lines of the section at intersection reestablish the center of the section.

What's the second step? The second step is always to establish the sixteenth corners around the exterior of the quarter you're going to subdivide. So if were going to subdivide the northeast quarter, how are we going to establish those sixteenth corners? And in this case two of those sixteenth corners are not going to be at midpoint, which one? What are the two sixteenth corners that are not going to be at midpoint? It's this one over here, why? Because what are the parenthetical distances that south half a quarter mile is 20 chains the north quarter mile is 19.18 chains, it's not at midpoint so it's going to be established at proportionate distance. Same thing with the center north sixteenth, the south quarter mile from the center quarter north is 20 chains.

The next quarter mile is 19.23 those are going to be established at proportionate position, once they are established then we subdivide the quarter by the intersection of straight line. So you can see that if we did not develop these numbers properly we're going to get two of those sixteenth corners in the wrong position and we're going to subdivide that northeast quarter in inproperly.

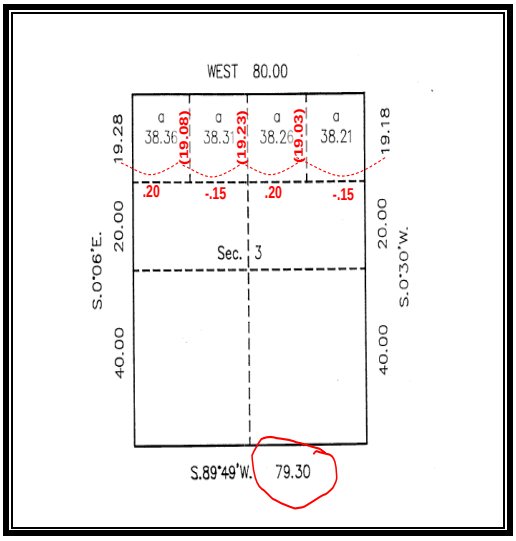
So it's very important that we get these numbers correctly, derived from the areas on the plat. I'm going to show a few things that confuse us, that may lead us down the wrong road sometimes but hopefully as we're through this you'll have a good handle on how we can approach each section in determining those protracted distances.

AREA RELATIONSHIPS – PART 1

Let's look at another situation, very similar but we're going to find a different result. And one of the things that's happened, remember I said we did this process over a hundred year period or a 150 year period things change, procedures change. You always have to be aware that any plat you look at may have had the areas calculated in some unique way. A little bit differently, maybe they used a different procedure for a very short time.

We have a new surveyor general there and he's doing something different so the areas may come from some procedure that's a little bit different, a little bit strange. And I'm going to show you just one, I'm aware of a lot of others, but I'm going to show you just one. And so wherever you are around the country whatever time frame you're working in you may find different strange little procedures that they used that maybe don't make a lot of since but once you realize they're there you can work through them and come up with the correct numbers.

Let's look at section 3 now. As we look at it we should be able to just subtract across, should we not?



So we should be able to take 38 because of north boundary is 80 our south boundary is within limits, we should be able to just subtract across. So lets do that. If we take 38.21 minus 19.18 we get 19.03. If we subtract 19.03 from 38.26 we get 19.23, if we subtract 19.23 from 38.31 we get 19.08 and if we subtract 19.08 from 38.36 we get 19.28. So it worked subtracting across we ended up with the distance on the far side but stop a minute and look at this a little more carefully and we might realize that it didn't really work.

Compare the difference between the east boundary and the next lot over 19.18 to 19.03, what's the difference there? Its getting shorter by 15 links, look at the next one; the difference between the next two. It's going to get longer by 20 links, let's try the next one.

Shorter by 15 links and the next one is longer by 20 links, so what's going on? This is supposed to be even progression across here. It should be getting slightly longer from 19.18 to 19.28 that's two and half links and it should be getting longer by about two or three links for each quarter mile as we go across there, that didn't happen here. Why, what's going on? Well let's look at it a little

AREA RELATIONSHIPS – PART 1

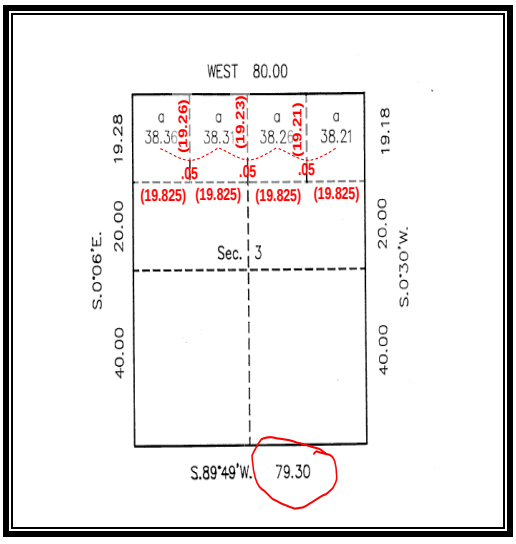
closer. So how about if we take 19.18 and subtract it from 19.28 we get 10 links. So each of these if we just did a even progression across there each of these distances should get longer by 2 1/2 or 3 links something like that. So we're going to get distances of about 19.23 or so.

Let's look at the areas a little bit and see what they tell us about the progression. If you look at the difference in the areas and we can see that between the northeast quarter and the area up there in the northeast quarter five-hundredths of an acre the next one is five–hundredths of an acre difference and last one is five-hundredths of an acre distance. So the areas are progressing evenly, they're progressing evenly, but those distance didn't.

So how about if we take 19.18 subtract it from 19.28 that gives us 10 links divided by 4 that's 2.5 links each. So we go 19.18, bout 3 links that gives us 19.21 for next one it gives us 19.25, for the next one it gives us 19.26 and last one 19.28. That's just strictly and even division of that difference across there but if we add those two together, 19.18 and 19.21, if we add this distance and this distance 19.21, 19.18, what do we get for that lot? We get 39.39 much larger than the area that's shown, so what's going on?

Well it's kind of an interesting little thing because it doesn't make a lot of sense but this area distance on the south boundary of 79.30 that is within limits.

On these plats and in this particular state this was done for about 13 years on all the plats were done this way. The 79.30 was divided by 4 and that total distance was moved up to the south boundaries of these lots. And so the south boundary of each of those lots is 19.825 not 20, it's 19.825.



I'm aware of similar things happening in several other states so it's important when you're working through these areas to get your protracted distance. Once you have the distances, really look at what they are see if they even progression where they're supposed to be. See the areas on the lots make an even progression. Really look carefully at your answer, don't just pick up your plat, subtract across and think you have the proper answers.

Always look carefully at the record, look carefully at your answers

AREA RELATIONSHIPS – PART 1

to see that they really make sense and you may find some situations were some kind of a unique or special method was used that complicates or changes how these areas are calculated. As it turns out in this case you always still get the correct number right there and that's one of the most important numbers that you need. The only error in the numbers ends up being here and here and those numbers are not near as important when we're subdividing the section.

So that's one the fortunate things even if you've kind of missed it you're still going to get the section subdivided properly.

First Manual Procedure for Area Calculations

Alright, let's go on and look at the next one. The 1894 Manual is the first Manual that gave specific instruction about how to calculate areas. Now probably the procedure that's described in the 1894 Manual had been used many years before that, before it actually got included in the Manual.

But1894 is the first time that the method is actually shown and it's important to understand the method that was used by the original draftsmen because sometimes that's helps us resolves discrepancies when there is some error in those areas or when we can't quite figure out what's going on to really know how they were computed really helps.

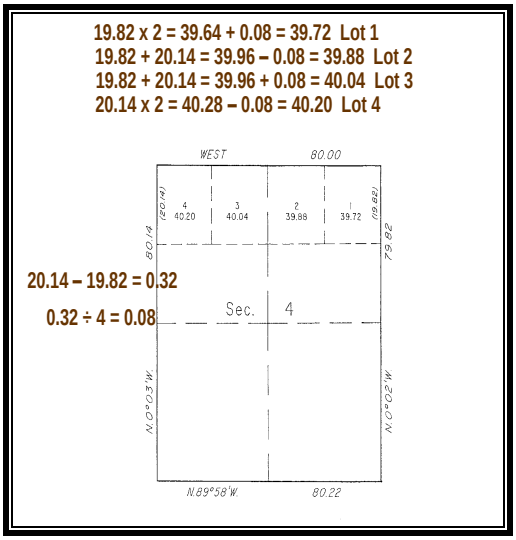
And several years ago I was doing some research in the National Archives at San Point, Washington and I came across an area in the index that said "Area calculations from the draftsmen. And I looked at that I thought "that's kind of interesting." So I got the box, began to look in it and what I found was page after page after page of the draftsmen calculations of areas on original cadastral survey plats, the GLO plats.

Most of the information I found was from the 1890's up to around 1910 to 1915 but when I looked at those I found this method that was described in the 1894 Manual was used over and over and over again in this time period. So I think it's important that we look at it and see what that method is. So here is the process, pretty simple its adding and subtracting and it give us a good area but the interesting thing is we don't compute any distances, it's a

AREA RELATIONSHIPS – PART 1

method for calculating the areas without calculating any distances.

So let's look at how it's done.
First of all let's start on the side with the smallest lot. So that's going to be over here, lot one because the distance 19.82 is shorter than the distance on the other side, so that lot's going to be the smallest. So let's start there and we take 20.14 minus 19.82 so we find the difference in those two distances.



The difference in distance of the east boundary and distance for the west boundary, find the difference, 32 links. We divide by 4 we have lots across there that distance is going to be getting by about 4 links per lot so we divide it by 4. If the remainder is a quarter of a link we drop it, if the remainder is a half link or larger we round up. So we get 8 links .08, now look at we do.

For lot one, we take the distance 18.92 we double it, gives up 39.64 and we add that 0.08 which gives us an area of 39.72. We add it, we double that distance and we add that .08. For lot 2 we add the east boundary, the distance of the west boundary 19.82 plus 20.14 equals 39.96 and since we're on the smaller side of the section we subtract the 0.08 and that gives us an area of 39.88.

Next we calculate lot three, same thing we add the east boundary with the west boundary 19.82 plus 20.14 equals 39.96 and because lot three is on the larger side of the section we add the .08 which gives us 40.04. And last we calculate the area of lot four which is 20.14 the distance on the long side and we double it, 40.28 and then we subtract the .08 which gives us 40.20.

It's a very simple method in the instructions in the 1894 Manual it says "These instructions are written out here but in actual practice its anticipated this will be done in your head." So it wasn't anticipated that any of this would be written down, this was just quick method for calculating the methods without calculating and distance its just adding and subtracting. And one of the results of this, if you look carefully at it is you can have lines that use a different distance for one side of line than they do for the other side.

Anytime that you have a number that's not divisible by 4 and we get any remainder and there's some rounding you're going to have

AREA RELATIONSHIPS – PART 1

lines that on one side of the line they used one number and on the other side of the line they used another number. They'll only be different by one link; they'll only be different by a link but you'll find that. And that help us down the road sometimes in resolving some discrepancies that we might come up one.

So knowing how this process worked is important and you can read is in the 1894 Manual which is contained in the history book *The History of the Public Land Survey System* that's in your material. You can look at this and see exactly how it works, ok?

Areas Within a Completion Survey (Sec. 8)

But let's go on, now we're going to begin to look at a little more complicated situation and first of all I want you to look at this section, just look at this section and answer this question; if this is the only plat of section 8 how would you determine the center quarter?

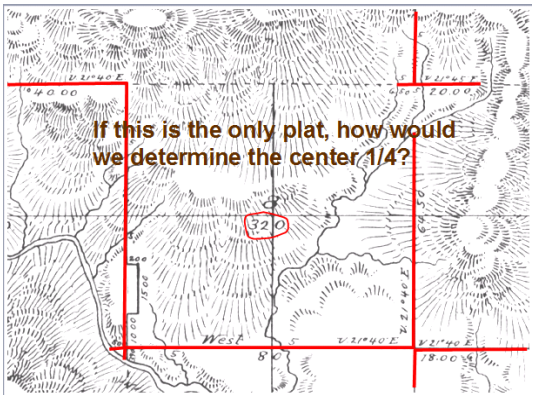


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

How would you determine where to put the center of the section? If this is the only plat? Give you a couple of hints just to make it clear about what has happened on this plat.

First of all, here are the lines that are run and you'll notice down here there was a little offset that is an offset to go around so kind of a cliff or some kind of terrain it doesn't change where the section line is. The section line is still the straight line but the offset shown on there that's what they did in the field. These are the lines that are actually run.

AREA RELATIONSHIPS – PART 1

A couple of other things, the south half the section is the only portion that is shown on the survey because look at this, 320 acres, half a section is surveyed. The north half is not surveyed even though the north/south center line is drawn all the way up it goes to a line that's not surveyed its not going through a point. There is no survey up there, the north half has not been surveyed. So, if this is the only plat, how are going to subdivide that south half? That becomes important because even though we're going to see that there is a later plat, patents may have been issued on this plat many years before the next plat was completed and this section was completed.

So we have to look at the plat that the patents were based on, we have to use it to determine how to subdivide the section and we have to use it to make sure that we protect the rights of those patentees. Now, lets look at what happened when it was completed.

The section was completed you'll notice that we have several lots; there are some major bearings over there 10 degrees or 11 degrees I think over there. Things didn't fit quite right we noticed this north boundary is 81.49 chains not exactly close to being a mile and we noticed that the boundary over here is 39.35 chains so there were some problems getting to all fit together.

As a results we have lots and we have six lots in that north half that we're going to have to look at and we're going to have to work back from the area to get to the distances that we need to tell us how to subdivide this section.

With that I want to take a short break. When we come back when we're going to work our way through these areas to get back to the numbers.

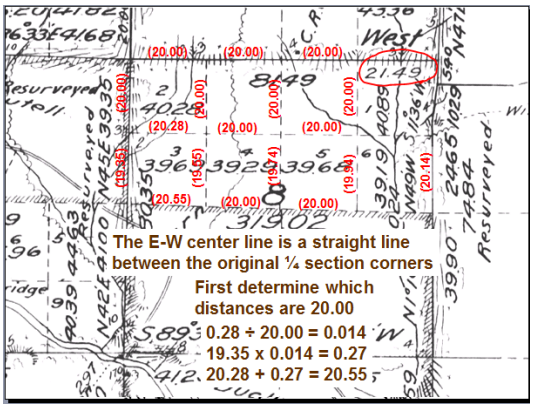
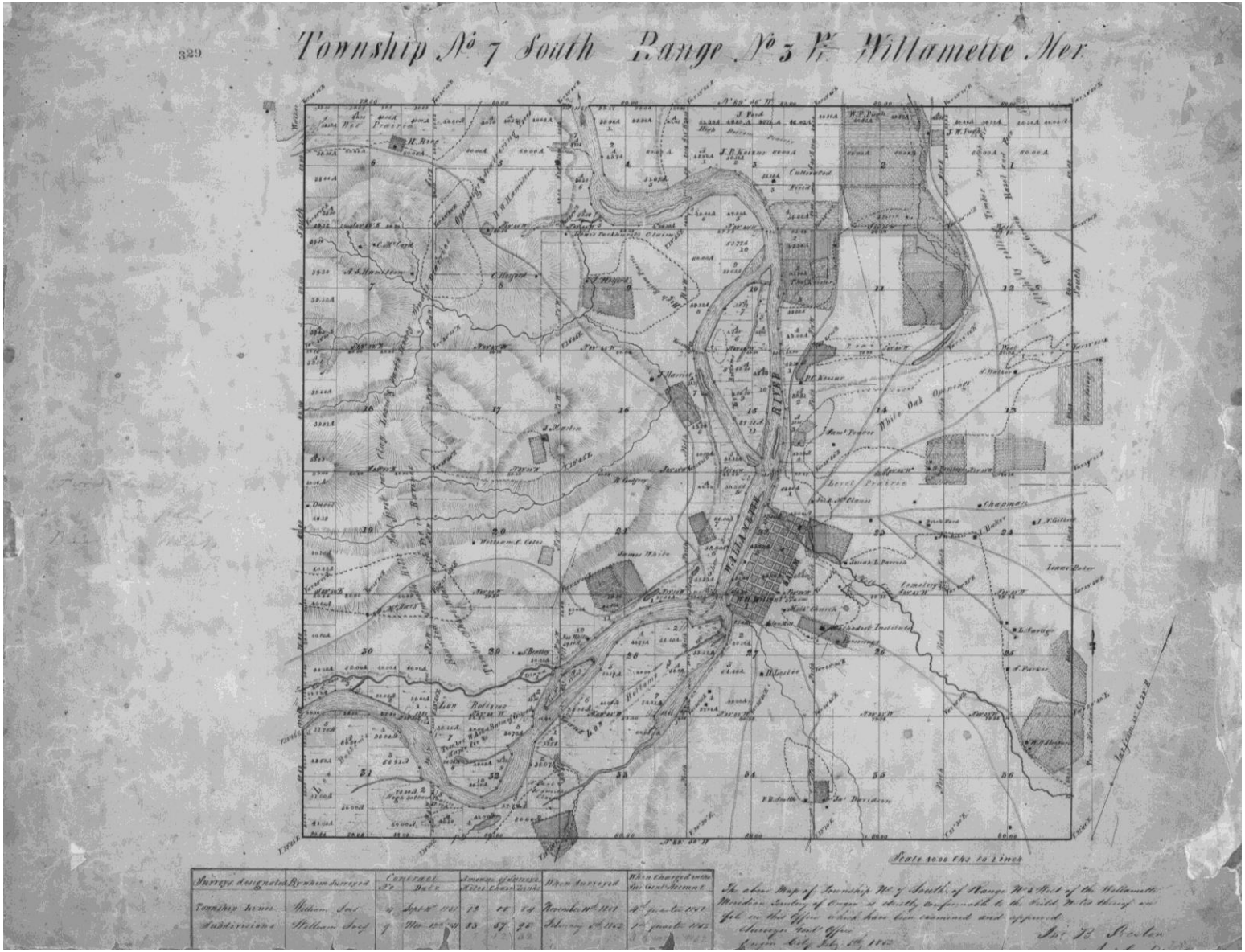
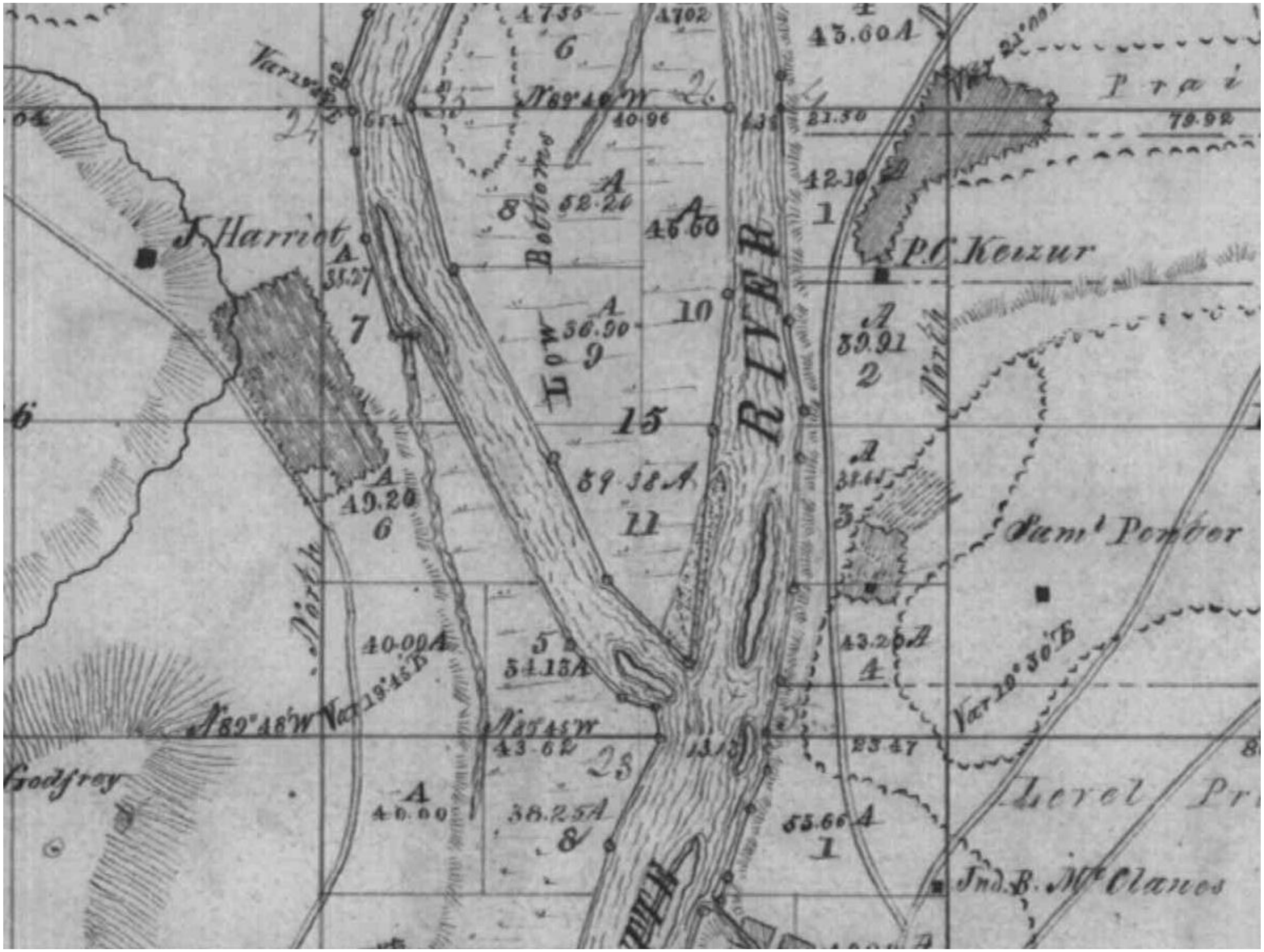
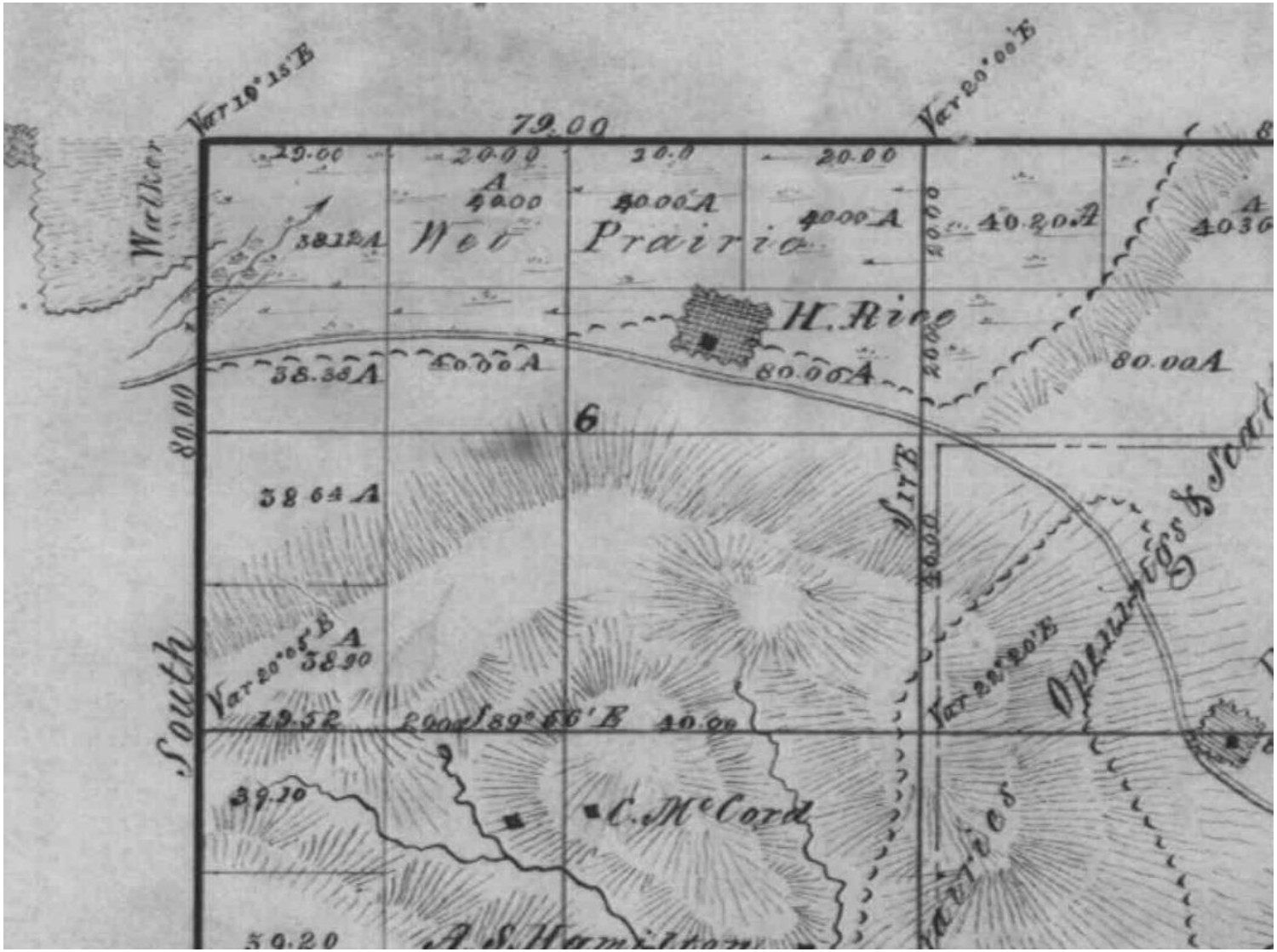


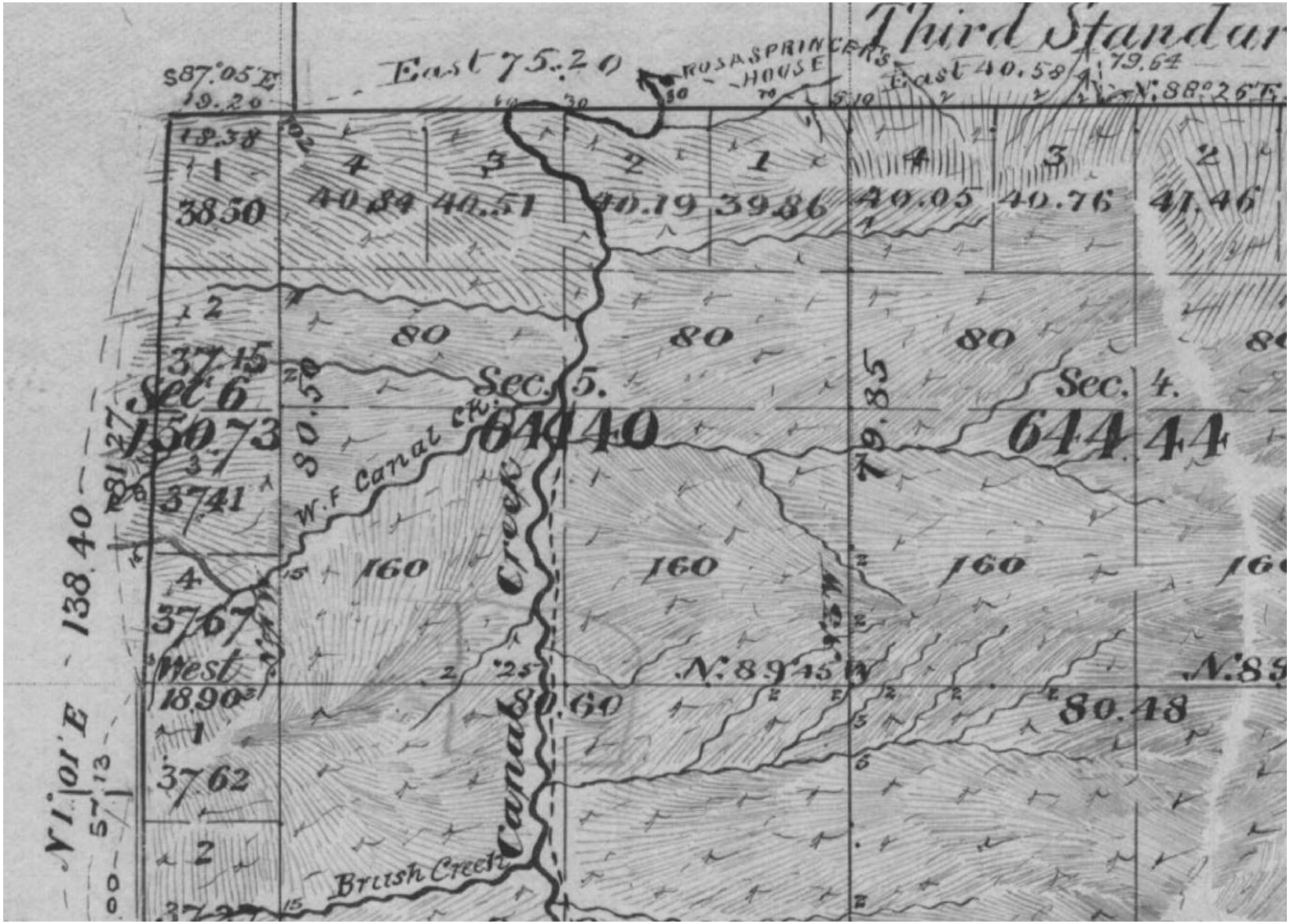
DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

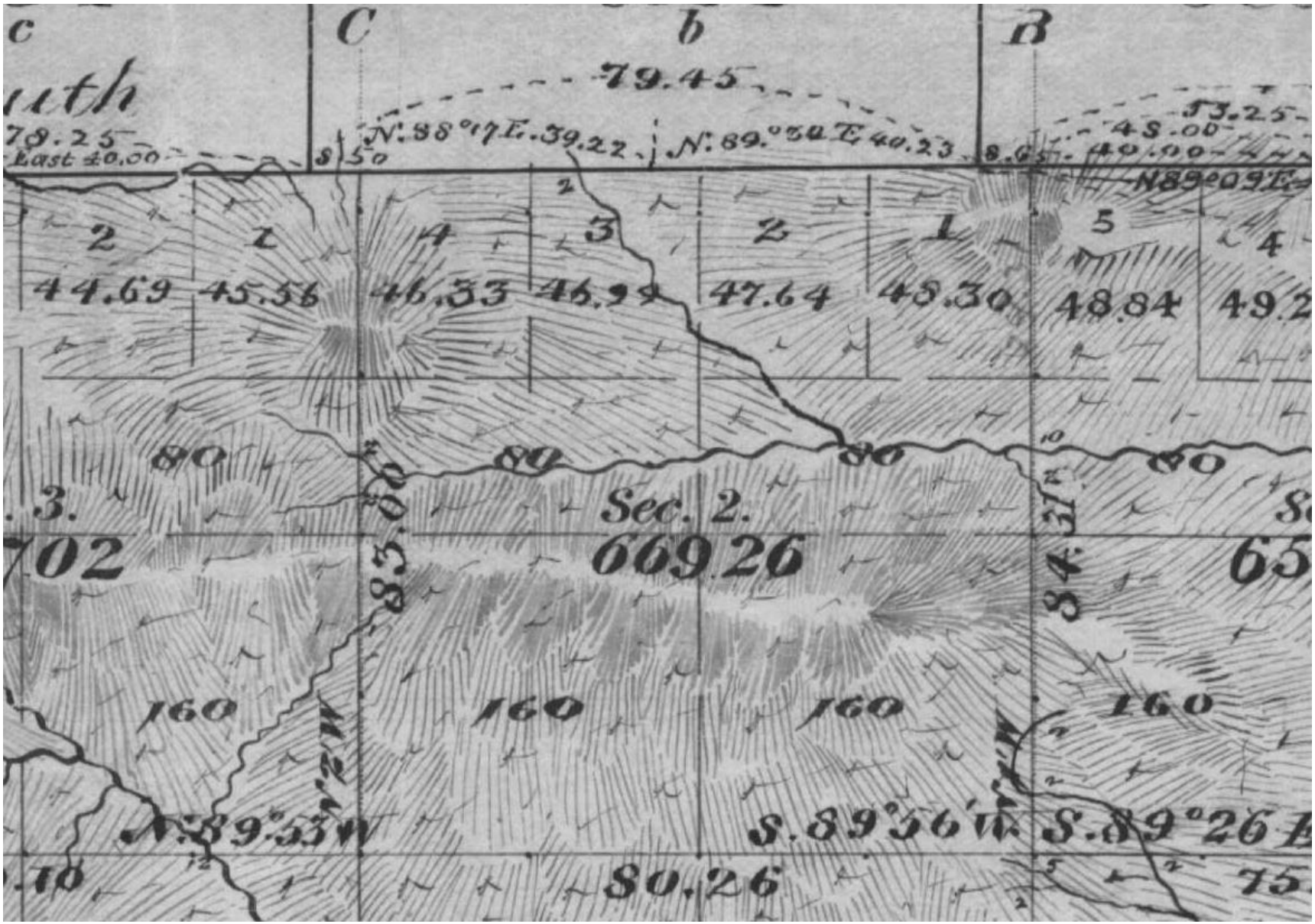
DIAGRAM

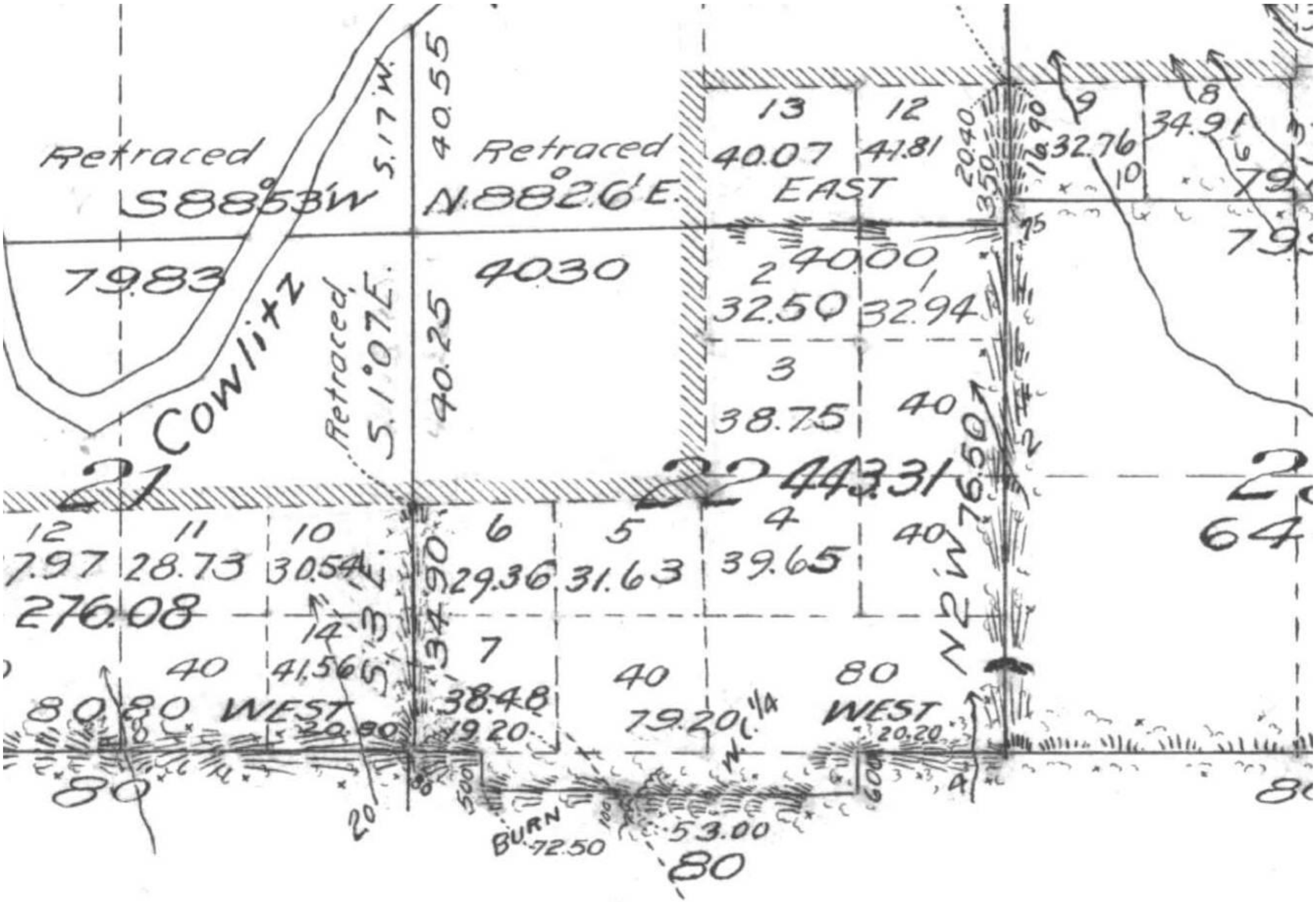

329
Township № 7 South Range № 3 W. Willamette Mer.
Scale 1000 Chs to 1 inch


RIVER
Low Bottoms
P.C. Keizur
Sam' Porter
Level Pr
Godfrey
J. Harriet
N89°48'W
43.60A
52.26
45.60
36.90
39.91
59.38A
49.20
40.00A
54.13A
43.62
38.25A
55.66A
40.00
43.26A
23.47
21.30
42.30
79.92

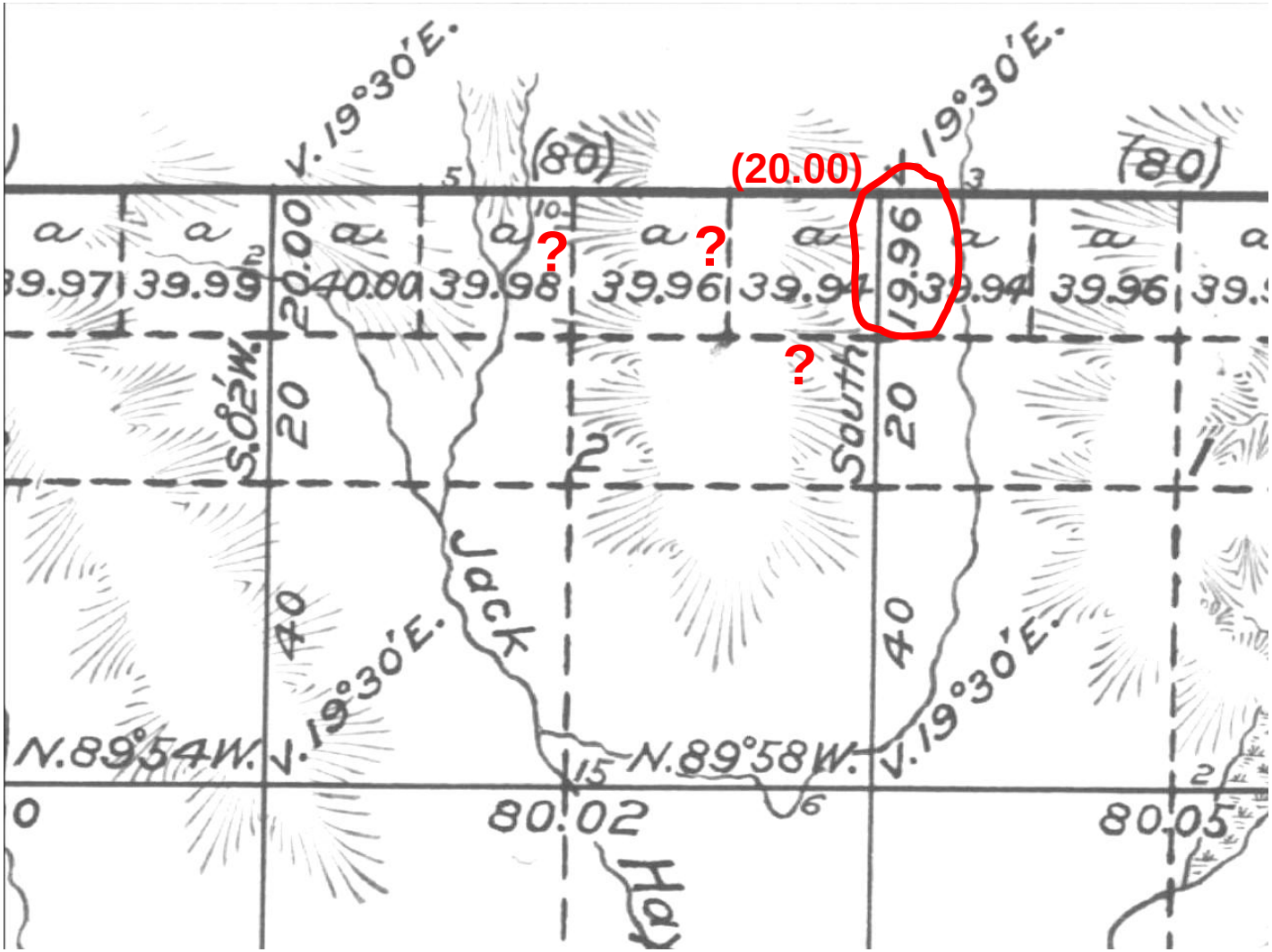

Var 19° 15' E
79.00
Var 20° 00' E
29.00
20.00
30.0
20.00
Walker
38.12 A
Wet
Prairie
40.00 A
40.20 A
H. Rice
38.36 A
80.00 A
80.00
6
38.64 A
South
Var 20° 05' E
38.90
29.52
S 89° 55' E
40.00
Var 20° 20' E
39.10
C. McCord
39.20

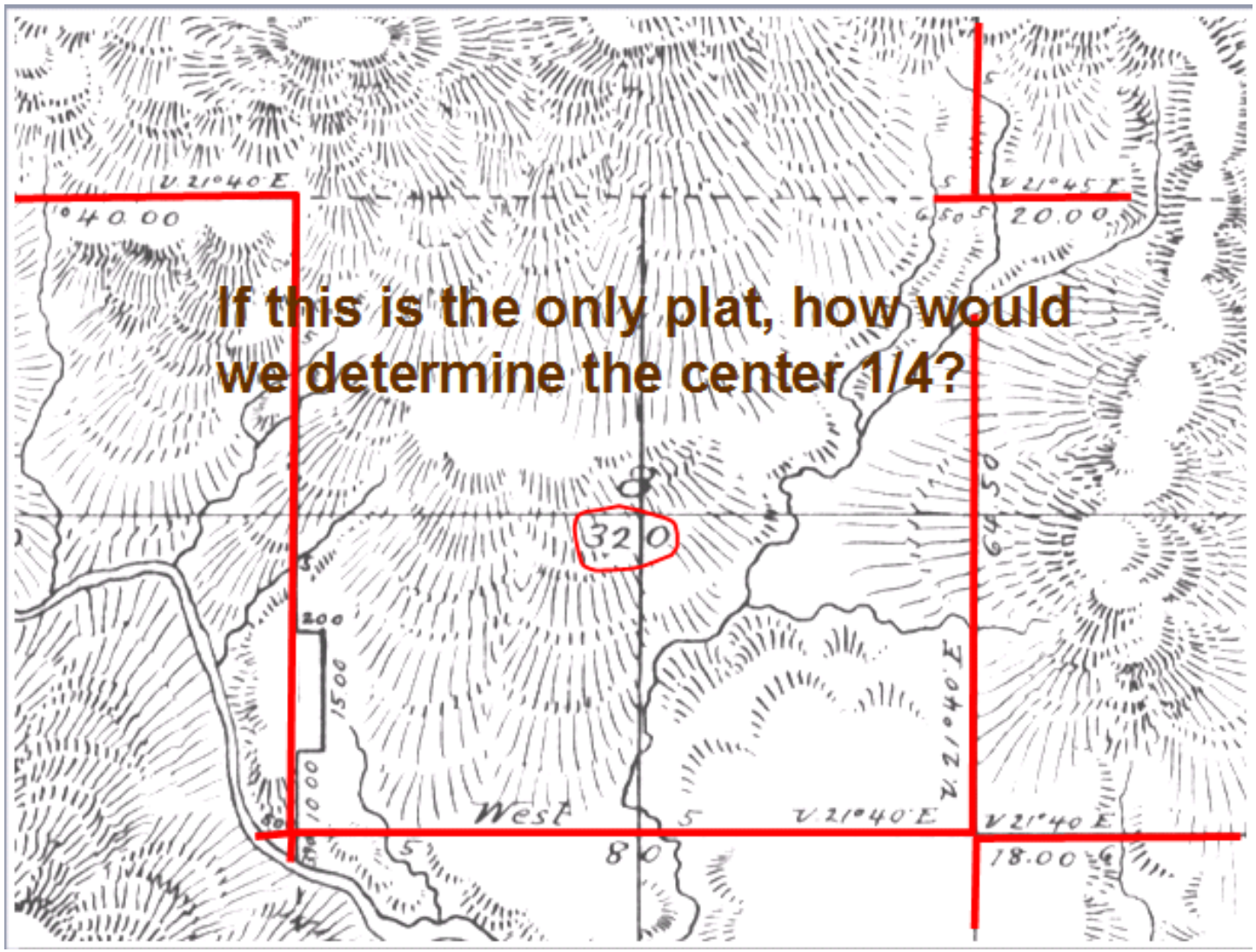

Third Standar
East 75.20
S87°05'E
19.20
ROSA SPRINGS HOUSE
East 40.58
79.64
N.88°26'E
Sec. 6
Sec. 5.
Sec. 4.
W.F Canal
Beaver Creek
Brush Creek
Canal
West
N.89°45'W
80.48
138.40
N.1°01'E

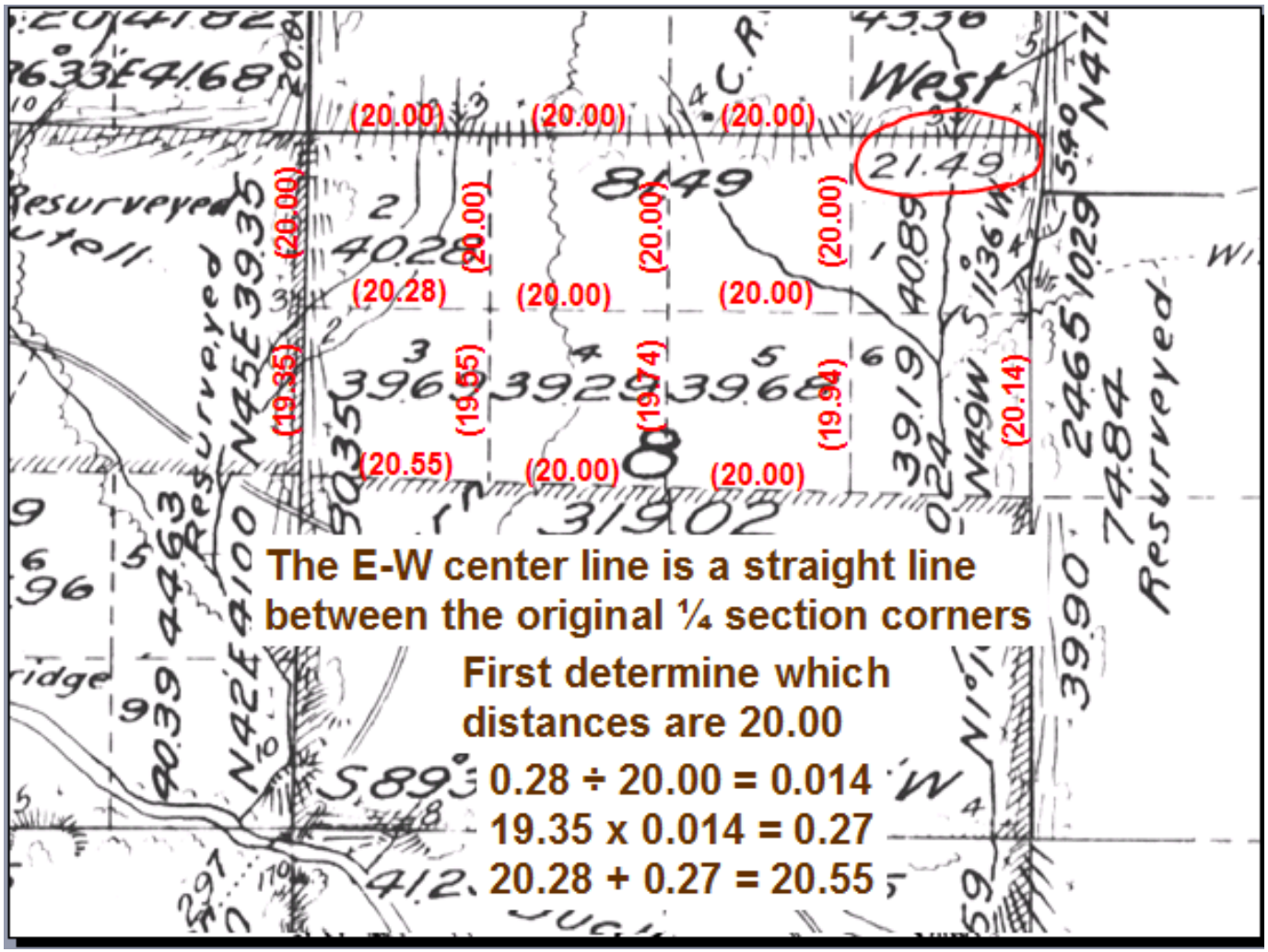

c
C
b
B
79.45
N. 88° 17 E. 39.22
N. 89° 30 E 40.23
79.25
Last 40.00
53.25
48.00
40.00
2
1
4
3
2
1
5
4
44.69
45.56
46.33
46.99
47.64
48.30
48.84
49.2
80
80
80
80
Sec. 2.
669.26
702
160
160
160
160
N. 89° 53 W
S. 89° 56 W
S. 89° 26 E
80.26


Retraced
S88°53'W
N.88°26'E.
Retraced
S.17 W.
40.55
7983
Cowlitz
Retraced
S.1°07'E.
40.25
4030
13
40.07
12
41.81
EAST
9
32.76
8
34.91
10
2
40.00
32.50
1
32.94
3
38.75
40
21
22
44.33
4
39.65
40
N 2 W 76.50
64
12
7.97
11
28.73
10
30.54
276.08
14
41.56
6
29.36
5
31.63
34.90
7
38.48
40
40
80
80.80
WEST
19.20
79.20
WEST
20.20
80
BURN
72.50
53.00
80


N 88 44 W
79.30
39.35
31.77
Sec 15
76.50
56.39
57.65
34.43
35.37
34.02
16.54
45.40
East 34.15
West
53.58
52.90
32.70


V. 19°30'E.
(80)
(20.00)
(80)
39.97
39.99
20.00
40.00
39.98
39.96
39.94
19.96
39.94
39.96
?
?
?
S. 0°2'W.
20
20
South
40
40
Jack
V. 19°30'E.
V. 19°30'E.
V. 19°30'E.
N. 89°54 W.
N. 89°58 W.
15
6
2
80.02
80.05
Ha

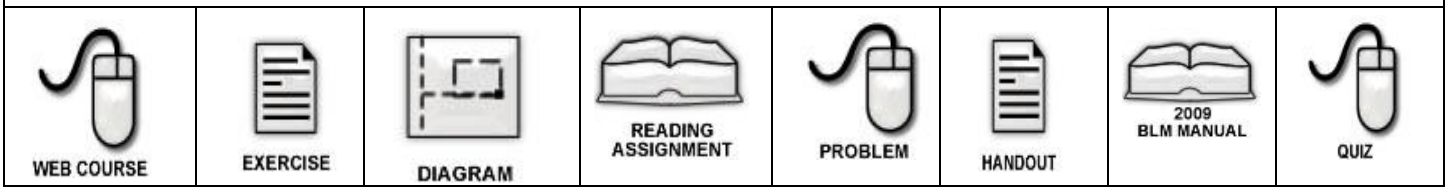

If this is the only plat, how would we determine the center 1/4?
N 21°40' E
40.00
N 21°45' E
20.00
320
West
80
N 21°40' E
18.00


(20.00)
(20.00)
(20.00)
(20.00)
(20.00)
(20.00)
(20.28)
(20.00)
(20.00)
(19.35)
(19.55)
(19.74)
(19.94)
(20.14)
(20.55)
(20.00)
(20.00)
West
21.49
The E-W center line is a straight line between the original ¼ section corners
First determine which distances are 20.00
0.28 ÷ 20.00 = 0.014
19.35 x 0.014 = 0.27
20.28 + 0.27 = 20.55

Course 6: Subdivision of Sections Study Guide

COURSE DESCRIPTION:	This course focuses on the subdivision of sections. It addresses subdivision of normal sections, lotted closing sections, elongated and fractional sections, as well as the unique method known as the "three mile method" on many Indian Reservations and some private lands.
COURSE OBJECTIVES:	Upon completion of this course, students will be able to: • Learn to properly subdivide regular sections • Identify exceptions to section subdivision rules • Demonstrate an understanding of area relationships on GLO/BLM plats • Identify and deal with fractional sections
COURSE INSTRUCTOR(S):	Ron Scherler, Bureau of Land Management Dennis Mouland, Bureau of Land Management
VIDEO LECTURE TITLE:	Area Relationships – Part 2 (57 minutes)

ICON LEGEND



AREA RELATIONSHIPS – PART 2

Areas Within a Completion Survey (Sec. 8),. Continued

So now lets look at Section 8, and how are we going to subdivide it and to decide how we're going to subdivide it, we're going to have to work through those areas. Get your calculators ready because we're going to work through these.

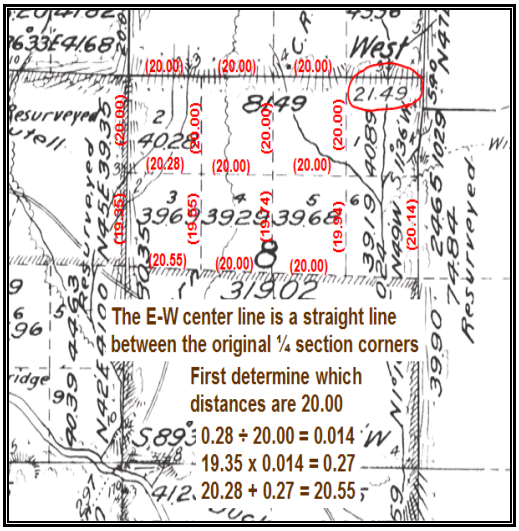


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

First of all, to subdivide the section, we must first find the parenthetical distances or the protracted distances. We know that. Let's look at it more carefully. The east-west center line is a straight line between the original quarter corners. We know that because remember that plat of the south half, it was a straight line between the quarter corner, and this is a completion of that section.

The east-west center line is going to be a straight line. That's a given. So the next step, and generally the first step in any of these sections where you have lotting and it's not clear where those areas come from; normally the first step in any of these is, determine which distances are 20. Determine which distances are 20.

So let's look at this plat, and we're talking about the north half now. We're working through to find the areas, or to find the protracted distances around lots 1 through 6 in the north half. That's what we want to do. So, in the north half, how many distances can you identify that are 20 chains. And as we begin to

AREA RELATIONSHIPS – PART 2

look at this, you'd be surprised how many are.

So where do we start. Well, I think the best place to start is right here and right here. No lot numbers. No areas shown. That indicates that those are 40 acre parcels, that they're aliquot parts, and if they're aliquot parts and they're 40 acre parcels, then that indicates that they're probably 20 chains on all sides. It's a good indication. May not be true, but that's probably what's going on. So let's do that. Let's put 20 chains on each side of those two lots. So now that we know that, what else can we determine? If that's true, and we're going to assume it is, what other distances would be 20?

What other distances might be 20. Well, let's see. If this distance is 20, and this distance is 20, and these lines are parallel, shouldn't this distance down here be 20? Let's try that. Let's try putting 20 down there, because if this distance is 20, and this distance is 20, then this distance should be 20, and the same thing over here. Let's try putting 20 in all of those. Where else might we find 20? Where else might we find 20? Well, if this distance is 20, and this distance is 20, and this distance is 20, what do you suppose that distance is? That distance is probably 20 too. Well, there's still some more. There are still some more 20s out there. 21.49 over here. Right over here. 21.49.

Well, we know that the north boundary of the section is 81.49, and we've got three of the distances 20, 20, and 21.49, so what does that leave? That leaves us 20 over here. So now we've got that whole north boundary figured out. We've got several other 20s. We've got quite a few numbers in there. Surprised that there are that many distances that are 20. So what might be our next step? What other distance in this north half of a section can we determine? Let's look at it and think about it now. What other distance. Well, if this is 20, and this is 20, how can we find this distance here? We subtract, right? We subtract across.

Remember if two sides, if the opposite sides are 20, then we can just subtract to find it. So we take 40.28 minus the distance of the north boundary, which in this case happens to be 20, minus 20 equals 20.28. So that makes sense. That looks reasonable. So now we have all of the 20s in there and we're beginning to look at these other numbers. What are some other numbers we might know?

AREA RELATIONSHIPS – PART 2

Well, let's look over here at the west boundary. We have 39.35 and we know that the north portion of that is 20. So what does that leave for the south portion? 19.35.

Now it's beginning to get a little more difficult. Now we've pretty much got all of the distances that we can just, that we can really determine what they are by just looking at the plat. If we look over here at the east boundary we've got a lot of confusion over there. We've got 3 or 4 different bearings, we've have some different distances, and it's really difficult to depend, to figure out any distances on that side. So, where do we go from here?

Remember, one of the examples that I gave you way in the beginning was, if the north boundary of two adjacent lots are 20, and the south boundary of those same two lots are 20, then we add the areas and divide by 4. Look right down here at Lots 4 and 5.

Let's add the areas of Lots 4 and 5. 39.68 plus 39.29, divided by 4. We want to divide it by 4. Remember that? There's that diagram back there. Go back and look at that. And what does that give us? 19.74. That gives us the distance between Lots 4 and 5. Well, now, with that distance, we can calculate a couple more, because, if we look at Lot 4, the north boundary Lot 4 is 20. The south boundary of Lot 4 is 20, so how do we determine the west boundary? We take 39.29, the area, and we subtract the distance of the east boundary, 19.74, and we get 19.55.

We're beginning to fill in the numbers. First of all, we've got all of the 20s that we could calculate. Then we begin to work along the boundaries to see what distances we can compute once we've filled in the 20s. Now we start going inside and determining what are some of these other numbers that we can calculate relatively easy. Now, we're getting a little more difficult. Let's…again this part over here along that east boundary looks pretty confusing, so let's concentrate on Lot 3, and there are a couple ways we could do Lot 3. We've got three sides so we can compute the fourth.

Another way is to look at what's happened above it. Let's look at that Lot 2. The north boundary of Lot 2 is 20 chains, and the south boundary of Lot 2 is 20.28 chains. So the difference is 0.28 chains. And in 20 chains, the north-south distance of that lot, it changed .28. Well, the next lot is only 19.35 chains from north to south, so

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if we take 28 links, or .28 chains divided by 20 we get 0.014. That's how much wider that lot is getting per chain of northing.

That lot, Lot1, or Lot 2, for every chain of northing, it's getting 0.014 chains wider. Now our next lot, Lot 3, isn't quite as long north-south. It's only 19.35 chains. But if we take 19.35 times 0.014, we get 27 links, or .27 chains. Let's add that to our 20.28. So 20.28 plus .27 give us the 20.55 for that south boundary. So that gives us a number there. We're not sure that that's the correct number, but it gives us a number. Let's see how it works.

So, if we have all the numbers around a parcel, how do we do that? We mean the north and south, so we take 20.28 plus 20.55, divide by 2, gives us 20.415, and then we want a mean of the east and west boundary. So we take 19.35 and 19.55 and divide by 2. That gives us 19.45, and we multiply those, and then we divide by 10 to give us chains. We divide by 10 to get acreage. And we get 39.71 and our plat has 39.69, so we're 2 hundredths off. Very close. So let's leave it there and keep going and see if maybe we might want to come back and mess with that a little bit to change something a link or more to get a little closer.

But if we get within 2 hundredths on that area, maybe that's as close as we're going to get. So, we've got everything except Lots 1 and 6 over there against that east boundary, and that east boundary has some strange bearings in it and some other strange things.

Where are we going to go now? What are we going to do next to decide what's our next number? And one our problems is, if we look up here on, we can look, we have a 20 here, and a 20 here, and a 20 here, and a 20 here. We could assume that there's a 20 on that side, but we'll notice that we have an 11 degree bearing there, we have a, almost a degree bearing. We aren't sure what's going on there. So I'm not sure that 20 chains is the proper number to put over there on that side. So let's look at Lot 6 and see what we might do there.

A common method, a very common method used for a long time in the calculation of areas is what I'm going to show you next. Calculating a mean distance for the center line of the section. Here's what they do. Calculate around the north half of the

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section, so take the bearings and distances around the north half of the section, inverse, across the east-west center line, and that gives us a distance: 80.221.

That's the inverse when we go around the north half and inverse back along the east-west center line. Do the same thing for the south half. Now remember that in the public lands surveys, these numbers were not adjusted to close.

What's given are the actual measured numbers and so there's going to be misclosure. When we go around one half and inverse, go around the other half and inverse, we're not going to get the same answer, and we don't. Here, for the south half, we get 80.296. Pretty close. There's only 7 links or so of misclosure in this section, so it's relatively close.

Once we've gone around both halves, what we want to do is mean those numbers. We want to find…and it's 80.259. So the average distance across there, the mean of those two is 80.259. That's the number that the draftsmen normally used in computing in computing these areas across there. So we're going to try that.

We're going to plug in that number into our diagram. So if we go back where we were, and we take, we know on our east-west center line so far we have distances of 20, 20, and 20.55. We already know those numbers. That equals 60.55. So if we subtract that from our mean distance of 80.259, it gives us a distance of 19.71. That's the number that is probably the distance for the south boundary of lot 6, and we'll see if that works. So let's put that in there. 19.71.

Now, how about the east boundary of Lot 6. Well, if we start here with 19.35, and then we go to 19.54. What's the difference in distance there? It's 19 links isn't there, or .19 chains. And then let's go to the next one. What's the difference there? It's .21, right? And then let's go to the next one. And it's .18. So somewhere in there, distances are changing about 19 links or so for every 20 chains. So let's try, let's try working on across there at what number we might come up with on that side. And, now I've worked with this section a little bit, so I know what some of the numbers are. I ended up with a number of 20.14.

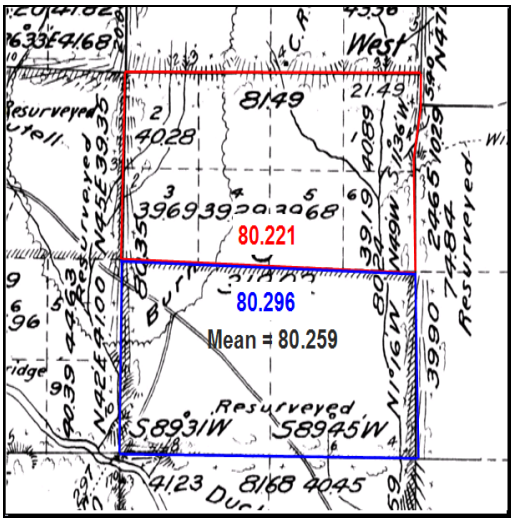

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

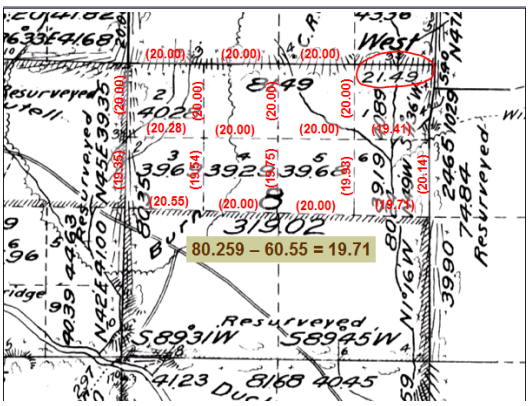

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

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When you're working with a section like this, a lot of times you have to change a number by a link one way or the other to get the numbers to come out, and we've tried to get as close to the actual areas as we possibly can, and, so, there's a little bit of, it isn't exactly an even progression across that south boundary, but these you'll see work out pretty well and they all make good sense. Maybe one should be changed a link here or there, but you'll see that they work out pretty well.

Well once we have three sides, we can compute that fourth side. Remember back to that formula that I showed you at the beginning. And if we do that in this case, we get 19.41 chains. And remember, all of these are cardinal lines. Everything is done as cardinal equivalents. All of these are rectangles or squares. Everything, all the angles are 90 degrees. We don't have any angles to worry about here. That's why it makes it easy to calculate these. It's a puzzle, but there are no complicated calculations. It's just a puzzle to figure out what did he actually do. What did the draftsman do?

Well, we've probably gone about as far as we can go with this diagram, and it all comes down to what happens up there in Lot 1, now. If we can make Lot 1 make sense, then we probably have got this solved.

Let's look at Lot 1 a little closer now. Now what have we already calculated? We've already calculated the south boundary. It's 19.41. We've calculated the west boundary. It's 20 chains. We know that this small portion of the east boundary is 4.51 chains, and then there's another small portion that's 5.40 chains.

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We know those, and then in between there's this distance of 10.29 on a bearing of 11 degrees, 36 minutes. Well remember we're supposed to be using cardinal equivalents. That's the way we're supposed to calculate, and also remember that because we have these different bearings on that east boundary, we need to calculate two intermediate distances for these lines across the middle to calculate these areas. We have to divide this lot into three rectangles, basically to get this area calculated right. So, what are we going to do?

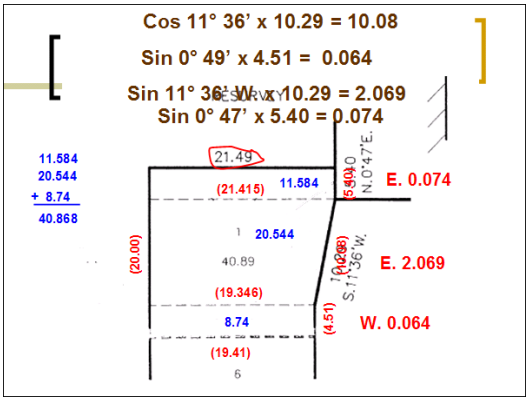

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

First step, let's look at that 4.51 chains down there, and we have a bearing on that of…one more thing is the north boundary. We know the distance of the north boundary. It was shown on the plat. 21.49. Sure. So, now. Next thing. This 4.51 chains down here, it's at a bearing of 49 minutes. So we take the sine of 49 minutes times the distance, and that gives us the easting or westing of that line.

So, using that we apply it to the distance on the south boundary. It's west 0.64. That's how much that short segment of line, how much westing there is. We do the same thing with the next segment, the 11 degrees, 36 minutes. We take the sine of 11 degrees, 36 minutes times the distance, give us 2.069. That's east. That gives us the next easting of that line, and then we do the same thing for this last segment. 47 minutes for 5.4. We take the sine times the distance, and that gives us 0.74.

What's next? Well, let's take those distances and calculate what our intermediate distances are. If the south boundary of this section is 19.41, and that 4.51 segment, that short segment at the bottom has a westing of 0.64, then what happens to that next distance. It's 19.346, and I've carried it out maybe farther than I need to, but that let's us see what that distance is. Now. Now we go east. We go the other way for 2.069. So if we take 19.346, (that's the distance here). That's the distance here, and then we add 2.069 to that. We get the distance of this line up above. 21.415. So now we've got those two intermediate distances.

Let's check and see how it works going on through. If we add the easting of that last portion of the line, 20.415 and 0.74, what do we get? We get 21.489. And what's our north boundary? 21.49. So our addition worked through. Something looks like it's working

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out right. We have one more thing to do. We still don't have a north-south distance for this portion of the line.

Remember cardinal equivalents? Let's find out the cardinal equivalent of the northing of that line is. The cosine of 11 degrees, 36 minutes times 10.29 equals 10.08. 10.08. So instead of when we're calculating our area, we're going to use that distance as 10.08, not 10.29. The cardinal equivalent. So let's put that distance in there.

Now, how do we compute these areas? What do we do? We mean the north and south boundary of each of these of these parcels. We mean the east and west boundary. We multiply, divide by 10. For this portion here in the middle, same thing. Let's see what happens. If we mean the north and south boundary of this first rectangle here at the bottom, mean the east and west boundary, multiply and divide by 10, we get 8.74 acres. Same thing with the next one. We mean the east and west, we mean the north and south, multiple, divide by 10. What do we get? 20.544. Same thing with the next one. Now some of you are saying, "well I don't have a west boundary. I don't have a west boundary." Look at this. Look what happens when we add up the distances on our east boundary. We have 4.51. We have 10.08, and we have 5.40. That gives us a total of 19.99. 20. Almost 20.

Remember as we were coming across that north boundary of that town, of that section? We thought that this distance should be 20, but because of the bearings, we weren't sure. We couldn't tell for sure what was going on. Now we've confirmed that it really is 20 going across there. So, the east boundary of each of these pieces is the same as the west boundary. There's no difference. So when we're doing this rectangle at the bottom, the northing of it is 4.51. There's no meaning. Both sides are the same. Same thing with the next one. 10.08. The northing of this next rectangle is 10.08. Same thing with the next one 5.40. The northing of it is 5.40.

Well, once we have calculated all these areas, the next step is to add them together and see if we've actually got the proper area. 11.58, 20.54, 8.74. We add them together, and we get 40.868. 40.87. We missed that area by 2 hundredths. That's pretty good. Normally, I don't like to go much farther than that. Normally you should be able to get within 1 or 2 hundredths of every area. If

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you've done than, you've probably got all of your distances correct.

You may be off by a link here and there, but that's really hard to determine. So in our whole section here, now, we've worked through the areas, worked back from those areas, and we have a distance for every one of the lines within this north half of the section.

How Will We Subdivide Section 8?

Well, so what do we do with it? Now that we have it, what do we do with it? And remember, in the beginning I asked you, how would we subdivide the south half of the section? That was question Number 1. Now that we have all these numbers, we need to determine how to subdivide the north half of the section. What does it tell us? How are we going to do it? I want to show you something first. This is a blowup of the center of the section, and remember at the beginning I said that the plat portrays information in three ways, and one is graphically?

Right here at the center of this section, it shows that those lines don't meet. When you look at this carefully, the draftsman when he created this plat, he shows that there are really two separate lines there. There is not one center of this section. So, what does that tell us?

Well, let's look at the south half of the section. And we really haven't covered all of the issues that we need to cover about how to subdivide the south half because we're going to cover some of those issues when we get to the fractional section.

Let me just say that, in situations where there is no opposite corresponding corner, which there is not here. Even though there's a quarter corner up there on that north boundary, it does not control the direction of the north-south center line of that south half-mile. So, what are we going to do? The law tells us that we run mean bearings. So that north-south center line, we're going to run on a north-south line that's a mean between the east boundary and the west boundary.

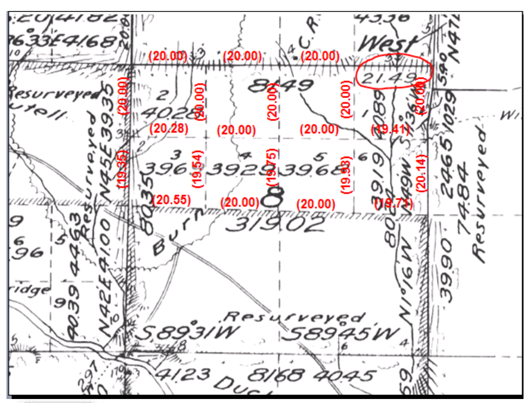

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

We'll talk about that a little farther when we get into fractional

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sections. Now some of you I know are thinking we should proportion along that east-west center line and put the center quarter at midpoint for the south half. Why not put that point at midpoint and then run the north-south center line to the center quarter, once we've established it at midpoint on the east-west center line. I think that's a very equitable method. It's a very reasonable and logical method.

It's a method that'll give us a good answer, but, it's not a method that you find in the law. The law says if the section's fractional, if there is no opposite corresponding quarter corner, if it has not been fixed, then you run on mean bearings. If you're challenged later on, and you have subdivided by running mean bearings, you're going to have a much solider ground for building your defense. It's much easier to defend because you can defend it with a law. You can defend it with the Manual.

It's much easier to defend than a midpoint position on that east-west center line. So, south half, mean bearing. And again, we will talk about that in more detail when we get to fractional sections.

How about the north half, though? What are we going to do here? Mean bearing? I know some of you out there are thinking, "yeah, mean bearing. That's sounds good." But you know when you look carefully at this, and you look at the numbers that we've developed, it's not platted based on a mean bearing. It just isn't. It's not parallel with the east boundary. It's not parallel with the west boundary.

Let's look at some of these numbers. The north-south center line up here at the north, it's 40 chains. From the north-west corner of the section to the quarter corner is 40 chains. Let's look at it down here on the center line, though. Down here. It's 20.55 and 20. The west boundary of the section and the north half of the north-south center line are not parallel. Likewise, the north half of the north-south center line is not parallel with the east boundary. It's not a mean between the two.

So what, how are we going to subdivide this section? Now remember, there's no opposite corresponding quarter corner here. There's no quarter corner on the south boundary that corresponds to the north half. There's a quarter corner down there, but it's not

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one that corresponds to the north half of the section. How are we going to do this?

Well, to me it seems like the only method, the only method that protects the plat, protects the areas on the plat, protects the patents that are based on those areas, is to proportion along that east-west center line, based on the numbers we have. 20.55, 20, 20,and 19.71.

Those proportions are going to control where the 16ths go, where the center quarter goes, and where the west 16th. The east 16th, west 16th, and center quarter will all be controlled by those numbers, but on the east-west center line. So what we have here is a situation where we have corners that are not common, and we use one method for the north half, (we're going to proportion) and for the south half, I think the best method is a mean bearing, because it follows the law.

On the north half, if we could, if it was platted as mean, then we would survey it as mean now. It's not platted as mean; therefore, and it's not platted as parallel; therefore, our only option to really protect the plat is to proportion along that line. However, looking back, if we don't get these numbers properly determined, then there's no way that we're going to subdivide this section properly. No way.

The first step is getting all of these numbers correct. And let me say that, don't give up to soon. I can think of sections that I have spent four to six hours, maybe even longer. Working, trying to figure out where these numbers came from, and eventually I figured it out. Eventually I figured out what the trick was, what's going on.

One of the things to always look at, are the numbers within limits? If they're within limits, then the draftsman probably was using 20, 40, 80 chains. He was using the standard number, not the actual measured number.

Are there strong bearings that create some cardinal equivalents so that we should be computing the cardinal equivalent and using the cardinal equivalent? Sometimes the draftsman should have been using the cardinal equivalent, but was not. So, as we're solving

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this puzzle, we have to sometimes try it one way and then try it another way.

First, we might try it using the cardinal equivalents and then figure out well, you know, that doesn't really work. Well let's try just using the number that's there, and we discover that the draftsman wasn't very careful in what he was doing, and he didn't use the cardinal equivalents like he should have. That's not very uncommon either. Take your time, though. Don't expect to be able to do this in, you know, 20 minutes or 30 minutes.

Sometimes you can, but often it's going to take, you know, a considerable amount of time to get these right, but it's worth it. Because if you don't get them right, your not going to get the section subdivided right. That's the bottom line.

Section With Bearing Breaks Along a Boundary

Let's look at another situation. And this, I want to look at a couple of things kind of together here. This is an 1893 plat. And if we look at the distances we'll notice that over here on the east boundary, the distance is 81.26. So that means that that north parenthetical distance is probably 21.26. And, if we look over here on the west boundary we've got 79.85. That means that that distance is probably 19.85.

What do we do next? Well, let's just try subtracting across. If you look at the areas, 42.17, 41.46, 40.76, 40.05, it's an even progression. Relatively even progression. So, let's just try subtracting across. Even though when I look at that north boundary, I notice that there are some bearings that are significantly off of cardinal. 88°26', right there. Then it changes to cardinal, so there's some kind of a major bearing break up there on that north boundary. But let's just try subtracting across and see what happens.

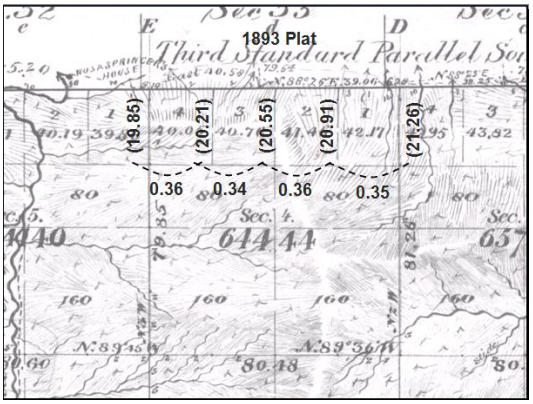

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

Now of course I have the benefit of having worked with all these sections, so I know what's going to happen. So sometimes that leads me, gets me ahead a little bit. Alright. Let's look at the next one. We just subtract across. So we start out. Let me go back here. The areas of Lot 1 is 42.17 minus 21.26 and that gives us 20.91. Let's subtract 20.91 from 41.46, and that gives us 20.55. Let's

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subtract 20.55 from 40.70, and that gives us 20.21, and then we subtract that last one of 40.05 minus 20.21, and that gives us 19.84, within a link.

Well, what that tells me is that the draftsman probably treated that north boundary as straight. And, this is an 1893 plat. Earlier in the system, almost always, when we had changes in bearing along the north boundary, the draftsman in computing areas treated the boundary as straight.

Somewhere around the 1890s, they began to deal with that and realized that, if we have some pretty major changed in bearing up there, it affects the area, and they began to actually compute the area based on the actual bearings of that north boundary, and they used a few different methods. So when you're in this sort of transition period, 1893, you're not really sure which method they might have used. Here, it was a straight line.

And if we look we can notice one of our checks remember should be an even progression of the difference of these distances. And we can notice 21.26 to 20.91 to 20.55 to 20.21 to 19.85, those are even. 35 links, 36 links, 34 links, 36 links. Pretty even progression across there that tells us that those are good numbers, that we've done it correctly there's not something different that's going to come along.

Now lets look at another very similar section it's another section that has some broken boundary, its got several bearings along the east boundary of this section. But the draftsmen went through a lot more trouble in calculating this. Remember that I told you I obtained the calculations from the draftsmen from the archives.

I'm going to show you some of those in a minute and this is a method that I found when I looked at those drawings or those calculations and it surprised me really how much work and how much effort went into calculating these areas. I've since found out that the method was used probably from the 1990's well up into the twenties maybe into the thirties to calculate areas of lots along boundaries were there were several different bearings to form that boundary.

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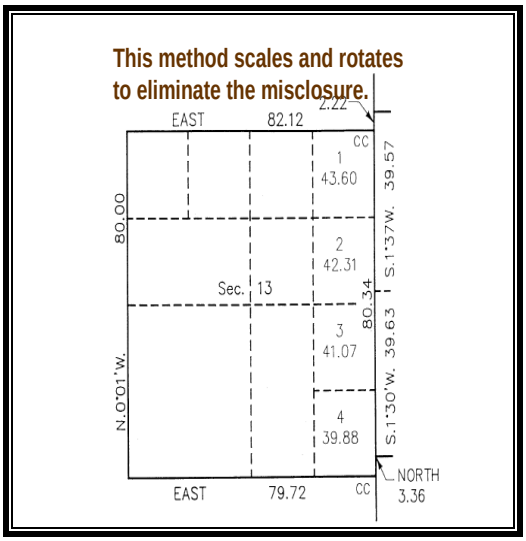
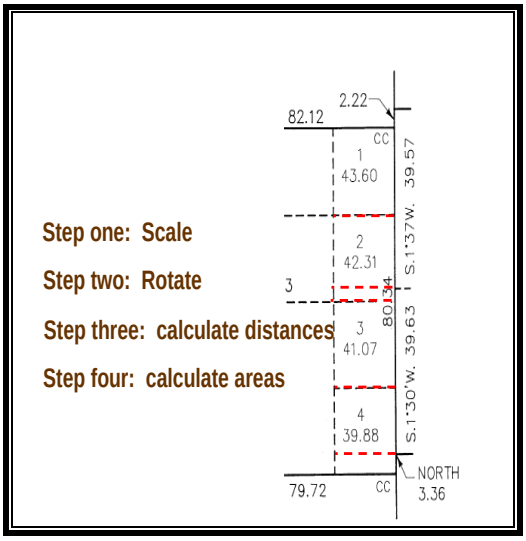
Let's look at how that happened. First of all it's a method that scales and rotates to eliminate the misclosure.



First step was to proportion every segment of that line and shorten them proportionally to get that distance back to 80, that's number one. The second thing was to rotate the bearings slightly to eliminate the east/west misclosure.

Once they'd done that then it was simply a matter of calculating the areas but they had a pretty unique way to do it. So step one was to scale, step two was to rotate, step three they needed to calculate the distances at each bearing break point.

Not only did they need the distances of the boundaries of the lots but each place that there was a bearing change they needed the distance across that lot so that we could break that lot up into several rectangles and then compute our area properly. And then the last step was to calculate the area.



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Now, here I've recopied their calculations so it's a little easier to read, they were all pencil they were kind of difficult to see and it was hard to understand what they'd done. Here's what they've done.

This first step up here is the scaling and you can see that they've just made a proportion out of 80 and 80.34 they've made a proportioned and they've shorted there are three segments to that line. They've shortened each segment proportionally. And what we have over here is the final outcome. So that's the numbers that they are now going to use for each segment of that line. That's step one.

The next step gets a little more interesting and I'm not going to work through every step of this process, we could do it when we were all done you would probably say "Well that's interesting and you know I don't think I could do it again though." What I want you to understand is that its here, that's it's a very good method, it's a method that was used all the time.

If the draftsmen actually used this method for calculating his areas and you go back and use this same methods you'll hit his areas within a hundredth of an acre. And by doing that you'll get all of the parenthetical distances around everyone one of those lots and you'll match his almost exactly.

So I want you know that this method is out there again probably used from about 1890 up into 1920's maybe up into the 1930's. It was used widely around the country and when you look at all the numbers it's a little confusing but if you ever need to use it you can just come back to this drawing and you kind of work your way through and see how its done and you can apply it. So for me to actually work through every step is probably not worth it.

I want to say a couple of things. They rotated the bearings; their method for rotating the bearings was to use the tangent. Remember that the tangent of that north-south line is going to give them an easting or a westing, alright? They used that number they actually added the tangent of the misclosure angle and came up with a new tangent for the corrective bearing.

When you look through this page you'll notice there aren't any

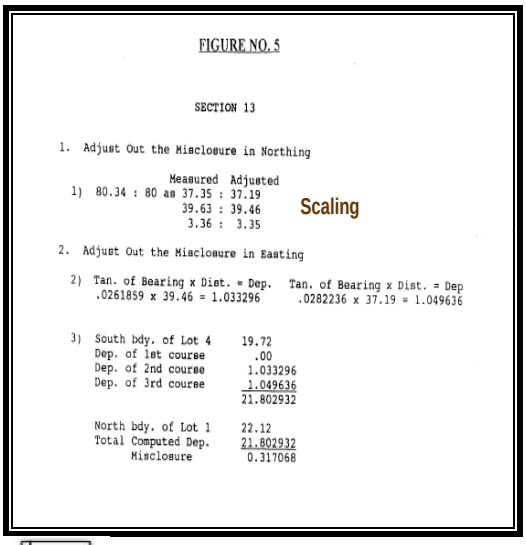

FIGURE NO. 5

SECTION 13

1. Adjust Out the Misclosure in Northing

	Measured	Adjusted
1) 80.34 : 80 as	37.35 :	37.19
	39.63 :	39.46
	3.36 :	3.35

Scaling

2. Adjust Out the Misclosure in Easting

2) Tan. of Bearing x Dist. = Dep. .0261859 x 39.46 = 1.033296

Tan. of Bearing x Dist. = Dep .0282236 x 37.19 = 1.049636

3) South bdy. of Lot 4	19.72
Dep. of 1st course	.00
Dep. of 2nd course	1.033296
Dep. of 3rd course	1.049636
	21.802932
North bdy. of Lot 1	22.12
Total Computed Dep.	21.802932
Misclosure	0.317068

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

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bearings and distances written down. There are some distances there are no bearings. They never calculated a new bearing. What they did is they used the tangent on a north/ south line east/west line the would've used the co-tangent. They used strictly the tangent and worked through to come up with the corrected distances.

So the next part, the top part of this page is where they did the rotating. And if you look through this carefully you can see exactly how it was done, its not something you probably want to do now.

Its probably something you want to do when you get a section that appears to have these broken boundaries and within that time frame with this method may have been applied. So this is where the rotating took place and then at the bottom , this is where they calculated the new distances. So there's three distinct steps in this process, this gives us the new distances and then you go back to the original plat and calculate the areas.

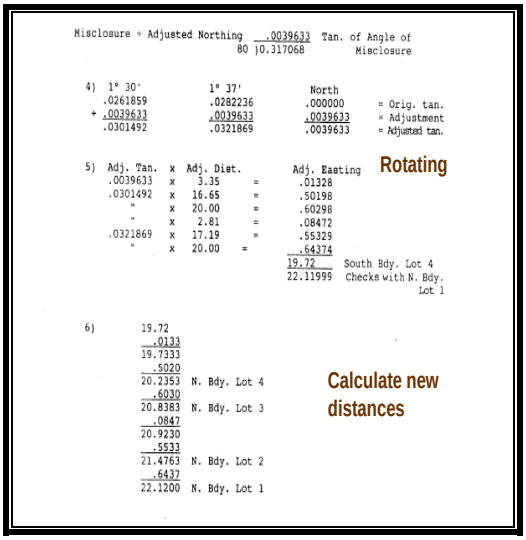
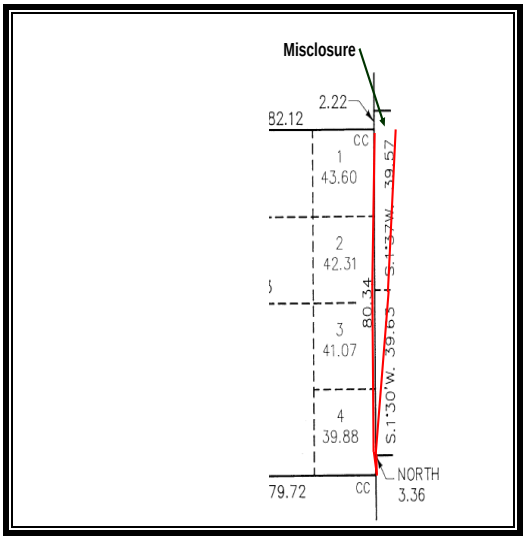


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

All that happened, I want to show this because, and I've exaggerated with this red line, I've exaggerated somewhere there was a misclosure up here. So, if we put those three bearings in and it did not close with the north boundary so somehow they had to rotate it over and they did.

One of the things I want you to notice is if you rotate those bearings, all three of those bearings rotated, look down here at the south boundary. Remember that bearing that little segment down there at the bottom that first segment of these three lines was north originally. Well if we have a misclosure and we're going to rotate everything a little bit counter clockwise, what happens to that bearing? It's no longer north and if you look at my drawing you can see that it's no longer north.



The next segment that was a degree and 30 minutes southwest or

AREA RELATIONSHIPS – PART 2

northeast it's probably something like a degree in twenty-six or twenty minutes. It's probably rotated four or five maybe even ten minutes. Nowhere on that sheet will you see those bearings. They didn't calculate the bearings they had a method for calculating the correction to get the distances they needed. So that method was just a method for dealing with those bearing breaks and those different distances that we get along the boundary. Again around 1900, 1800 up to 1920, 1930 somewhere in that frame there are several people in most of the BLM offices that know how to do that can help you with it if you need help.

Contact your BILS they can probably help deal with that if you need help. Its not something you're going to run into a lot but its something that you need to know how to do when you get there.

A Second Method to Deal With Bearing Breaks Along A Boundary

Let's look at a next one. What we've done is I taken that exact same section, the exact section, and I've put a little different areas on there.

Prior to say 1890's they began to deal with bearing breaks. They used a little different method though, not quite as sophisticated a method they didn't really adjust out any area they just used a different method. Here's how it was done, using these areas we have some different bearings on the boundary and if we look at the areas we'll notice that the areas are not an even progression.

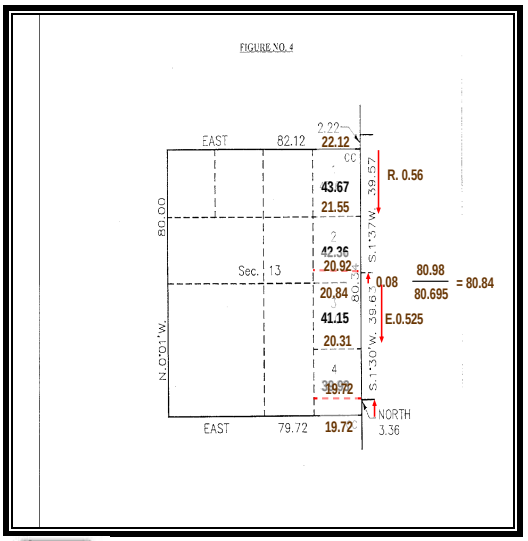


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

We have 39.93 and the next one's 41.15; well that's 22/100 of an acre difference. If we go from 41.15 to 42.36, what's that? That's 21/100 acre difference. Then if we go from 42.36 to 43.67 that's 31/100 acre difference, it's not an even progression. That tells us that those are not two straight lines. The east boundary and the west boundary of all these lots are not straight. They did take into account the fact that the bearings change along that east boundary. So how are they going to come up with the areas? Well, let's see what we know to start with. Always start with is what we know.

Well we know that we're going to have compute two intermediate distances because we know where the bearing change is and at the bearing changes we need to compute at the intermediate distance

AREA RELATIONSHIPS – PART 2

so we can create rectangles that are based on cardinal equivalents that are 90 degree angles all cardinal lines.

So we know we're going to need those two distances. What else do we know? Well we know the distance of the south boundary of lot 4 is probably 19.72 chains because the total distance along that boundary is 79.72 and it appears that the excess or deficiency has been placed against the east boundary of the section so that's probably a pretty good guess. We know that the north boundary of lot 1 is probably 22.12 for the same reason.

The total north boundary is 80.12 the excess was placed against this boundary so it's probably 22.12. So now where do we go from there? Well, remember in our last example or a couple of examples back where we calculated the center line going around the north half, calculated the center line going around the south half and meaned it, that's what we're going to do here.

If we go around the north half of this section in inverse across the centerline we get 80.98. If we traverse around the south half of the section inverse across the east/west center line we get 80.695. If we mean those we get 80.84 so we have a east/west center line that is probably for the draftsmen calculations, he probably used 80.84. We know that west ¾ of that is 60 chains, what does that leave us with? 20.84 for the east/west center line for the south boundary of lot 2 the north boundary of lot 3, 20.84.

Here he began to use the bearings. This was the first sort of attempts to use the bearings to calculate these angles. Here's what they did. First of all we know that first little segment down there along our boundary is 3.36 chains long and its north. We know that. So if that's the case then this distance right here is 19.72 because the south boundary is 19.72. They're both 19.72 because that's north. Then we go on to the next one, if we know that the east/west center line is 20.84 and we know that the bearing south from there one degree and thirty minutes southwest then we can compute that easting.

It comes out 0.525 its northeast or southwest. So if we go from the center line we're going to go west, I have it east here but we're going to go west. So let's take 20.84 the distance of the east-west center line and subtract 0.525 that gives us 20.31 that's the

AREA RELATIONSHIPS – PART 2

distance of the south boundary of lot 3. Now if we were to compute that same distance beginning at the south boundary using the bearing shown on the plat and working our way north we get a different distance because there's misclosure here.

This process did not eliminate the misclosure, it didn't mean out the misclosure ,it didn't adjust the misclosure; it's still there. What they did is they just arbitrarily calculated these distances coming from one direction or the other. Generally they start on the south boundary and work north a ways.

They'd mean that east/west center and then they'd start at the east/west center line and work south then work north and then they'd go up to the north boundary and work south from there. So you're never quite sure which direction they're going or which number to use but if you work at it you can figure out the different combinations that work and you compute the correct number. Here started on the south boundary and worked north to get that first number of 19.72 and then went to the meaned east/west center line and worked south to get that south boundary lot 3 or the line between lots 3 and 4.

Now next we start at the north boundary and work south, I'm not sure where that R came from I think that supposed to be a W, I must have hit the wrong number there .56 links that's the westing of that line. So if we take 22.12 minus .56 that gives us 21.55 or .56 that's the distance between lots one and two. Started from the north and work south.

Now again if we started from the center line and calculated going north, we'd get different numbers because there's misclosure in there. So, it is a little puzzle to begin to compute these different distances from different directions and begin to combine them until you find out which is the number that was used by the draftsmen to compute this.

There are three methods really that we've looked at so far that we use when we have broken boundaries or several different segments to a line that all have different distances. Number one, straight line, the oldest surveys they just used a straight line. We can subtract across, no problem.

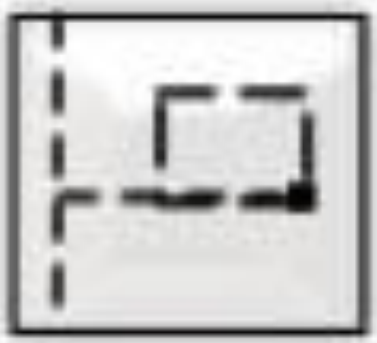
AREA RELATIONSHIPS – PART 2

Next the method we just looked at that began to deal with it but in kind of a crude way and they didn't really take the misclosure out they just kind of dealt with it by shuffling it around in different places. And then the final one, the one that you saw from the archives, they actually adjusted the numbers, took the misclosure out and then completed the area. All three of those methods and maybe more are used in different places in the country in different time frames to compute these areas against boundaries that have several segments with different bearings and distances.

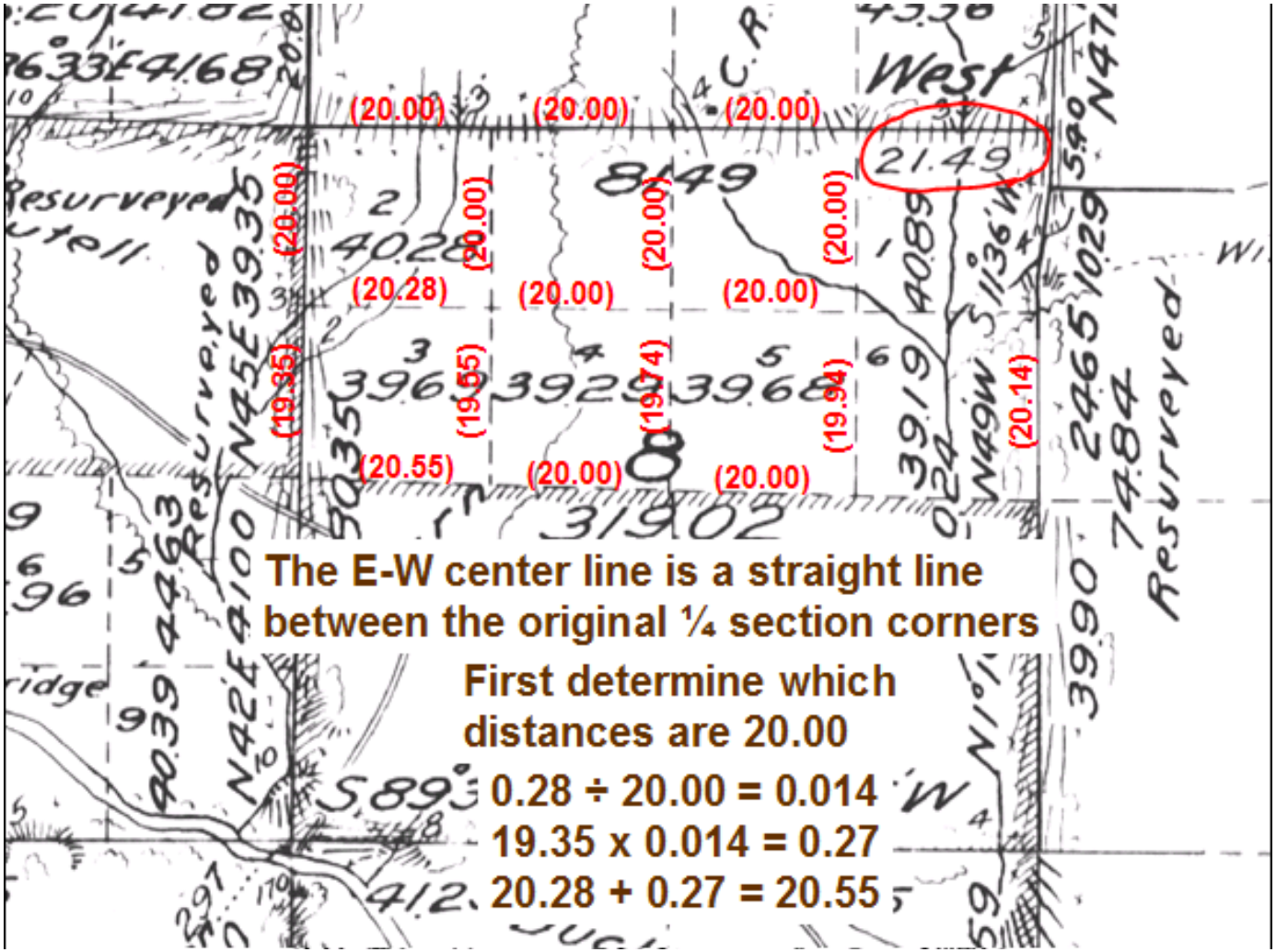
Got to be aware of this because if you don't get the numbers right, then you aren't going to subdivide the section. So once we have these numbers then we know what points are at midpoint, we know what sixteenths go at midpoint, what sixteenths do not go at midpoint, we know what sixteenths need to be proportioned, what sixteenths are not portioned and what numbers are used to proportion it. Now we can subdivide the section properly.

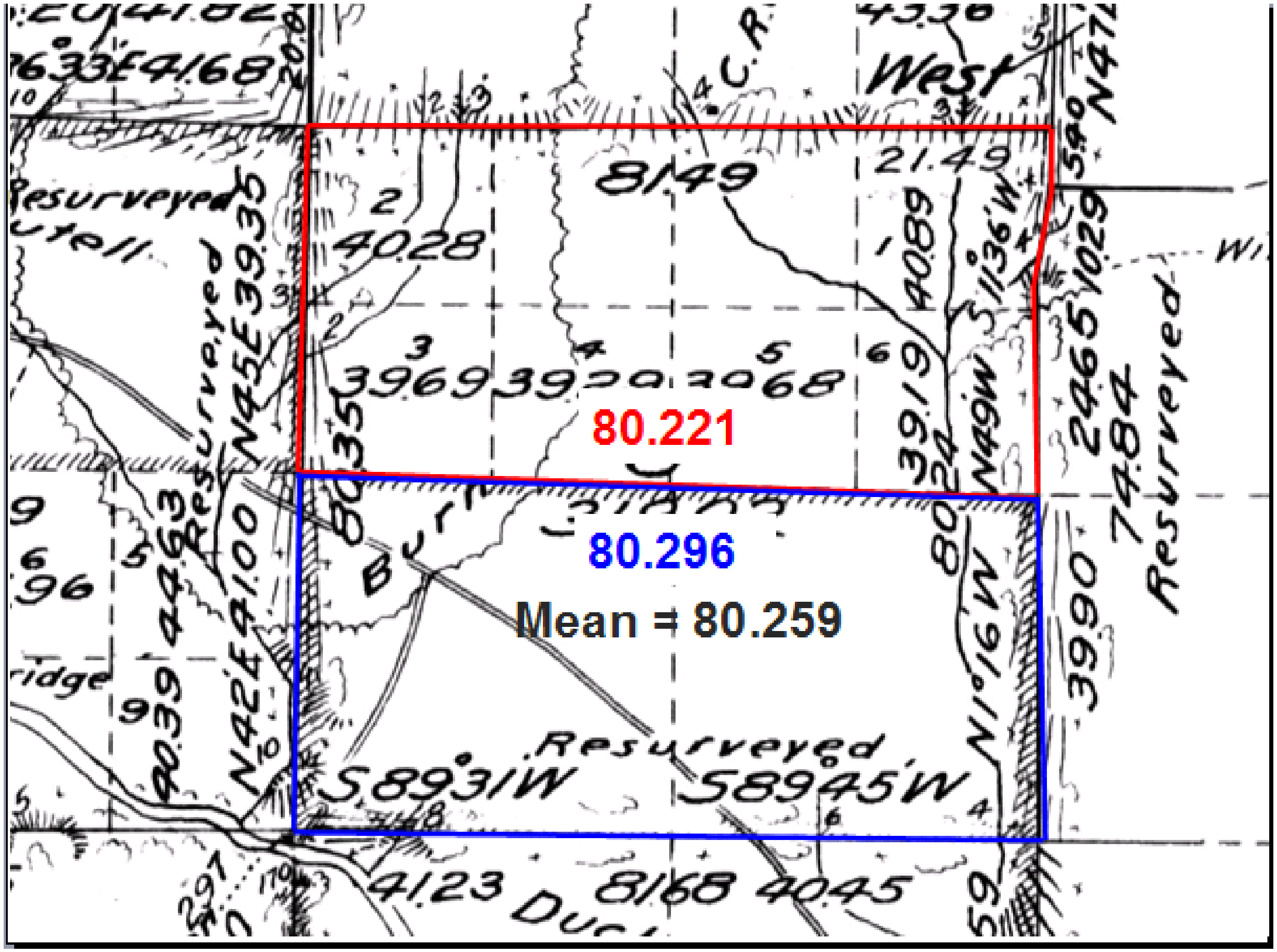
We're going to take a short break here and then we're going to move on and look at a couple of few other examples.

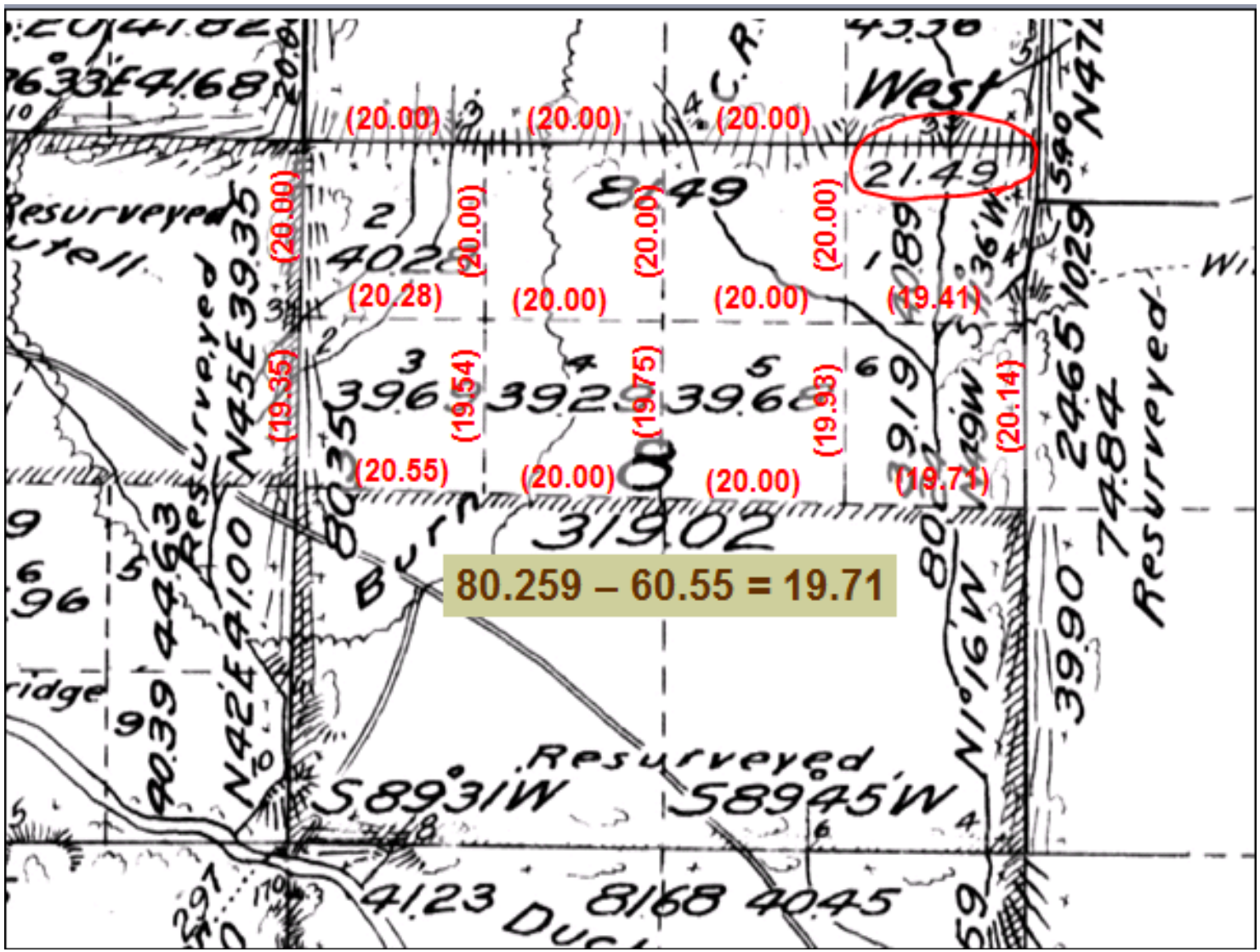
Before moving on to the next topic, complete the "Calculating Parenthetical Distances" problem which you can access from the course description page.

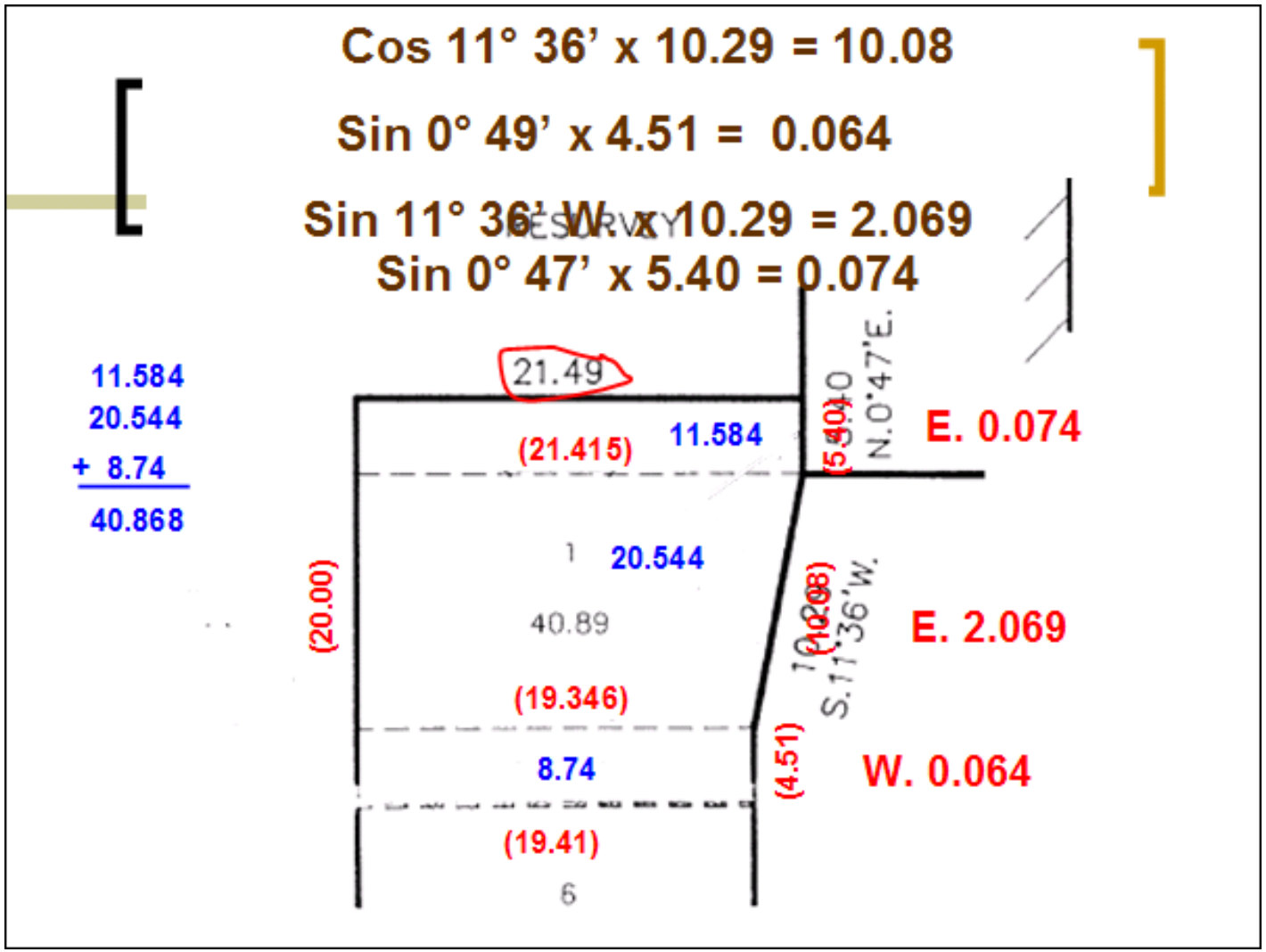


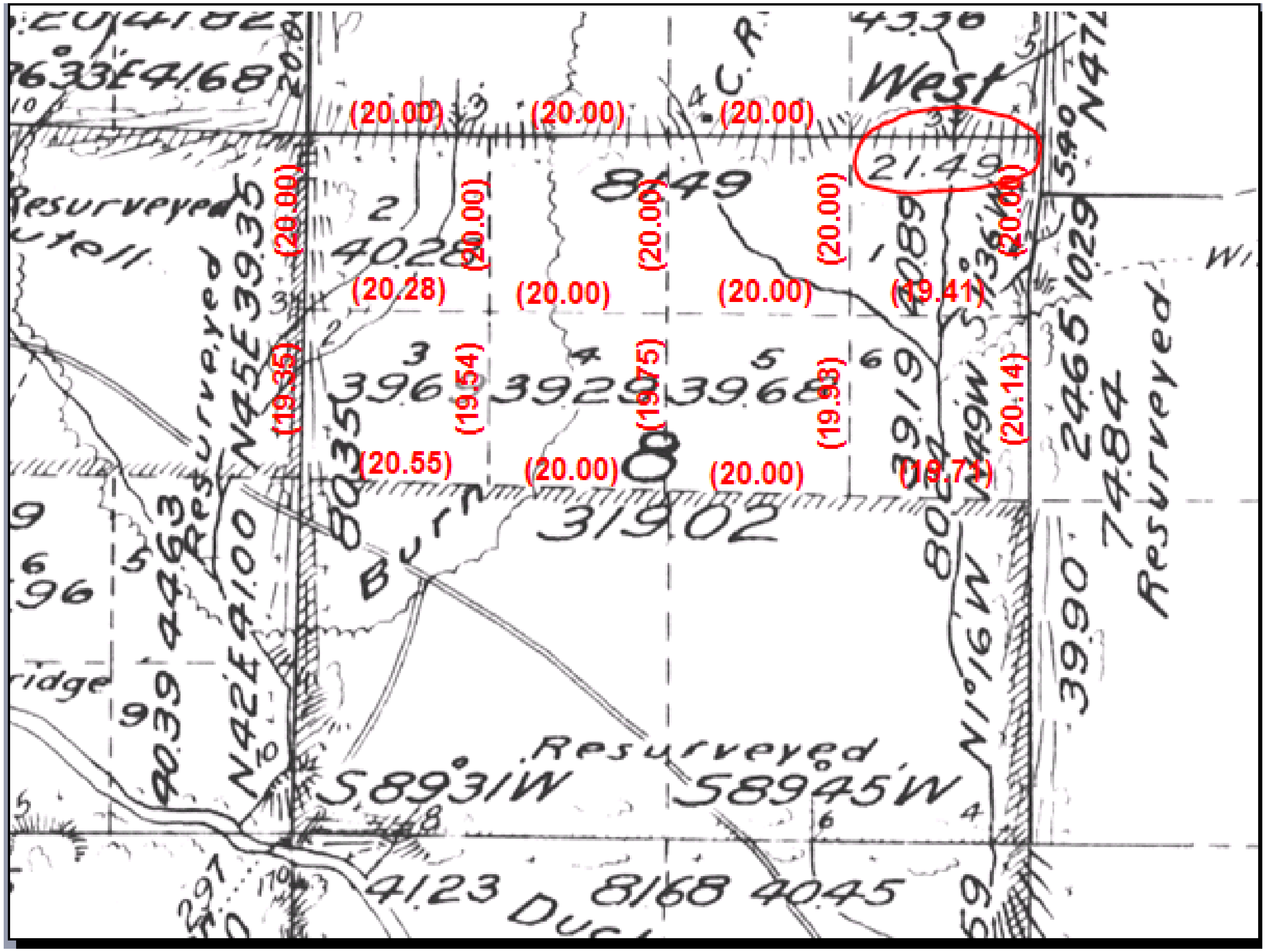
DIAGRAM


(20.00)
(20.00)
(20.00)
West
21.49
(20.00)
(20.00)
(20.00)
(20.00)
(20.28)
(20.00)
(20.00)
(19.35)
(19.55)
(19.74)
(19.94)
(20.14)
(20.55)
(20.00)
(20.00)
The E-W center line is a straight line
between the original ¼ section corners
First determine which
distances are 20.00
0.28 ÷ 20.00 = 0.014
19.35 x 0.014 = 0.27
20.28 + 0.27 = 20.55


80.221
80.296
Mean = 80.259


(20.00)
(20.00)
(20.00)
West
21.49
(20.00)
(20.00)
(20.00)
(20.00)
(20.28)
(20.00)
(20.00)
(19.41)
(19.35)
(19.54)
(19.75)
(19.93)
(20.14)
(20.55)
(20.00)
(20.00)
(19.71)
80.259 – 60.55 = 19.71
Resurveyed
S89°31'W
S89°45'W
Resurveyed


Cos 11° 36' x 10.29 = 10.08
Sin 0° 49' x 4.51 = 0.064
Sin 11° 36' W. x 10.29 = 2.069
Sin 0° 47' x 5.40 = 0.074
11.584
20.544
+ 8.74
40.868
21.49
(21.415)
11.584
(5.40)
N.0°47'E.
E. 0.074
1
20.544
(20.00)
40.89
(10.08)
S.11°36'W.
E. 2.069
(19.346)
8.74
(4.51)
W. 0.064
(19.41)
6


(20.00)
(20.00)
(20.00)
21.49
8149
(20.00)
(20.00)
(20.00)
(20.00)
(20.00)
4028
(20.28)
(20.00)
(20.00)
(19.41)
(19.35)
(19.54)
(19.75)
(19.93)
(20.14)
3961
3929
3968
3919
(20.55)
(20.00)
(20.00)
(19.71)
319.02
Resurveyed
S89°31'W
S89°45'W
4123
8168
4045
West
Resurveyed

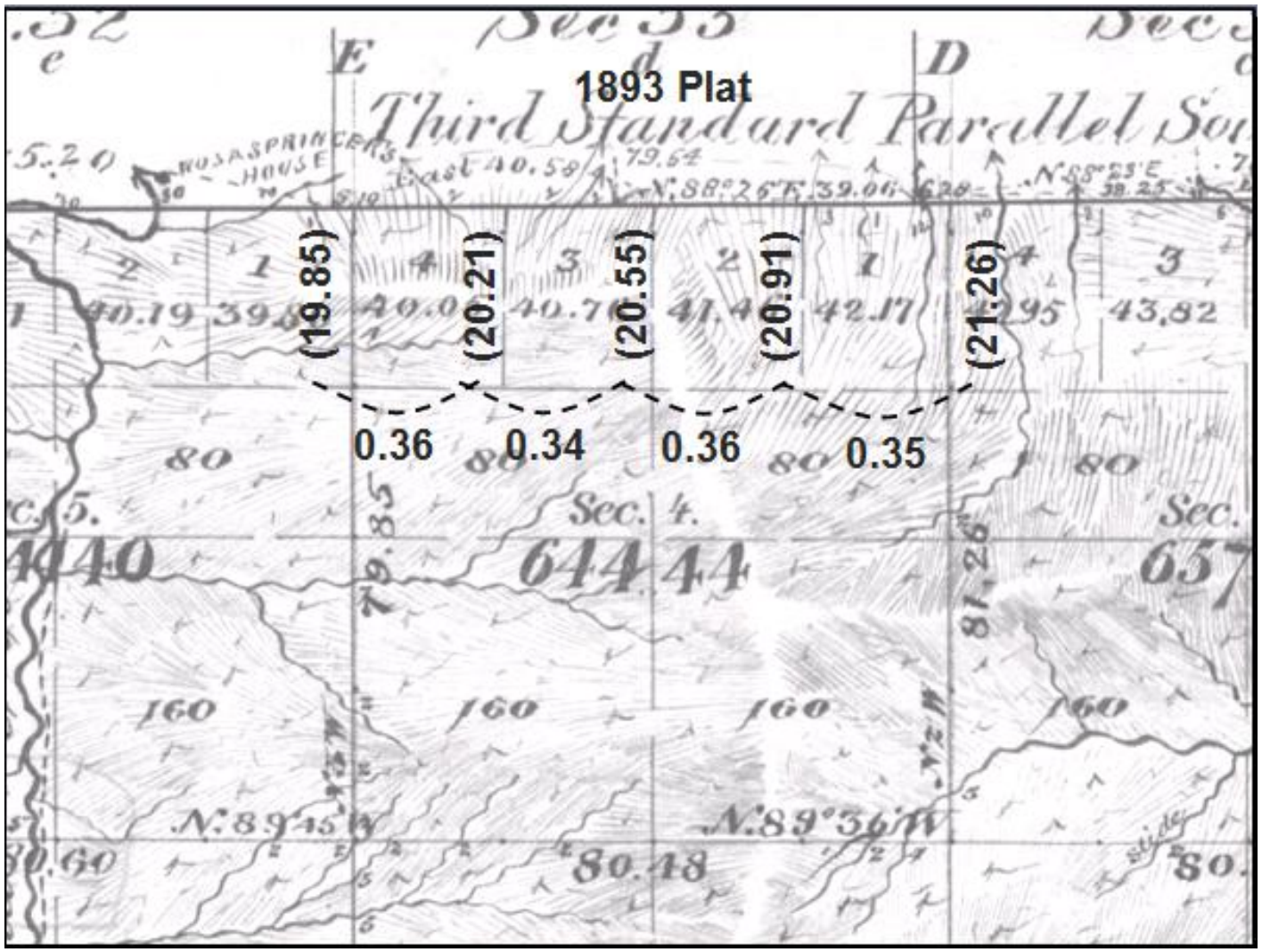

1893 Plat
Third Standard Parallel
(19.85)
(20.21)
(20.55)
(20.91)
(21.26)
0.36
0.34
0.36
0.35
Sec. 5.
Sec. 4.
Sec.
1040
644.44
657
160
160
160
160
80
80
80
80
N. 89° 45' W.
N. 89° 36' W.
80.48
79.85
81.26

FIGURE NO. 5

SECTION 13

1. Adjust Out the Misclosure in Northing

	Measured	Adjusted
1) 80.34 : 80 as	37.35 :	37.19
	39.63 :	39.46
	3.36 :	3.35

2. Adjust Out the Misclosure in Easting

2) Tan. of Bearing x Dist. = Dep. .0261859 x 39.46 = 1.033296

Tan. of Bearing x Dist. = Dep .0282236 x 37.19 = 1.049636

3) South bdy. of Lot 4	19.72
Dep. of 1st course	.00
Dep. of 2nd course	1.033296
Dep. of 3rd course	1.049636
	21.802932
North bdy. of Lot 1	22.12
Total Computed Dep.	21.802932
Misclosure	0.317068

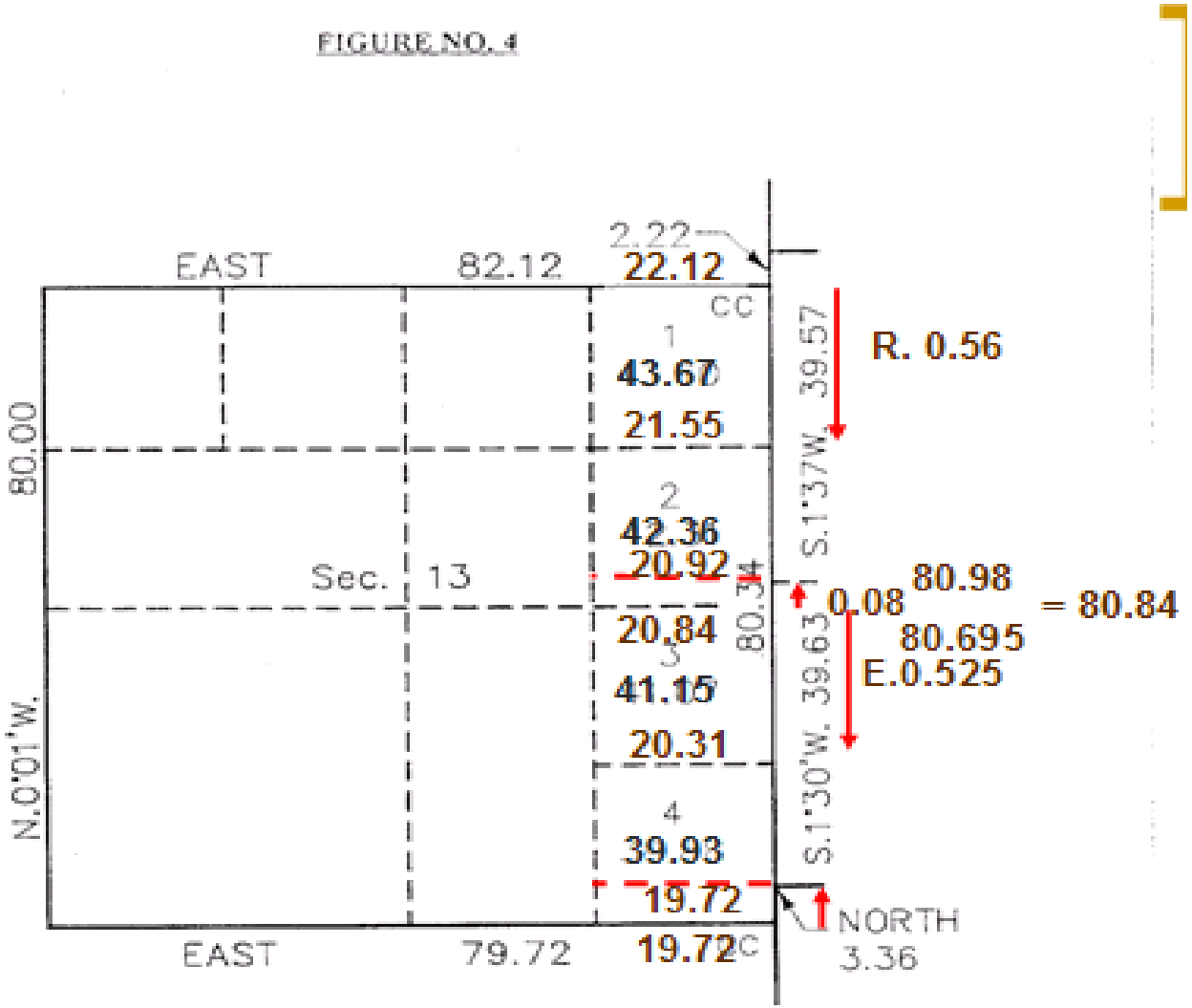
Misclosure ÷ Adjusted Northing .0039633 Tan. of Angle of
80)0.317068 Misclosure

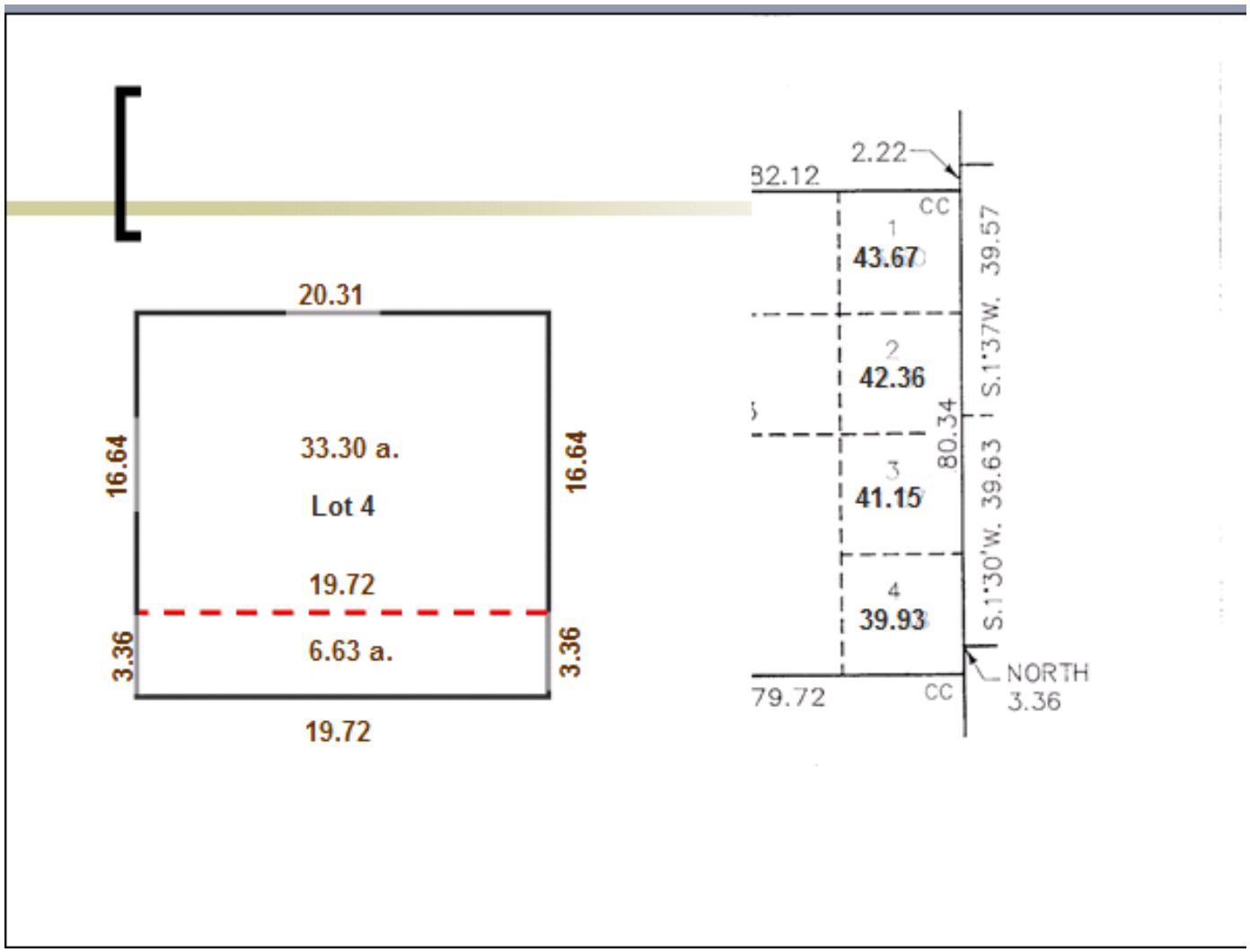
4)	1° 30'	1° 37'	North	
	.0261859	.0282236	.000000	= Orig. tan.
+	.0039633	.0039633	.0039633	= Adjustment
	.0301492	.0321869	.0039633	= Adjusted tan.

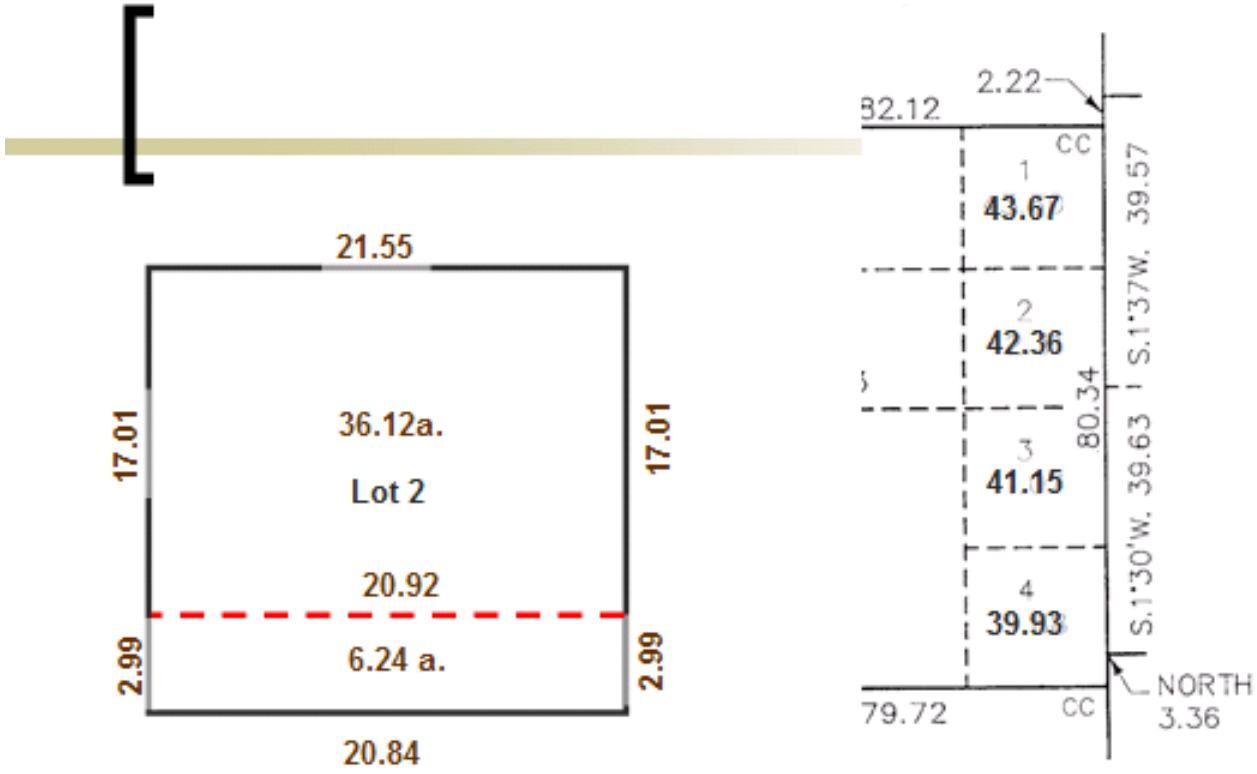
5)	Adj. Tan.	x	Adj. Dist.		Adj. Easting	
	.0039633	x	3.35	=	.01328	
	.0301492	x	16.65	=	.50198	
	"	x	20.00	=	.60298	
	"	x	2.81	=	.08472	
	.0321869	x	17.19	=	.55329	
	"	x	20.00	=	.64374	
					19.72	South Bdy. Lot 4
					22.11999	Checks with N. Bdy. Lot 1

6)		
	19.72	
	.0133	
	19.7333	
	.5020	
	20.2353	N. Bdy. Lot 4
	.6030	
	20.8383	N. Bdy. Lot 3
	.0847	
	20.9230	
	.5533	
	21.4763	N. Bdy. Lot 2
	.6437	
	22.1200	N. Bdy. Lot 1

FIGURE NO. 4


EAST
82.12
2.22
22.12
CC
1
43.67
21.55
2
42.36
20.92
Sec. 13
20.84
3
41.15
20.31
4
39.93
19.72
19.72
EAST
79.72
80.00
N.0°01'W.
80.34
S.1°37'W. 39.57
R. 0.56
80.98
0.08
= 80.84
80.695
E.0.525
S.1°30'W. 39.63
NORTH
3.36

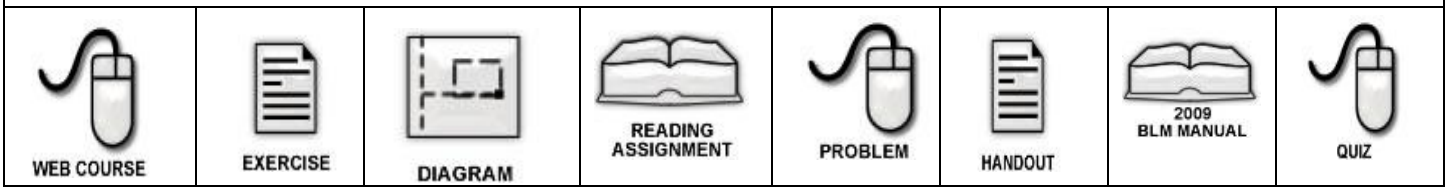

20.31
16.64
33.30 a.
Lot 4
16.64
19.72
3.36
6.63 a.
3.36
19.72
2.22
32.12
CC
1
43.67
2
42.36
80.34
3
41.15
4
39.93
S.1°37'W. 39.57
S.1°30'W. 39.63
79.72
CC
NORTH
3.36


21.55
17.01
36.12a.
Lot 2
17.01
20.92
2.99
6.24 a.
2.99
20.84
32.12
2.22
CC
1
43.67
2
42.36
3
41.15
4
39.93
80.34
S.1°37'W. 39.57
S.1°30'W. 39.63
79.72
CC
NORTH
3.36

Course 6: Subdivision of Sections Study Guide

COURSE DESCRIPTION:	This course focuses on the subdivision of sections. It addresses subdivision of normal sections, lotted closing sections, elongated and fractional sections, as well as the unique method known as the "three mile method" on many Indian Reservations and some private lands.
COURSE OBJECTIVES:	Upon completion of this course, students will be able to: • Learn to properly subdivide regular sections • Identify exceptions to section subdivision rules • Demonstrate an understanding of area relationships on GLO/BLM plats • Identify and deal with fractional sections
COURSE INSTRUCTOR(S):	Ron Scherler, Bureau of Land Management Dennis Mouland, Bureau of Land Management
VIDEO LECTURE TITLE:	Area Relationships – Part 3 (38 minutes)

ICON LEGEND



AREA RELATIONSHIPS – PART 3

Meander Board Calculations

Now we're going to look at another section, and again, this is a document that I retrieved from the national archives in Sand Point near Seattle.

This was something that really surprised me. I had no idea that something like this happened, but this is the actual drawing. This is the actual draftsmen's computation. And you'll notice down here at the bottom, I hope you can read it, it says meander board calculation. And I got this information probably 10 to 15 years ago and have done a lot of presentations around the country and I always ask; does anyone know what a meander board is? And I have yet to find someone who knows
what a meander board is.

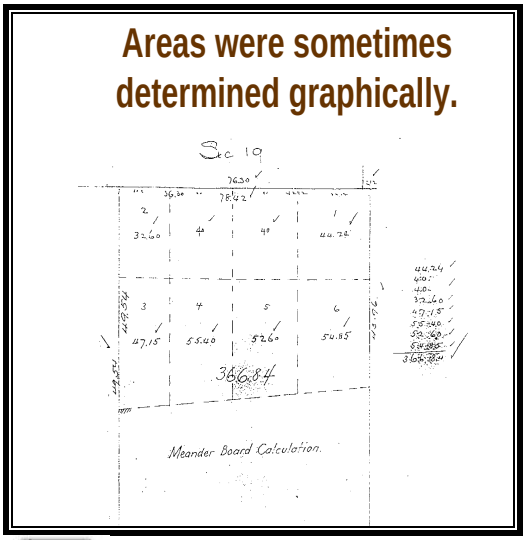


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

However, it's clear that it was some method that was used to graphically compute areas. I found section after section after section that was drawn up to scale and had the notation on the bottom computed on meander board. Most of the time they were sections against water or they were sections that were invaded some other way so they were not regular sections. And the one we're looking at right now it's a completion survey. So, the south half was surveyed first and then it was a completion survey so they were not normal lots. If you'll notice the lots are carried out to the nearest 500ths of an acre. Almost always areas on lots are carried out to the nearest 100th of an acre.

Some of the sections I looked at were only carried out to the nearest 10th of an acre. So, if you get one of these sections and you begin to try and work back from the areas to determine the distances around the lots, since they weren't calculated they were computed graphically, you can't get numbers that work. Numbers that work for one lot don't work for the adjacent lot. There's too much error in the areas. So, if you get into a situation where the areas are only carried out to the nearest 500ths or the nearest 10th and they just don't really make any sense. You can't find any numbers that will give you all of the correct areas. You're probably looking at a section that wasn't computed it was calculated graphically. It was determined graphically.

AREA RELATIONSHIPS – PART 3

Well, it still tells us something though. Normally, we can look at one of these sections and we can tell where was the excess or deficiency placed? We can tell where are the 20's? We normally are going to get a good idea if the center lines of the section are parallel to one of the boundaries or if they are a mean between the boundaries.

So even though we can't come up with all the numbers that we need, we generally can come up with the procedure. Where did they put the excess? Where did they put the deficiency? And then we can use the actual bearings and distances on the plat to subdivide the section on paper, I guess ourselves, and come up with the correct areas by calculation and from that the correct distances.

Just something I wanted to make you aware of because it's out there. I'm not sure how widespread this was. I know that in the state of Washington is where I've seen these. I don't know if it happened in other places.

I would assume it probably did. If it happened in one state it was probably happening someplace else. As a side note if any of you do know or have a description of what a meander board is; how it worked, what it looked like? I'd like to know so you know give me a call and let me know what that meander board is so I can find out really what it is; just wanted to make you aware of this one.

AREA RELATIONSHIPS – PART 3

Resurvey Lotting

The next section, this is a fairly straight forward section. If we look at this it's a regular section. There's no lotting, there are no lines that are out of limits; its 640 acres, no problem. Well, there has been a resurvey though.

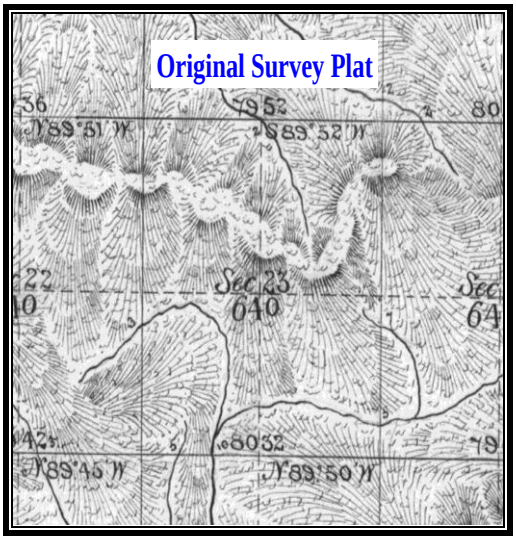


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

Let's look at the resurvey plat. This is the same section shown on a resurvey plat. This is sometime after 1940 I'm not sure exactly; 1935, 40, on up from there, sometime after that time. And we look at this resurvey plat and we find a section that used to have 640 acres, a section that used to have 4 quarters each containing 160 acres.

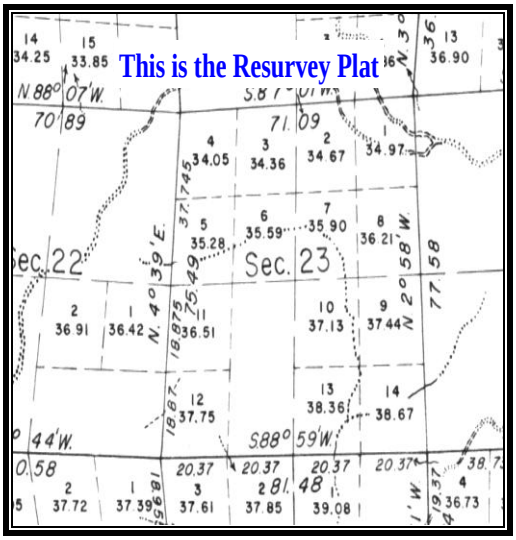


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

We find a section that used to have all of the boundaries within limits, now it looks nothing like that original section. None of the boundaries are within limits. We have bearings of 4 degrees. We have bearings of 87 degrees. We have areas of parcels that were originally 40 acres that now are 34 or 35 acres. We have lot numbers through portions of this section, but other portions do not have lot numbers and do not have areas.

So what's going on? How am I supposed to subdivide this section now that I have this resurvey that created all these lots and all these strange areas? What's happening? Well, it's not as complicated as it might seem.

First of all, it is a resurvey. And what the resurvey found was there

AREA RELATIONSHIPS – PART 3

were some pretty major discrepancies in the original survey. So there are some bearings and distances that are out of limits. There are some pretty major distortions. At this time frame, there was a time frame where we were trying to show the BLM, GLO, we're trying to show the true areas within sections when we surveyed. The true areas of the federal land.

Today if the area of a 40 acre parcel, an aliquot part, varies by more than about 5 percent of the record area of 40 acres, or in other words, if it's less than 38 acres it's more than 42 acres, generally we'll give it a lot number and put a true area on it. But we only do that on the land that is remaining in federal ownership.

If we look at this plat we'll notice that the east half of the southwest quarter is not lotted that indicates it probably was private land. It had already been patented. If we went back and checked the records we would probably find that at the time this survey was done that was private. We have no authority to change the area or the description of a parcel that's already been patented. So, no areas or no lot numbers are shown there.

The rest of the section, however, was federal land because it all has lot numbers and it all has areas. Now, we were not changing the way this section was subdivided. We changed nothing about how it was subdivided. This is still a regular section as far as subdividing goes. And here's the way you can verify that. If you take the exterior boundary of this section, you put all those numbers in you're going to find that it miscloses by some amount.

If you do a Compass Rule Adjustment of that exterior, place all of the 16th corners around that exterior at midpoint between the quarter corners and section corners, if you run straight center lines between the quarter corners, place all of the 16th corners within that section at midpoint between the quarter corners and the center of the section, and then subdivide the section by straight lines between 16th corners; what you will find is each one of those quarter-quarter sections when you compute the area you'll match the area on these plats.

What you'll find is this section is subdivided normally just like a regular section. It is a regular section because it was created as a

AREA RELATIONSHIPS – PART 3

regular section. We did nothing to change that. All we're showing here is the result of a normal subdivision of this regular section, and the results look kind of strange because there were discrepancies and errors in that original survey. Some of those bearings and distances in that original survey were not very good resulting in these areas, but it still is subdivided as a regular section.

That's the way it's created and if you do the Compass Rule Adjustment and subdivide like I said you'll get these numbers. So even though it looks like it might be a complicated section, even though it looks like there might be something strange for us to do there, there isn't. It's a regular section. I wanted to point that out because you could spend a lot of time trying to figure out where all these lots came from, and maybe even end up trying to subdivide the section incorrectly if you didn't know about that little history.

And today, today BLM still often times lots, areas, that do not match the original area by 5 percent or more, so if it's over 42 it's under 38 it will get a lot number and an area, maybe the parcel right next to it, the aliquot part next to it, is within that 5 percent so it doesn't get a lot number. Adjust the exterior, subdivide it normally, and you'll usually get those numbers.

Now, prior to oh the 30's or so, we weren't doing that Compass Rule Adjustment. We began to start adjusting things somewhere around the turn of the century, and they were more limited adjustments and we worked our way up to where we ended up doing the Compass Rule Adjustments.

Today on some plats you will see adjusted numbers reported. Here they did the Compass Rule Adjustment only for area calculation purposes. They still reported the unadjusted numbers on the plat and that's what you'll find.

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Determining the Method of Subdivision Once the Protracted/Parametrical Distances are Determined

We're going to switch gears now and we're going to go from how to determine those distances to look at a little broader picture of some of the other things those distances, those protracted distances, do for us.

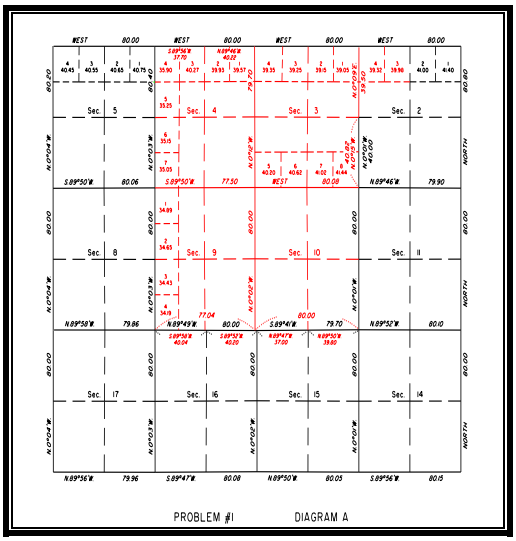

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

I want to look at this plat, and let me tell you first what it represents. The black lines, everything in black, represents an original survey, and so on the original survey the northwest quarter of section 2, section 3, section 4, section 9, and section 10 were not surveyed. They were shown as unsurveyed; however, the entire north boundary was surveyed and all the other sections that are shown in black. 3 quarters of section 2 was surveyed but not the northwest quarter. The red represents a completion survey done sometime after that original, and you'll notice that some lines were retraced in the red survey. Some lines were; some lines were not. Everything that's shown in red is what was shown on the completion survey plat. Where there is no new numbers shown in red, say the distance between sections 4 and 5, then the completion plat used that original number.

AREA RELATIONSHIPS – PART 3

I have another diagram that looks just like the first diagram except the lines are in green.

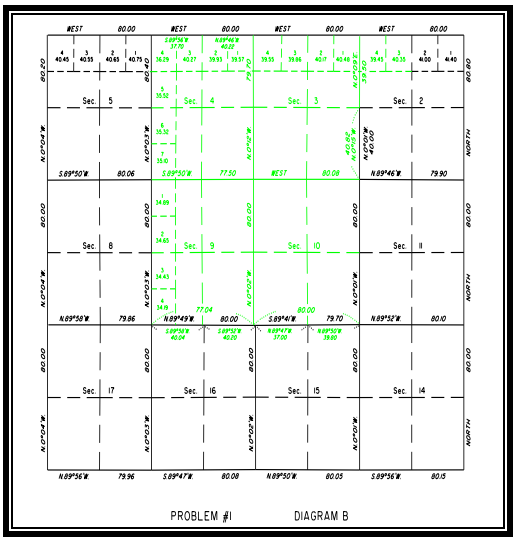

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

The difference is the areas. Every bearing and distance on here is exactly the same as every bearing and distance on the red line. Nothing changed. The only thing that changed is how the draftsman dealt with deficiencies, excess and deficiency, dealt with the difference in distances created by retracing some lines.

Now, we're not going to look at this entire plat but we're going to look at the line between section 2 and 3, because I want to make a point here about what those parenthetical distances and what the areas show us about subdividing sections. And more specifically about what corners are common and what corners are not.

Let's go back to the red plat, let's look at this one first. First we see that the south half mile between sections 2 and 3 was retraced. Originally, the black number, this south half mile was 1 minute northwest for 40 chains. If you were to look at that original field notes that surveyor surveyed 1 minute northwest 40 chains and established the quarter corner for 2 and 3, he monumented it. It's there 2 and 3. If you look at the retracement you'll find that he retraced that mile. He found the section corner of sections 2, 3, 10, and 11.

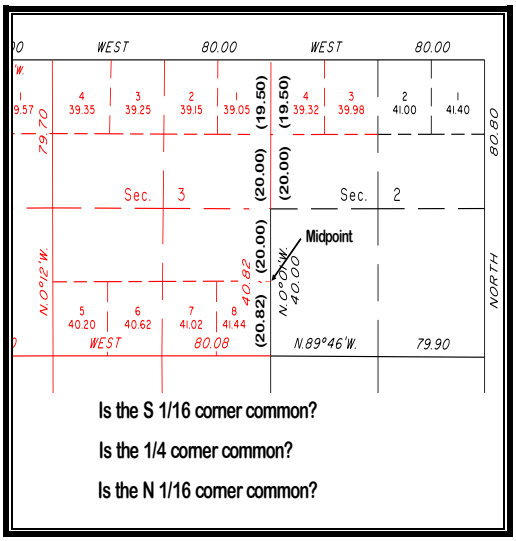

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

He also found the quarter corner of 2 and 3, the original. But he has a different bearing and distance. He remeasured it got a different bearing and distance. He has N. 0° 15'W for 40.82 chains. So the original had 40 chains; the retracement has 40.82 chains.

Then in the second survey, the red surveyor the second surveyor there, he completed that mile by running the north half mile; and in doing so he got a distance of N. 0° 09' E 39.50 chains for that north half mile.

Everything looks fine but look at section 3 and you'll notice that there are lots along the south boundary. There are not only lots

AREA RELATIONSHIPS – PART 3

along the north boundary, along the north boundary of the township, but lots along the south boundary of section 3. Why is that? Well, first of all we can determine that the south 16th for section 2 is at midpoint, correct?

The original surveyor found that to be 40 chains. His plat shows that the southwest quarter is normal 160 acres, so the south 16th for section 2 is at midpoint. But let's look at section 3. In section 3, the lots 5, 6, 7, and 8 are based on a distance of 20.82 over here for this south quarter between sections 2 and 3. The draftsman looked at that distance, that retracement distance of 40.82, and he said, "That's **out of limits**. That's a chain and 64 links for a mile. That's out of limits, therefore I need to put that excess I need to put that excess into a lot, give it a lot number, give it an area because it's out of limits. I can't treat it as just 40 chains." So he pushed that excess to the south boundary of the section, and he created lots all the way along the south boundary of the sections.

Lots 5, 6, 7, and 8 and they're based on a distance of 20.82. The north half of the southeast quarter and the north half of the southwest quarter those are both 80. That tells us that the numbers were looking at are 20 and 20.82.

Those are the parenthetical distances for section 3 for the south half. So, let me ask you this. Is the south 16th between sections 2 and 3 common? The section corner is the original it's obviously common, the quarter corner was recovered by the retracements surveyor, its original it's obviously common, but is the south 1/16th common? What do you think? Well, when you look at the numbers the answer has to be no.

Because for section 2 the south 16th is at midpoint its 160 acre normal aliquot part, midpoint, for section 3 what have we done? We've taken that excess of 82 links and we've pushed it down to the south boundary and created a lot. So the south 16th for section 3 is going to be a proportionate 20 and 20.82. We have two corners there, one for section 2 and one for section 3. It's not a common 16th.

Now, the north half if we're to look at the areas along the north boundary of section 2 and the areas along north boundary of section 3, we'll find that in each case they're based on 20 and

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19.50, the distance from the recovered quarter corner up to the north boundary of this section.

So, the next question is, is the quarter corner common, which we've already talked about. Yes it's obviously common. The retracements surveyor recovered it, he called it the quarter corner of section 2 and 3, and his areas are based on his recovered position. So, obviously the quarter corner is common.

Is the north 16th common? Well, if the quarter corner is common, if we look at the parenthetical distances for the two sections, they're identical. That north 16th is going to be proportioned, but it's the same proportion for section 2 as it is for section 3. It's the same proportion. The north 16th is common.

So, here we have a situation where we've recovered the original south section corner. We've recovered the original quarter corner, yet the south 16th is not common. The quarter corners common and the north 16th is common. Two of the three corners along this line are common one's not, and the only way we know that is when we look at these areas and compute those parenthetical distances.

What that tells you is if you're working in section 2 you want to also take a peak over there at section 3. You also want to have a look there to make sure that you aren't setting a monument and calling it the south 16th of 2 and 3, when over in section 3 there's something that tells us that corner's not common.

It also tells you if you are surveying a section line, you might want to keep in the back of your mind what's going on, on either side of the line in those section should they be subdivided so you know what corners are common, where lines are common, where they're not. Of course, the line is common but the corners are not.

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Now let's look at the green plat. Now, remember all the bearings and distances on the green plat are the same as on the red plat. The only thing that's different is the area; what the draftsman did with the excess or deficiency. If we look at this plat we'll notice there are no lots along the south boundary of section 3. On the red plat there were. There are lots along the north boundary of section 3, north boundary of section 2, but those lots have slightly different areas than the lots shown on the red plat. So, let's see what the draftsman did. Let's look at this.

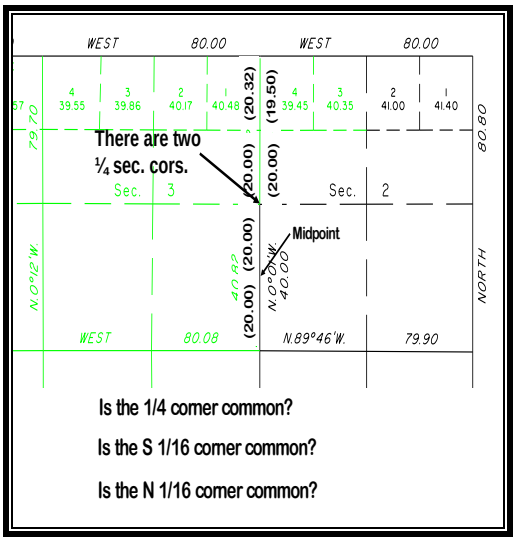

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

First of all, areas 1, 2, 3, and 4 up there on the north boundary, those are based on a distance of 20.32 for the east boundary of lot 1. 20.32, so where did that number come from? The north half mile is only 39.5 chains long. Where did 20.32 come from? Well, if you add 39.50 the distance of the north half mile, 40.82 the distance of the south half mile, we get 80.32.

The draftsman took the distance of the entire mile and took the excess, everything over 80, and put it all in the north quarter mile. He put it all in lot 1, 2, 3, and 4. So, if we're to look at these other numbers we have 20 chains, 20 chains, and 20 chains. And that makes sense when we look at the areas in section 3, because this south half of the northeast quarter is 80 acres. It doesn't say 80 but its 80 because there's no lot numbers there. Likewise down here in the southeast quarter its 160 acres so it makes sense that those distances, all three of those distances, are 20. We add them up and we get 80.32 that's the total retracement distance for that mile.

Again, if we look at the field notes for this surveyor are going to say that he found the corner of 2, 3, 10, and 11. They're going to say that he surveyed N.0° 15"W, I believe it is for 40.82, and he recovered the quarter corner of section 2 and 3. And he's going to call it common, and then he's going to continue, and at 39.50 he sets the corner for 2 and 3. But let's see what happens here.

Let's look a little closer at what's going on. We have the same numbers for section 2 as we did on the red plat. Lots 3 and 4 are based on 20 and 19.50 that's the measurement from the recovered quarter corner to the north boundary the north half mile, 20 and 19.50.

Is the quarter corner common? Well, I can see several of you

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saying, "Well that's kind of a strange question of course it's common. It's the original quarter corner it was set as the quarter corner of 2 and 3. It was recovered by the retracement surveyor who called it the quarter corner of 2 and 3 and now if you recover it, of course it's common. It's the quarter corner of 2 and 3." Well let's go down here and say is the 16th corner common, the south 16th? Well, you look at that and say, "Of course it's common.

Look at the plat. On the section 3 we have 20 chains and 20 chains, shows the south 16th at midpoint; for section 2 remember it shows it at 20 chains because it's a regular aliquot part. Of course it's common. Of course it's common. Why are you asking the question?"

Let me say that a few weeks ago I did a seminar at a conference and we talked about this exact issue, and in a room, I did it three times, in a room of about 80 people the first day about 25 said there were 2 corners the rest said there was 1. The next day in a class of about 100 one person said there were 2 corners the rest of the class said there was 1. Well, I think there are 2. Let's look at the north 16th and see what we see there, and once we've looked at all 3 of these we'll see where we're going with this. And I can see some of you saying, "Oh he doesn't know what he's talking about. How can he make two corners? Where is he coming from? This is crazy."

Give me a chance to explain and let's see where we go. North 16th, are there two north 16ths? Well, here it looks like there are because look at those two numbers between lot 4 of section 2 and lot 1 of section 3; 19.50 for one side 20.32 for the other side. Yeah there's probably 2 north 16ths. So you might give me that, you might give me that there are 2 north 16ths, but how in the world am I going to create 2 quarter corners with 2 south 16ths? I say there are 2 quarter corners, why?

What did the draftsman do? Let's look at what the surveyor did first. The retracement surveyor found the section corner, found the quarter corner, said that they were 40.82 chains apart. Where did the draftsman put the quarter corner though? Did he put it at 40.82? No, he put it at 40 chains, not 40.82, 40 chains. Well, you're saying, "Well wait a minute, he's the draftsman, how can he do that?" Let's think a little bit about how the system worked at

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this time. In the GLO, of course we had contract surveyors, the contract surveyor did the survey in the field. He wrote up the field notes. He provided a sketch plat of the survey showing topography and other things.

Turned that into the Surveyor General and then who created the plat? It was an employee of the Surveyor General; it was an employee of the GLO, that's the person that created the plat. Do any of you today ever have a disconnect between the field surveyor and the draftsman? Yeah, I can see you shaking your head I'm sure you do. It's a common problem that's gone on for a long time.

The draftsman was looking at this and saying, There's excess there, I'm against the north boundary. I need to put that excess against the north boundary." The field surveyor, when he was in the field, he was surveying and said, "I found the original quarter corner; it was the original quarter corner for both sections so it still is," and he called it for both sections. But let's look at the time, the sequence of events again. After the surveyor made that call, created his field notes, gave them to the draftsman, the draftsman created the plat, and the Surveyor General signed that plat with the lottings and areas shown as they are here. Not only did he sign that plat, but all of the patents that are issued on this section 3 are issued based on the lottings and areas shown on this plat.

This is the basis for everyone's area determination and the draftsman, by his actions, created a new quarter corner position. He created a position at 40 chains. There's a lot of people out there still shaking your heads. You're saying, "Nah I'm not buying this, I'm not buying this."

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Let's look at something else. Let's look at this section 3 and let's just do a hypothetical. Let's say that you recover all of the section corners. And you recover all of the original quarter corners. All of them found them all, originals no doubt. And let's say you retraced the boundary of this section, all those boundaries. And each one of those lines you matched the original surveyor exactly.

Now, I know that doesn't happen but humor me here a minute. You matched all of those bearings and distances exactly. You found all the original corners and you've matched all his bearings and distances exactly. Now, if you are going to subdivide that section under those situations, it seems to me that you should match the areas shown on the original plat exactly. Is that true? Think you'll agree that you should. If we match all the bearings and distances around the section exactly with the original surveyor and we have all the original corners, then if we subdivide the section properly we should agree with every area on that plat.

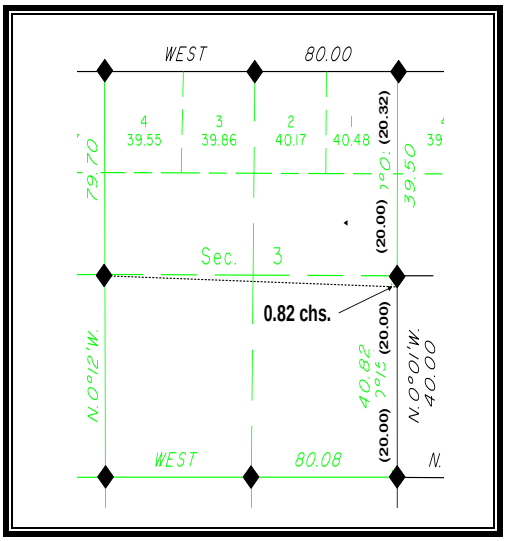

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

Let me tell you, if you match every bearing and distance around this section and you find all the original corners the only way to match those areas is to create a quarter corner position at 40 chains from the south. That's the only way. If you use the found quarter corner, the one at 40.82, then all the areas in the south half of that section are going to be larger than shown on the plat and all the areas in the north half of that section are going to be smaller. The only way to subdivide that section exactly as the plat shows, and the plat remember is the basis for every conveyance out there, the only way is to create another quarter corner position at 40 chains.

So you say, "Well wait a minute. I get out there in the field and this section was subdivided 60 years ago. They've been using that as a common quarter corner for the last 60 years. There's 15 surveyors based on that. There's houses, and subdivisions, and roads, and fences, now you're telling me there's 2?" There are two but there's some caveats that go with that. There's a 82 link difference between the two, there are two, they're there.

Now, I'm going to survey that section. Am I going to establish two? Well if I'm the first surveyor, the section hasn't been subdivided, there are no improvements, there are no use patterns out there; then yes I'm going to establish another quarter corner. There's going to be two quarter corners there. One for section 2,

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one for section 3, and I'm going to subdivide section 3 accordingly. However, if I get out there and I find that there is use and occupation to that existing quarter corner, that old original one, then that might modify my approach and here's why.

Let's look at Section 6-16 in the Manual, bona fide rights. It tells us some situations where we can consider that an entry man has entered in good faith. He's entered in good faith and we're going to protect that good faith in certain situations. Read what these are.

BONA FIDE RIGHTS

Section 6-35

1. complicated conditions involve a double set of corners, both of which may be regarded as authentic;
2. there are no existing corner in one or more directions for an excessive distance;
3. existing marks are improperly related to an extraordinary degree or
4. all evidence of the original survey which have been adopted by the entryman as a basis for his location have been lost.

Complicated conditions, there's 4 of them, complicated conditions involving double set of corners both of which may be regarded as authentic. What do we have?

We have a double set of corners only one monumented and obviously it could be considered as authentic. So, if we get out on the ground we find that people have located based on that original quarter corner that we have surveys based on it, we have homes, we have roads, we have fences whatever, then we're going to fall back on this bona fide rights section in the Manual where it tells us that we can consider someone has located in good faith if there's a complicated condition involving a double set of corners both of which can be regarded as authentic.

Obviously the one that they're using could be regarded as authentic. Now, it's not just the adjacent parcel to the quarter corner. It's any place within section 3. If section 3 someone has located their land in section 3 based on that original quarter corner position then that's going to cause us to look at the bona fide rights, look at the good faith location, and begin to evaluate what method we should use to subdivide that section.

The important thing for you is that you recognize the situation that you document in your files that you realize the plat in section 3 created another quarter point. You need to recognize that, you need to document that, and then you need to document how you dealt with that. And the situation in section 3, the current situation is going to help us decide how to do deal with that. It's a common point that many people miss and it's a point that we want to make clear here that the areas, as shown on the original plat, often create situations where we have corners for one side only, double corners, where just the casual viewing of the plat does not appear

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to create that.

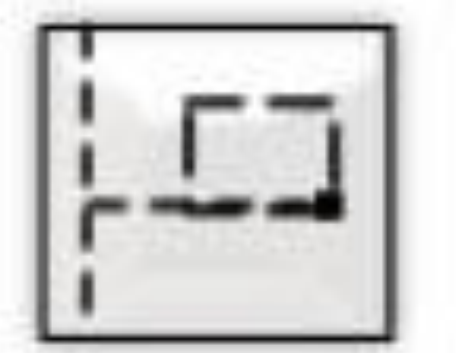
We've pretty much covered area relationships now. We've looked at the relationship of just the chain to the area, how that simplifies things. We've looked at how we're supposed to use cardinal equivalents that we're dealing with right angle rectangles we aren't dealing with bearings most of the time.

And then we've looked at a few of the most basic methods for working back from the areas to get the parenthetical distances; how we then use those distances to subdivide the sections properly. And now we've finished up by looking at situations where those areas may actually create double corners along boundaries.

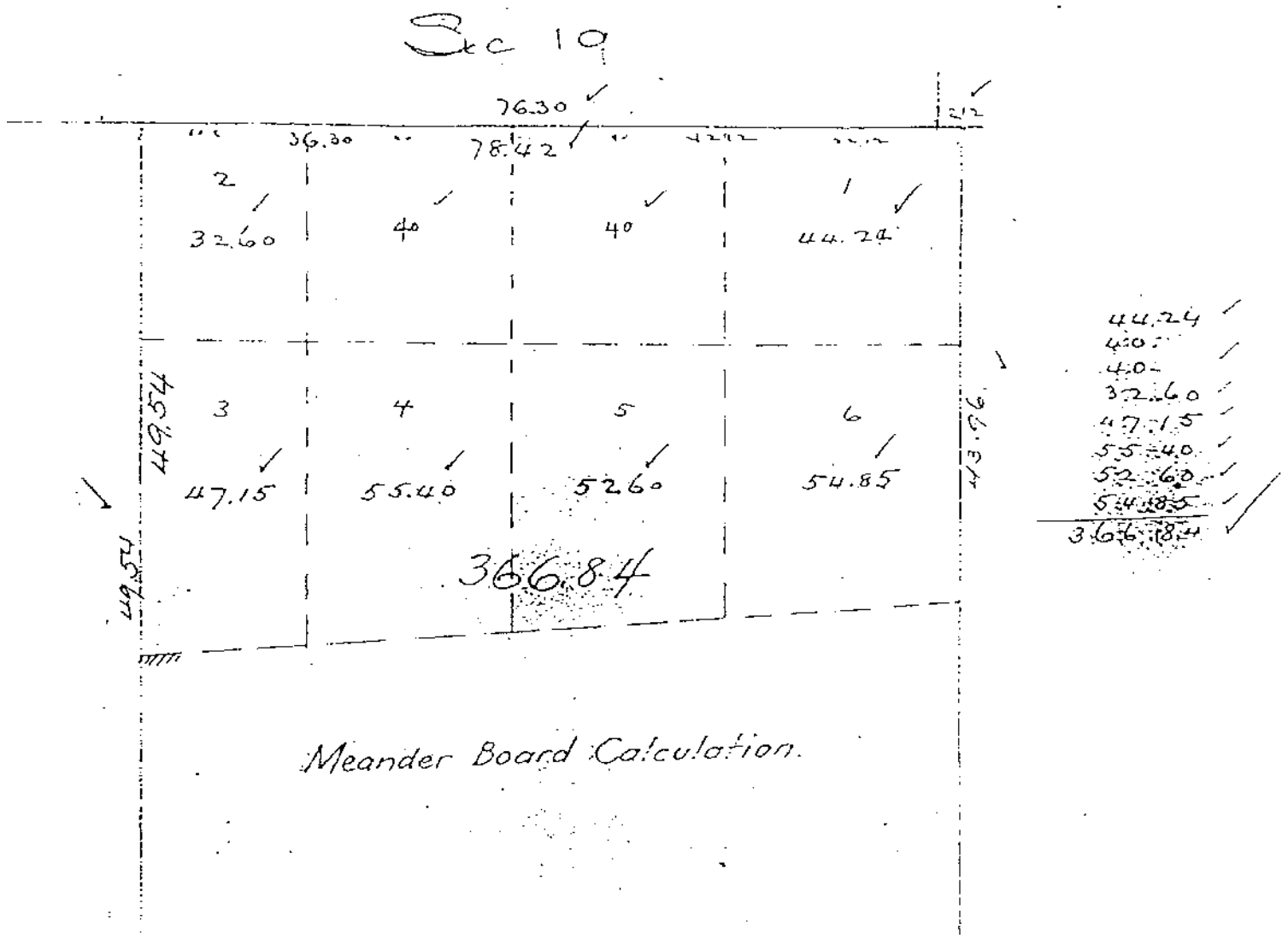
Sometimes a quarter corner may be common and a 16th is not. We may have a strange combination of things, but that plat and the areas on the plat are what's telling us that. And we must have a good understanding of how to work back from those areas to get the numbers; and once we get those protracted numbers then interpreting those protracted numbers correctly to subdivide the section correctly, and to establish those 16th corners around the section.

We have one more segment in our subdivision of section course and that is Subdivision of Fractional Sections so next time we'll be looking at the Subdivision of Fractional Sections.

Before moving on to the next topic, complete the "Subdividing a Section" problem which you can access from the course description page.



DIAGRAM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36.30
78.42
2
32.60
40
40
1
44.24
3
4
5
6
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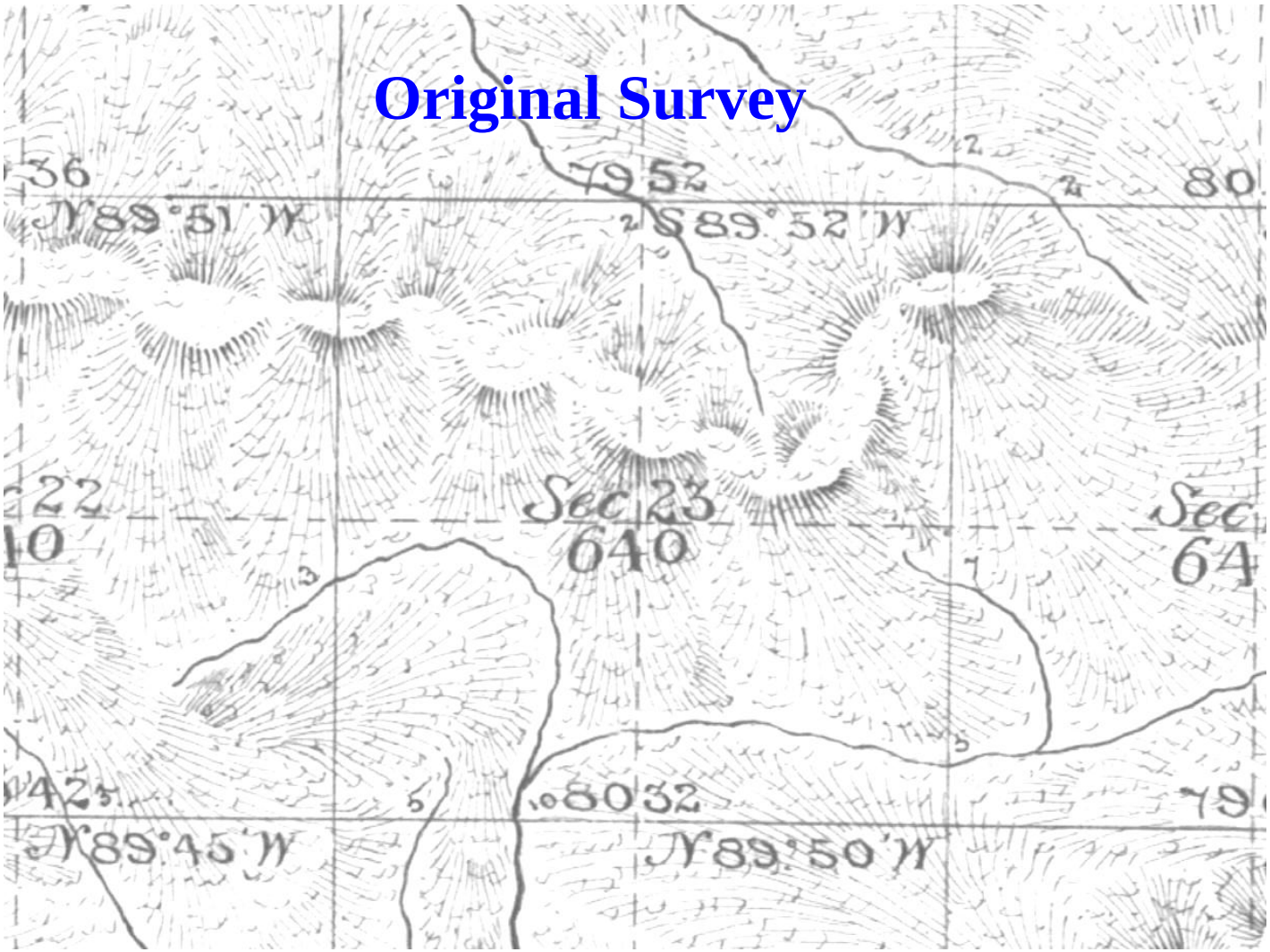
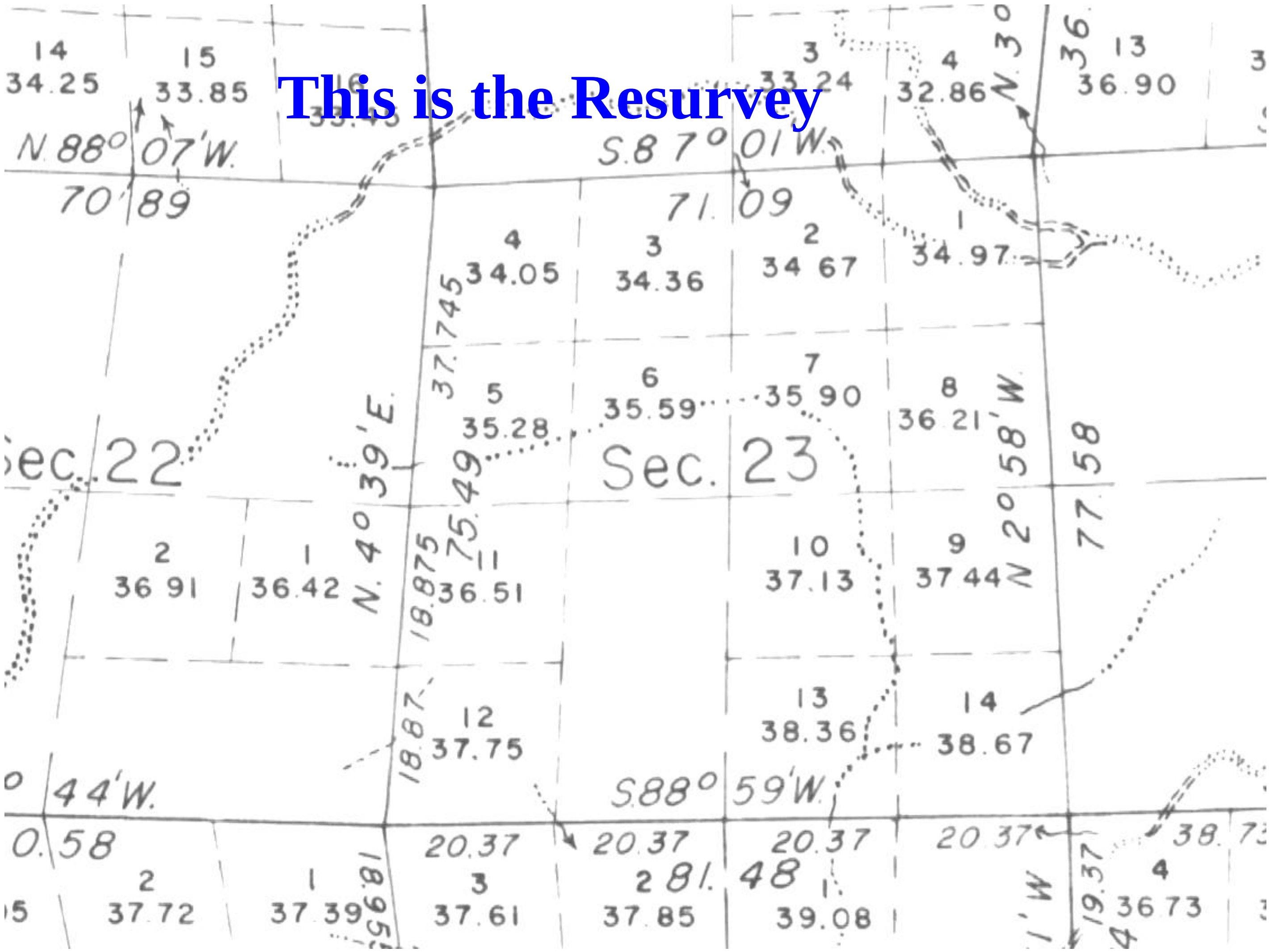
55.40
52.60
54.85
49.54
49.54
43.76
36.84
Meander Board Calculation.
44.24
40
40
32.60
47.15
55.40
52.60
54.85
366.84


Original Survey
36
N 89° 51' W
79 52
S 89° 52' W
80
22
Sec 23
640
Sec
64
42 31
80 32
79
N 89° 45' W
N 89° 50' W


This is the Resurvey
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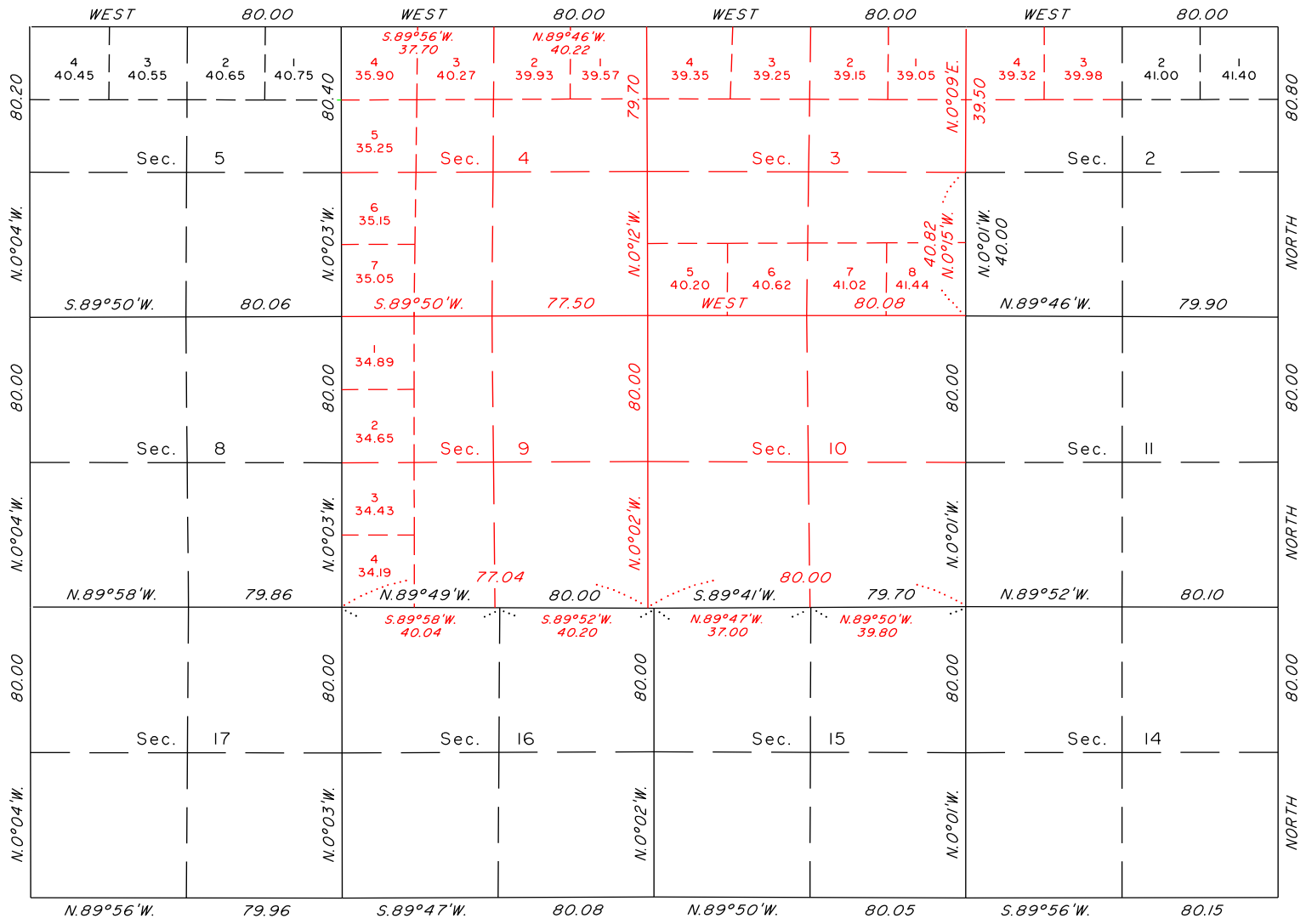
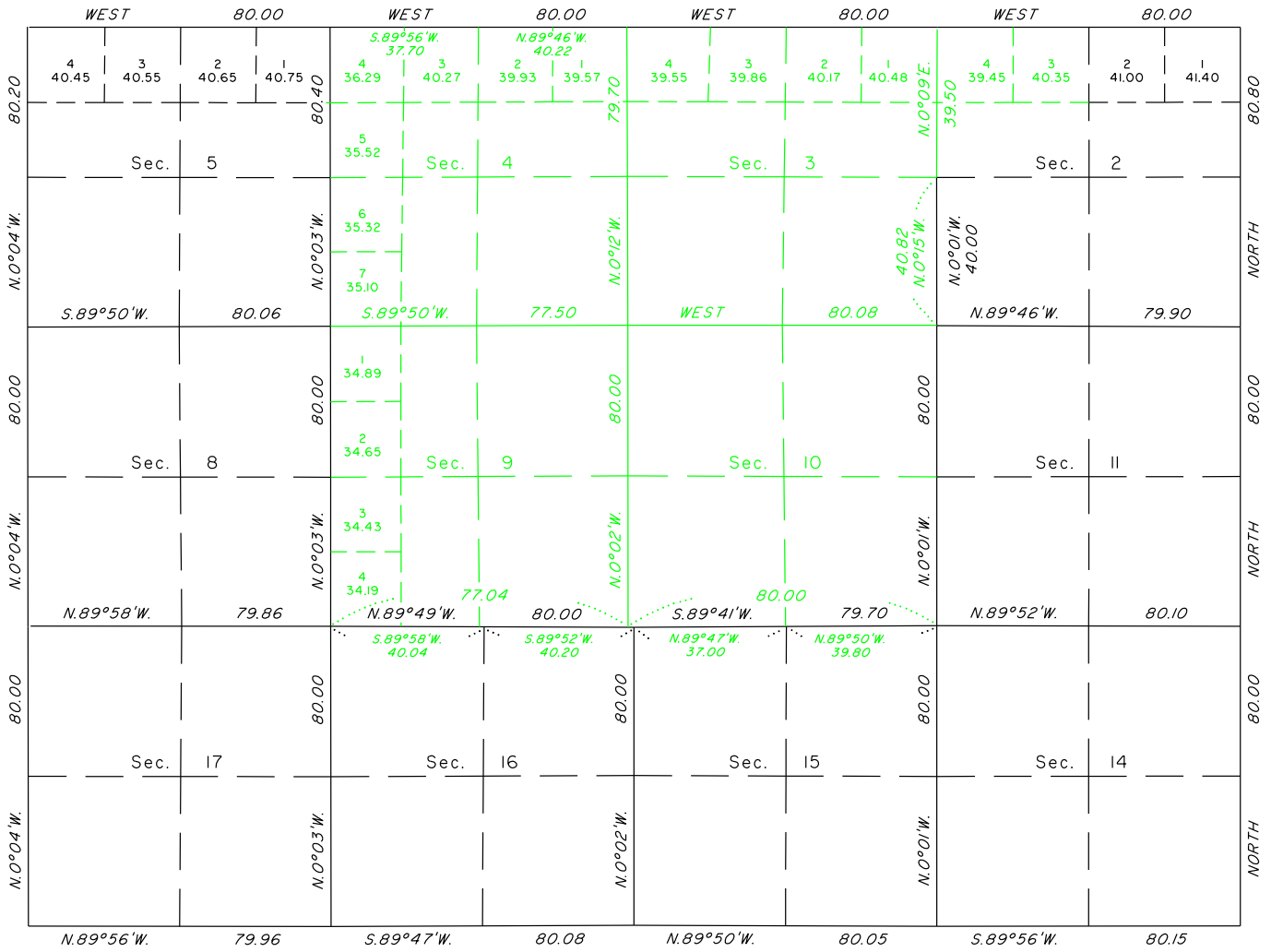
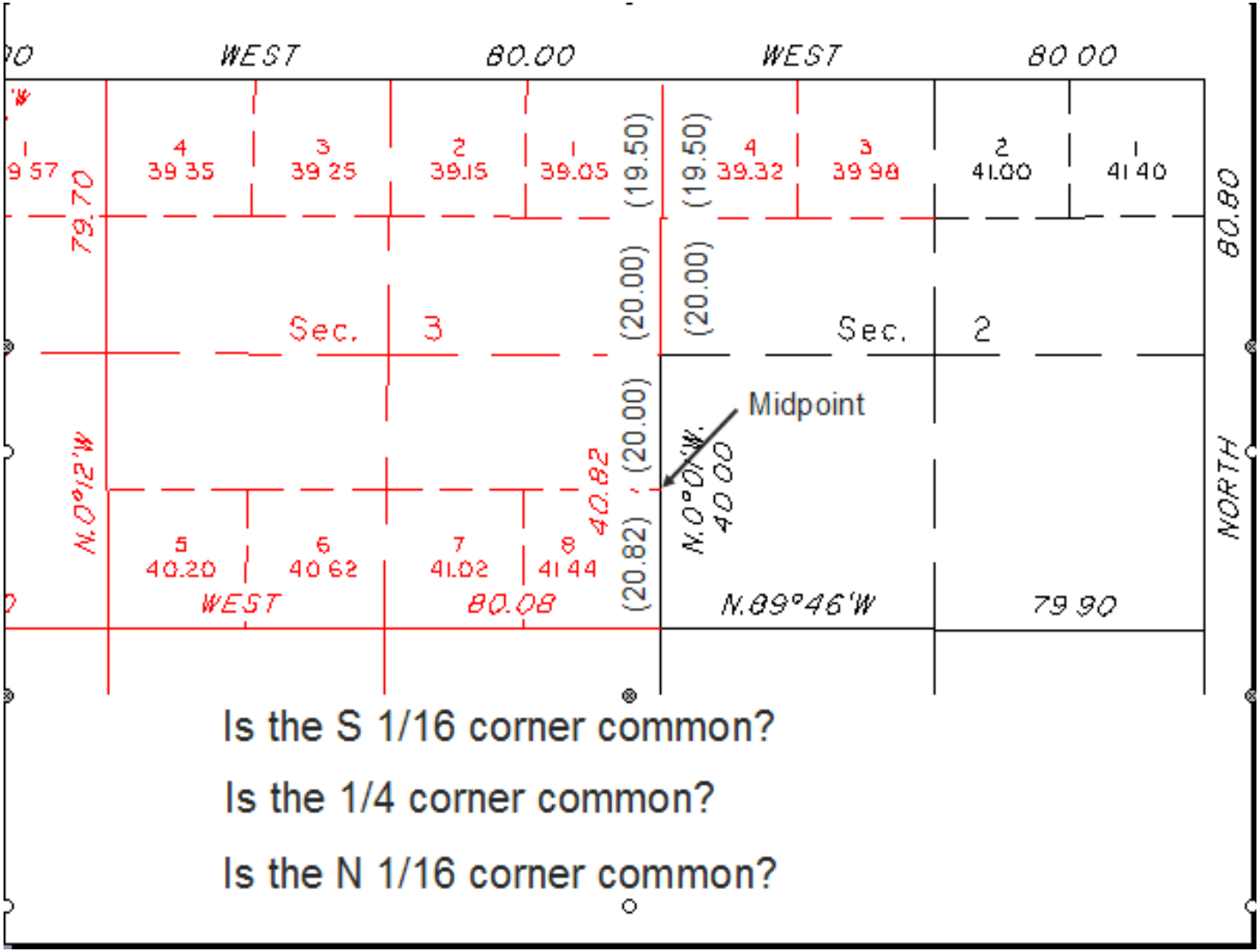
70.89
S. 87° 01' W.
71.09
Sec. 22
Sec. 23
N. 40° 39' E.
N. 2° 58' W.
77.58
S. 88° 59' W.
81.48



PROBLEM #1 DIAGRAM A



PROBLEM #1 DIAGRAM B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WEST
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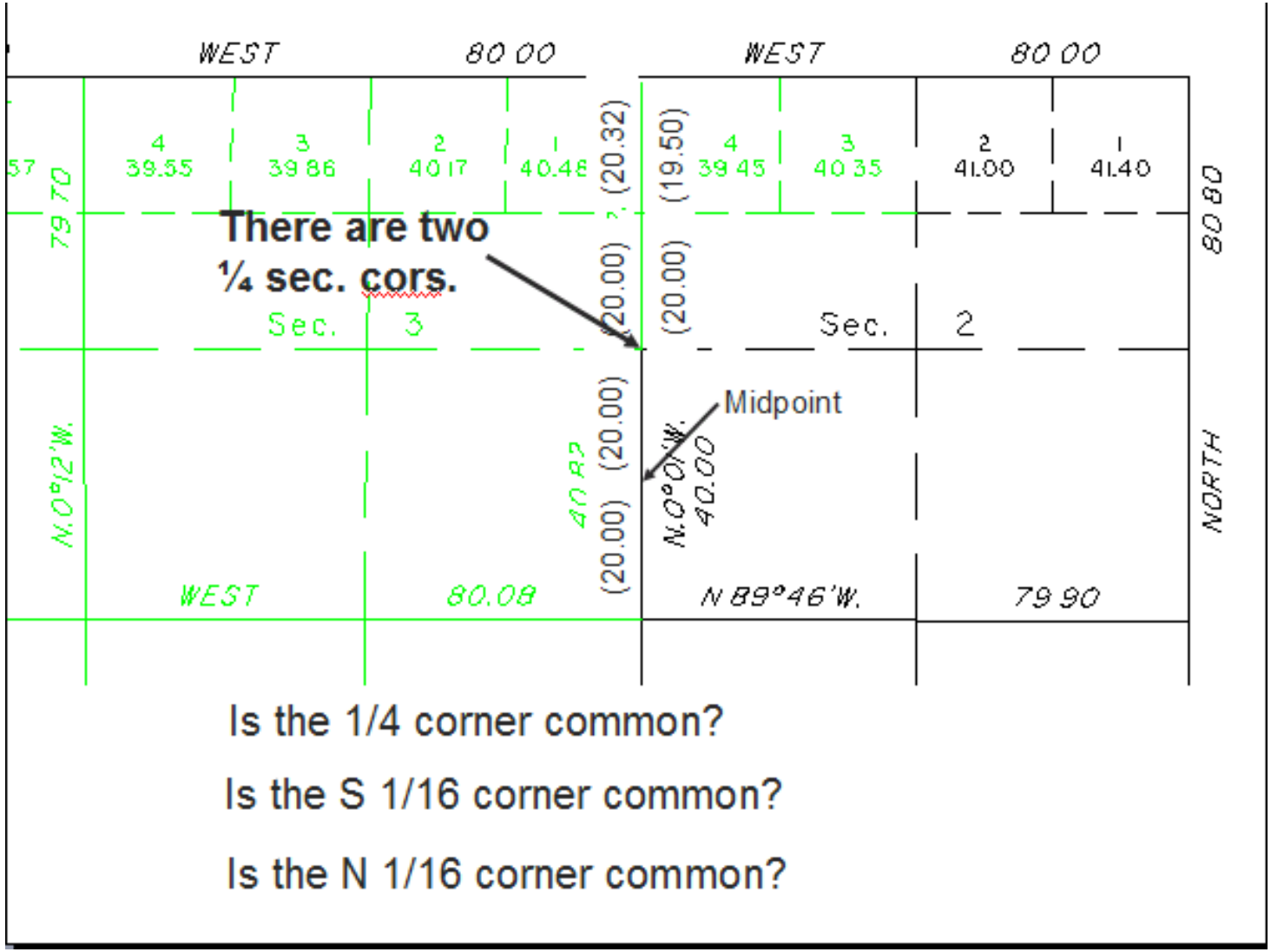
4
39 35
3
39 25
2
39.15
1
39.05
(19.50)
(19.50)
4
39.32
3
39 98
2
41.00
1
41 40
80.80
79.70
(20.00)
(20.00)
Sec. 3
Sec. 2
Midpoint
N.0°12'W.
(20.00)
40.82
N.0°01'W.
40 00
5
40.20
6
40 62
7
41.02
8
41 44
(20.82)
WEST
80.08
N.89°46'W
79 90
NORTH
Is the S 1/16 corner common?
Is the 1/4 corner common?
Is the N 1/16 corner common?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WEST
80 00
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3
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2
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1
40.48
(20.32)
(19.50)
4
39 45
3
40 35
2
41.00
1
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79 70
There are two
¼ sec. cors.
(20.00)
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Sec.
3
Sec.
2
Midpoint
N.0°12'W.
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WEST
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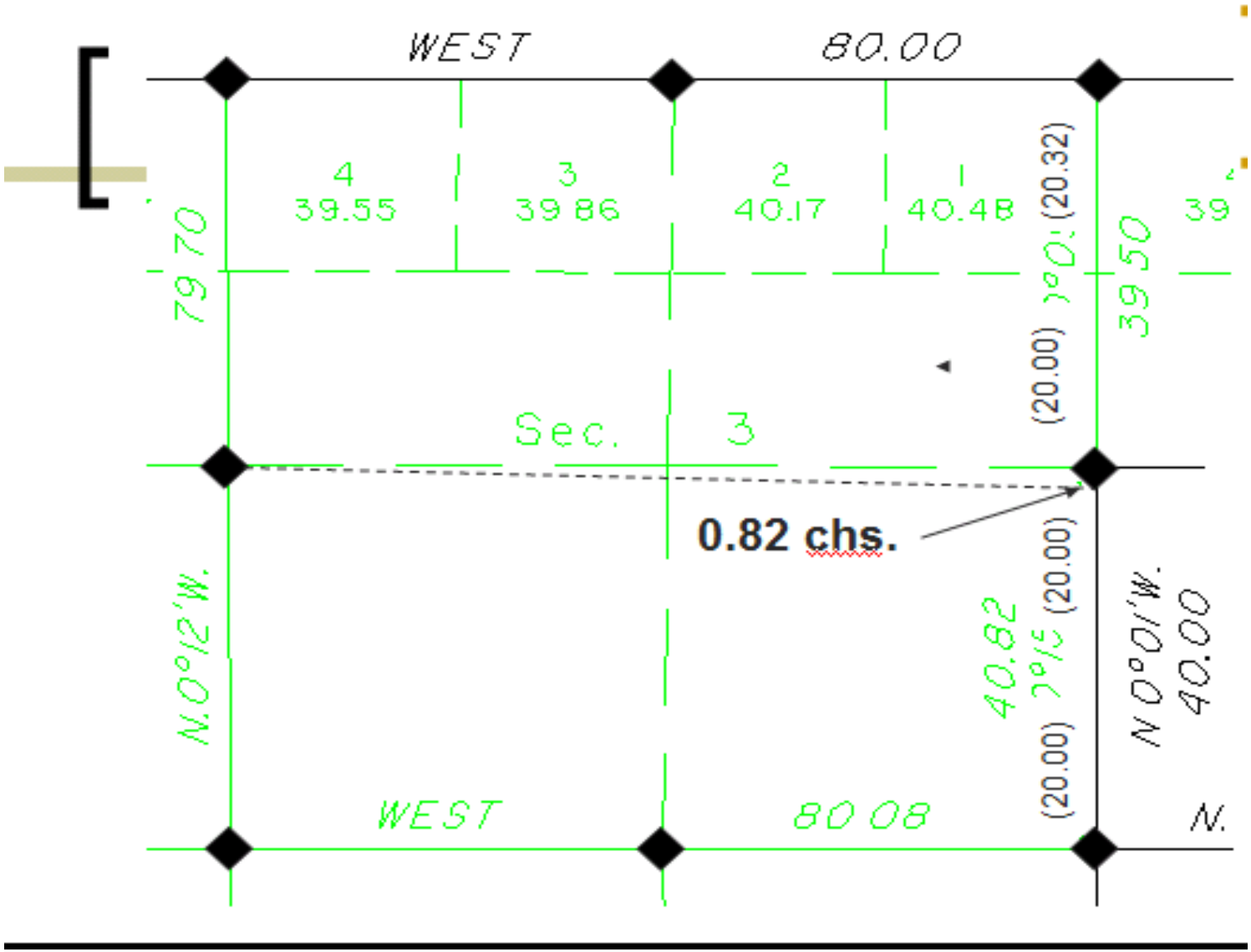
79 90
80 00
NORTH
Is the 1/4 corner common?
Is the S 1/16 corner common?
Is the N 1/16 corner common?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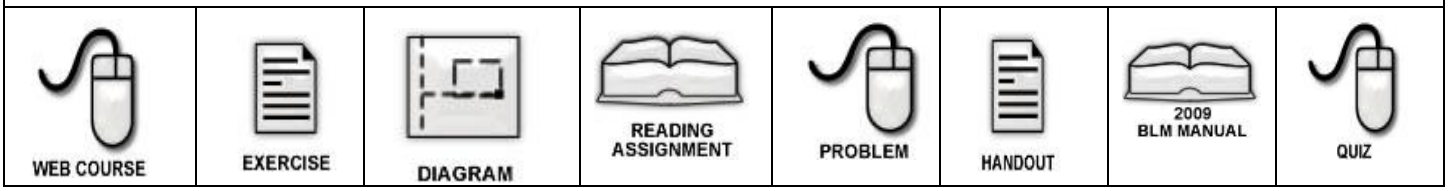
Course 6: Subdivision of Sections Study Guide

COURSE DESCRIPTION:	This course focuses on the subdivision of sections. It addresses subdivision of normal sections, lotted closing sections, elongated and fractional sections, as well as the unique method known as the "three mile method" on many Indian Reservations and some private lands.
COURSE OBJECTIVES:	Upon completion of this course, students will be able to: • Learn to properly subdivide regular sections • Identify exceptions to section subdivision rules • Demonstrate an understanding of area relationships on GLO/BLM plats • Identify and deal with fractional sections
COURSE INSTRUCTOR(S):	Ron Scherler, Bureau of Land Management Dennis Mouland, Bureau of Land Management
VIDEO LECTURE TITLE:	Fractional Sections – Part 1 (20 minutes)

ICON LEGEND



FRACTIONAL SECTIONS – PART 1

Introduction

Hello again and welcome to our final segment in subdivision of sections. This segment is going to cover subdivision of fractional sections.

Now we've already covered regular sections, subdivisions against the north boundary, and those special sections where we have to modify our method because there's some kind of lotting or other area relationships that requires a modified method. Now we're going to look at fractional sections.

SUBDIVISION OF

FRACTIONAL

SECTIONS

First of all, I want you to know that there are two types of fractional sections. And we're going to discuss that briefly but we're going to focus on one kind.

Second, we want to determine when a section should be subdivided in accordance with section 3-88 of the Manual. And that's not always as easy as it might seem.

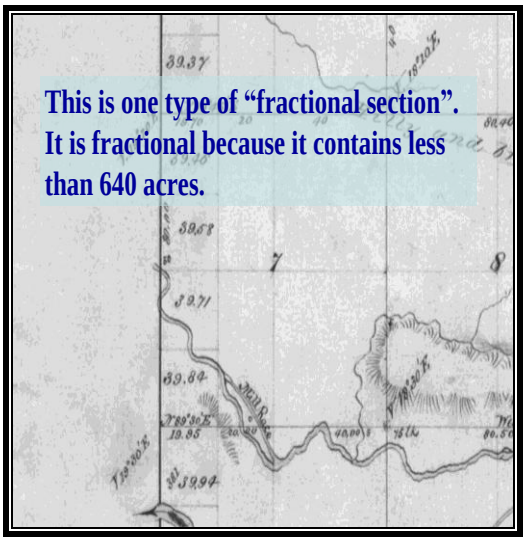
And then third, we're going to discuss how the principles in section 3-88 should be applied. And so let's start with the two types of fractional sections.

- Identify the two types of fractional sections.
- Determine when a section should be Subdivided in accordance with Section 3-120 of the Manual
- Discuss how the principles in Section 3-120 should be applied

FRACTIONAL SECTIONS – PART 1

This is one type of fractional section. It's fractional because there are less than 640 acres. The entire section is there. It's against the boundary.

The deficiency is placed against the boundary. And this is the kind of section that we looked at earlier when we talked about subdividing sections against the boundary. This is not the type of section that's talked about in section 3-88.



Fractional Section as Defined By Sec. 3-120 of the Manual

This type of section, a section that's invaded by water, a reservation, a land grant, maybe several large mineral claims, something has invaded that section and therefore a portion of it is not surveyed.

That's the kind of section we're talking about when we talk about fractional sections in section 3-120 of the Manual. And that is the type of section that needs a specific and special method for subdividing. And we're going to look at that section in the Manual so we can determine when should that special method be used and we're going to talk about what that special method is.

So, let's look at what the law says. In 1805, and this is one of those sections that you've read in your assignment, but I just want to go back and look at it again.

Act of Feb. 11, 1805

but in those portions of the fractional townships, where no such opposite corresponding corners have been or can be fixed, the said boundary lines shall be ascertained, by running from the established corners, due north, south, east or west …

FRACTIONAL SECTIONS – PART 1

And here's what the law says. "But in those portions of the fractional township (notice it's not talking about sections here it's talking about townships) where no such opposite corresponding corners have been or can be fixed, the said boundary line shall be ascertained by running from the established corners due north, south, east, or west."

Act of Feb. 11, 1805

but in those portions of the fractional townships, where no such opposite corresponding corners have been or can be fixed, the said boundary lines shall be ascertained, by running from the established corners, due north, south, east or west …

1805, well what was happening here? In 1805 remember we were only surveying every other section line within a township. We were only establishing every other section corner. So once those patents were issued, we needed a method to establish the section corners that had not been established in the original survey. This was the method that congress outlined for establishing those section corners.

Basically, at intersection, but in 1820, they went on to modify that and by 1820 they were patenting land, the federal government was patenting land, in pieces as small as 80 acres so we had to subdivide sections.

So here congress said "and the contents of half-quarter sections (that's 80 acres), which may thereafter be sold, shall be ascertained in the manner and on the principles directed and prescribed by the second section of an act entitled and dated February 18, 1805.

Act of April 24, 1820

and contents of half quarter sections which may thereafter be sold, shall be ascertained in the manner, and on the principles directed and prescribed by the second section of an act entitled "… dated February 18, 1805…"

So what congress did, when they needed to subdivide a section, when they got to that point, they looked back to that previous law that said we're going to establish those section corners that had not been established at intersection and they said ok we're also going to establish the subdivision of section corners that same way.

FRACTIONAL SECTIONS – PART 1

So where there has not been an opposite corresponding section corner established we were going to run north, south, east, or west. Here it's saying when the opposite corresponding quarter corner has not been established we're going to use that same method. So, north, south, east, or west.

There's two things I want you to look at in this 1805 law.

- First of all, it said where the opposite corresponding corner has not been or cannot be fixed. What does fixed mean? We'll talk about that in a minute.
- The second part I want you to look at is it says we're going to establish these by running north due north, south, east, or west. Let's look at that a little bit and see how that's been modified.

Act of Feb. 11, 1805

but in those portions of the fractional townships, where no such opposite corresponding corners have been or can be fixed, the said boundary lines shall be ascertained, by running from the established corners, due north, south, east or west …

First of all, fixed. What do we mean when we say fixed? I got this out of the dictionary. Went and looked in the dictionary, what does it say?

Fixed means fastened, attached, or placed so as to be firm and not readily movable. Firmly implanted, stationary, rigid. Definitely and permanently placed. Definite, not fluctuating or varying.

Fixed:
1) fastened, attached, or placed so as to be firm and not readily movable; firmly implanted; stationary; rigid.

4) definitely and permanently placed.

5) definite; not fluctuating or varying

Now the law didn't say where the opposite corresponding corner has not been or cannot be monumented. It said where it has not been or cannot be fixed. So what are they getting at here?

Well, we'll talk about that in a little bit as we work through this process. And I think we will come up with some principles that may help guide you through that.

FRACTIONAL SECTIONS – PART 1

Principles for Determining When a Section is Fractional According to Sec. 3-120 of the Manual

Here's one of those principles. And this is not found in the Manual. This is a principle that one of the offices I worked in used to help define when a section was fractional and when it wasn't. I think it helps a lot. I think it works very well.

First of all, we're going to look at a section as being fractional and subdivided according to the Manual section 3-120 when an exterior section corner or quarter corner or quarter section corner has not been originally established and/or has major portions of the section boundary not surveyed.

Let me read that again. An exterior section corner or one quarter section corner that was not originally established and/or has major portions of the section boundaries not surveyed. That's one situation. Here's the next.

Guidelines

1) an exterior section corner or ¼ section corner that was not originally established.

and/or

has major portions of the section boundaries not surveyed.

And, some or all of the subdivision of section lines protracted on the original plat will terminate at the meander line or other boundary.

So, we're saying there are a couple corners not set, either a quarter corner or a section corner or both, maybe more. And major portions of some of the boundaries in the sections have not been surveyed, and some or all of the subdivision of section lines terminate at a meander line reservation boundary, something.

They do not terminate at the section boundary. And, the total distance for the mile will not be returned. In other words, these lines that are going to terminate on a meander line or reservation boundary, they're going to stop there and there's not going to be a dashed line or something off across the reservation line or out into the water to a point. They stop at that boundary that they're intersecting.

and

2) some or all of the subdivision of section lines protracted on the original plat will terminate at the meander line or other boundary.

and

The total distance for the mile will not be returned.

Just a couple guidelines that can maybe help us get some

FRACTIONAL SECTIONS – PART 1

consistency I think to our decisions. Next, north, south, east, or west and remember the law said due north, south, east, or west. Well, later that was modified.

A letter dated July 26, 1869, and this comes from the History of Rectangular Survey System by Al White, in his research he uncovered this letter. 1869 was the first founder in this period that introduced the concept of mean bearing over due north, south, east, or west wording in the law.

So, as far back as 1869, at least, the General Land Office began to realize that due north, south, east, or west didn't always work well. It didn't always accomplish the goal, which was to equitably subdivide the section. So they began to modify that by saying well we might want to run mean bearing in these cases instead of north, south, east, or west. And we'll look at that a little more.

North, South, East or West

A letter dated July 26, 1869 was the first found during this period that introduced the concept of mean bearing over the due north, south, east, and west wording of the law.

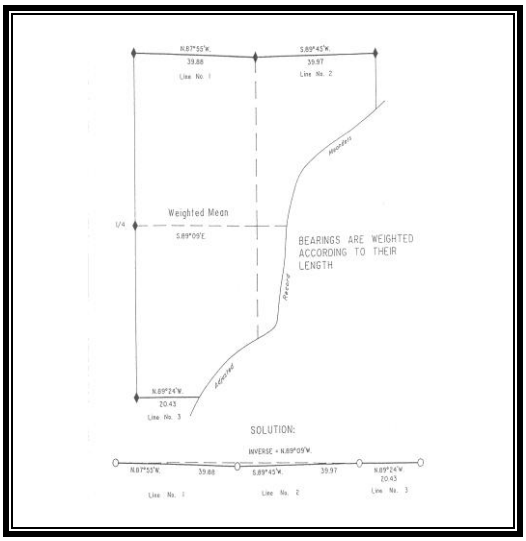
How to Determine Mean Bearing

So, what do we mean by mean bearing? Well, there are several ways to get a mean bearing. First of all, there is an arithmetic mean. We have chosen in BLM, and we've been doing this for quite sometime, to use what we call a weighted mean or has been referred to often as a weighted mean.

And this is the method that we use and this is the method you should use when subdividing sections and calculating a mean. And it's actually pretty simple. Let me show you.

FRACTIONAL SECTIONS – PART 1

On this diagram, you'll notice the north boundary is a broken boundary and it's all there though. And then we have a portion of the south boundary.

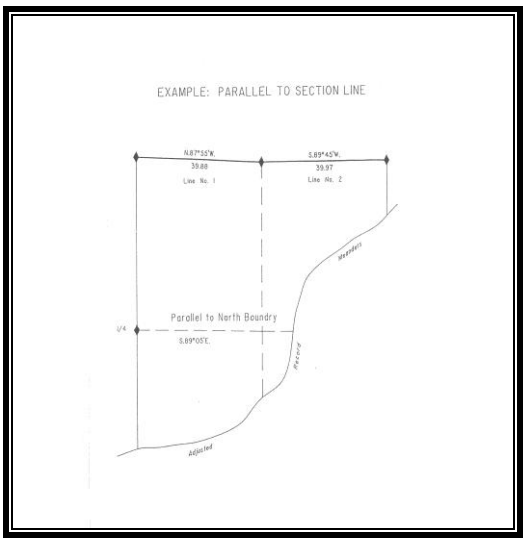


To compute the weighted mean for the east-west center line, we simply take the bearing and distance for the west half of the north boundary (we showed it as line 1), the bearing and distance for the east half of the north boundary (we showed as line 2), and the bearing and distance for the south boundary (line 3).

There are three segments here. And right down here at the bottom of the page, you can see we just put those end to end like a traverse. Just put them together as a traverse. Calculate that across and inverse back from the end points. When you inverse back from the end points, that gives you the weighted mean.

What it basically does is it lets the length of each portion control the bearing change in relation to its length. So it's a good method. It works very well in all situations, even when one boundary is very, very short, one boundary is long, when both boundaries are about the same distance, it works very well in all situations. And this is the method that we should be using when we want to compute a mean.

Now, another situation we are going to run into is situations where there is no opposite boundary. We don't have two boundaries. There's nothing to mean against.



Well, as we're going to see, the process we need to use there is parallel (with the existing boundary). So here if we want to survey the east-west center line of this section and we have a full north boundary but no south boundary, then we want to survey parallel with the north boundary. Well, how do we decide parallel because when you look at this north boundary again, we have bearings that are not the same? It's not a straight line.

Very similar to what we did on the weighted mean bearing. We basically put the lines end to end and inverse back. It's an inverse. And you'll notice down here this bearing shown on this plat is an inverse between those two section corners of the entire boundary. That's how we're going to come up with the bearing for our parallel line.

FRACTIONAL SECTIONS – PART 1

As we get into some examples, you're going to see where that's not always quite as straightforward and simple as it appears here. But those are the two basic methods we're going to use to determine center lines. Either a weighted mean bearing, any time that the Manual says mean bearing we're talking weighted mean bearing, or a parallel line. Let's move on. Let's look at what the Manual says.

Subdividing a Fractional Section

The law provides that where opposite corresponding quarter-section corners (notice that it says they're corresponding, it doesn't just say they're opposite) have not been or cannot be fixed (there we're using that same word 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 boundary, or other boundary of such fractional section as represented upon the official plat.

Sec. 3-120. 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 corner north, south, east or west as the case may be , to the water course, reservation boundary, or other boundary of such fractional section as represented upon the official plat.

It goes on to say, now we get another paragraph that clarifies that north, south, east, or west section, and it says "In this, the law presumes that the section lines are due north and south or east and west, but usually this is not the case hence in order to carry out the spirit of the law (that's what we want to do), it will be necessary in running the center lines through fractional sections to adopt mean courses where the sections 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 corner."

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.

So the Manual tells us ok here's what the law said then here's the way that we interpret that law because we're trying to meet the spirit of that law and it gives us the guidelines of mean bearing or parallel depending on the situation that we have.

And this is in keeping with that letter from 1869. So we've come 150 years almost now of being pretty consistent on how we approach and interpret that portion of the law.

FRACTIONAL SECTIONS – PART 1

Subdivision of Fractional Quarter Sections

Now, there's one other portion in the law or in the Manual that speaks about fractional sections and it tells us how to subdivide quarters. The quarter of a section if it's fractional.

And it says, 3-124, the subdivisional lines of fractional quarter-sections will be run from properly established quarter corners or 16th 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.

> Sec. 3-124 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.

You notice that it doesn't say that we're going to run mean bearings. It doesn't say that we're going to run parallel lines. It just says with courses governed by the plat. And I think the reason is that when we get into fractional sections, it's just not as clear-cut how they should be subdivided. Any kind of distortion can cause a problem.

One of the common errors in the original surveys is the triangulation across water boundaries so sometimes there are some significant errors where the water is crossed and because of that it can have some drastic affects on how the section should be subdivided.

Often sections of this type are kind of in two part portions and maybe one side needs to be subdivided differently than the other side. So the Manual's giving us a little bit of leeway. It said look, fractional sections are a little tougher to subdivide.

There's a little more judgment involved. You have to gather a lot of information and you have to use some good judgment. You have to interpret the spirit of the law to come up with the method for subdividing a fractional section.

FRACTIONAL SECTIONS – PART 1

Fractional Section Exercise

Now, here's what we want you to do now. We have an exercise for you and we want you to download that exercise.

EXERCISE **Before moving on to the next topic, complete the Fractional Section exercise which is located at the end of the study guide.**

There are 16 sections. In each of these sections, they're real sections, what you're going to see is the original plat for each of these 16 sections. I want you to look and study each of those sections and determine if that section should be subdivided by the method defined in section 3-120 and 3-124 in the Manual. Is it fractional as defined by section 3-120 and section 3-124 in the Manual? Is it regular? Is it just going to be subdivided normally as the previous session talked about?

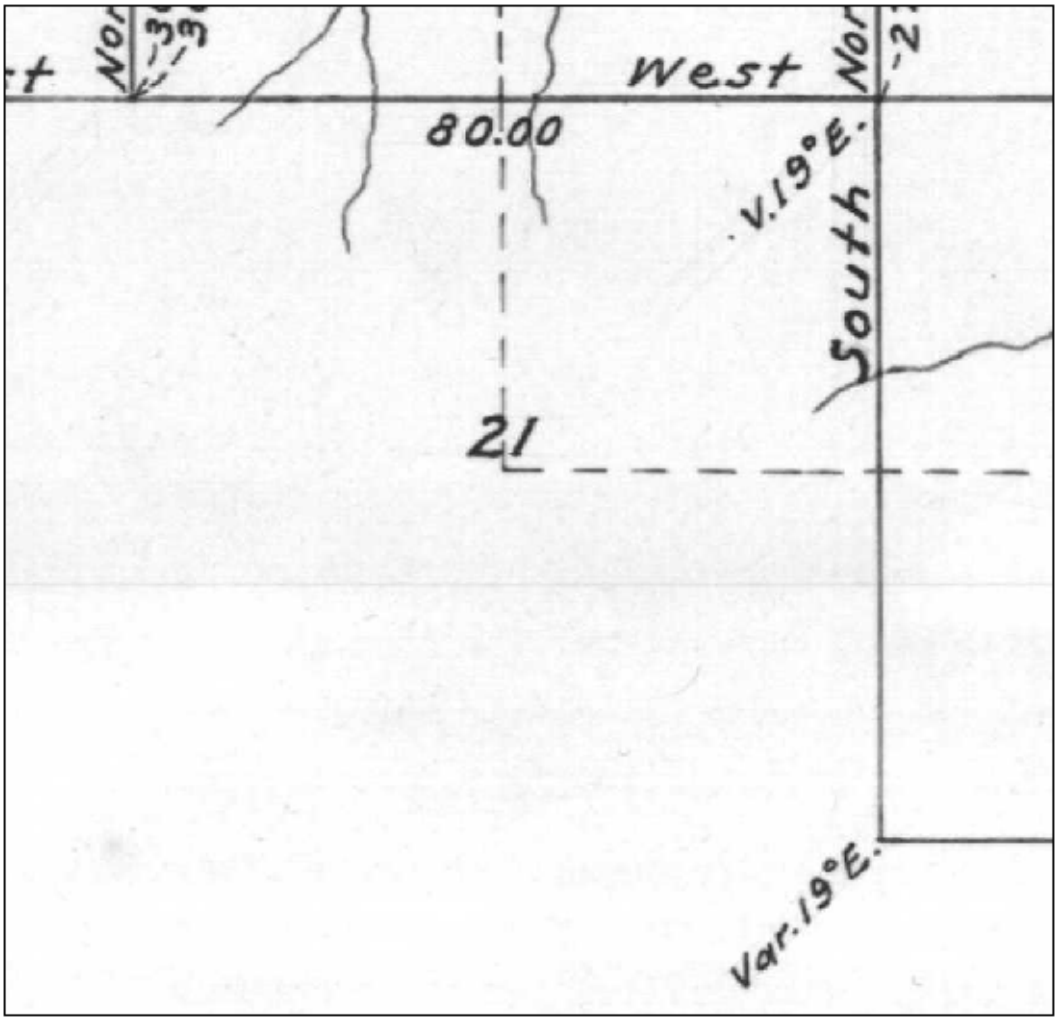
So I want you to download those. I want you to look at each one of those. Just put an R in the upper corner if you think it's regular, put an F if you think it's fractional. And I'll just give you a couple hints. There may be places where you need to calculate some parenthetical or protracted distances before you can decide if it's a fractional section or not. There may be some that look very simple. There may be some that look pretty confusing. I've used these same 16 sections in classroom situations in the past and there's about 3 of them that we generally have agreement on.

The rest, it's often about a 50/50 split. And that's troubling because what that tells us is half of the surveyors out there are going to subdivide this section in one manner and half of the surveyors are going to subdivide it in another manner. That's troubling. So what we hope to do here is give you some principles, work through these, and maybe get a little closer where we have a more consistent approach to determining when we should subdivide these as a fractional section. So do that, download those, and when you come back, Dennis Mouland is going to join me and we are going to discuss those sections and how they should be subdivided. So we'll see you back in a little while.

EXERCISE

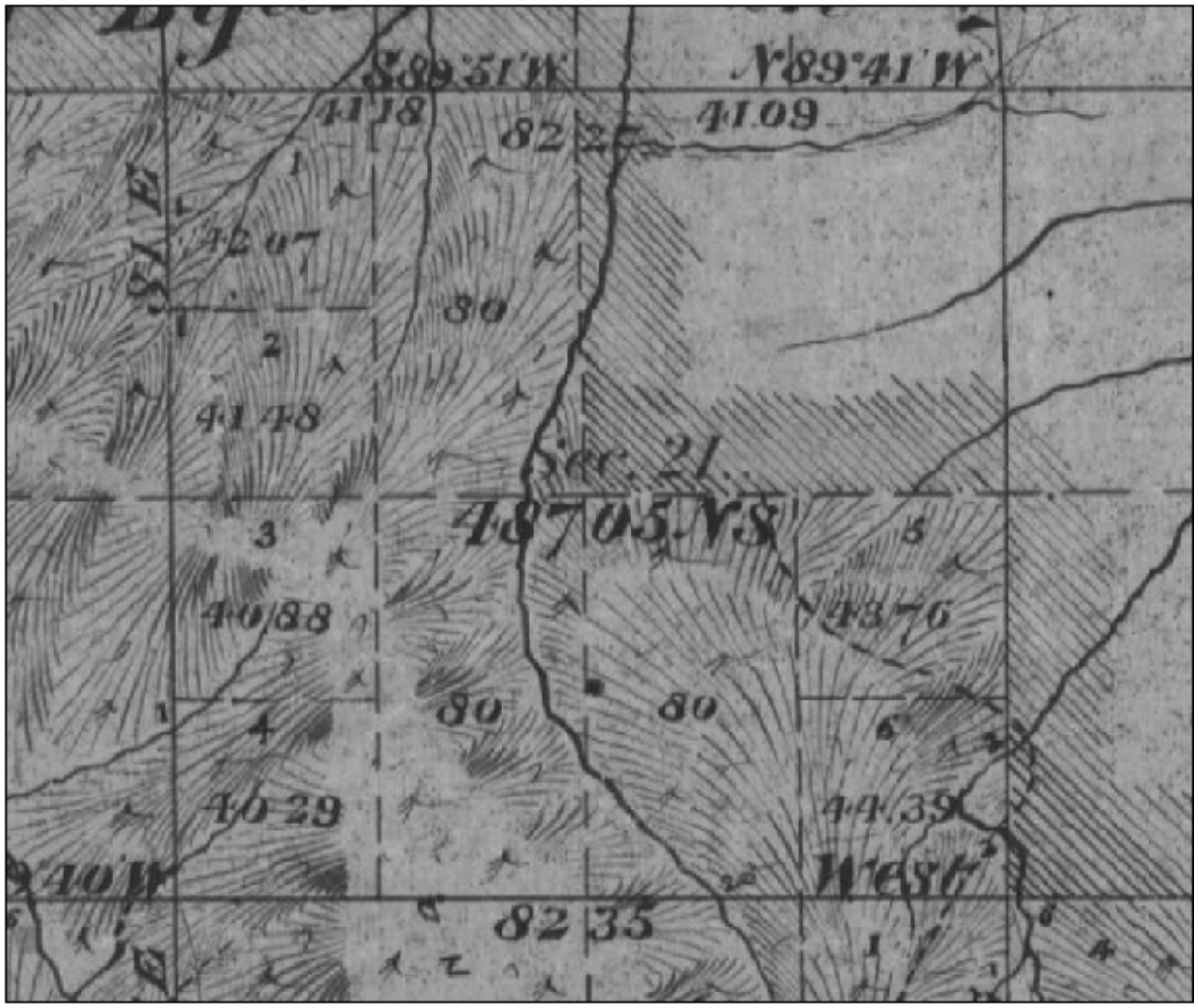
Problem #1

Regular ☐ **Fractional ☐**



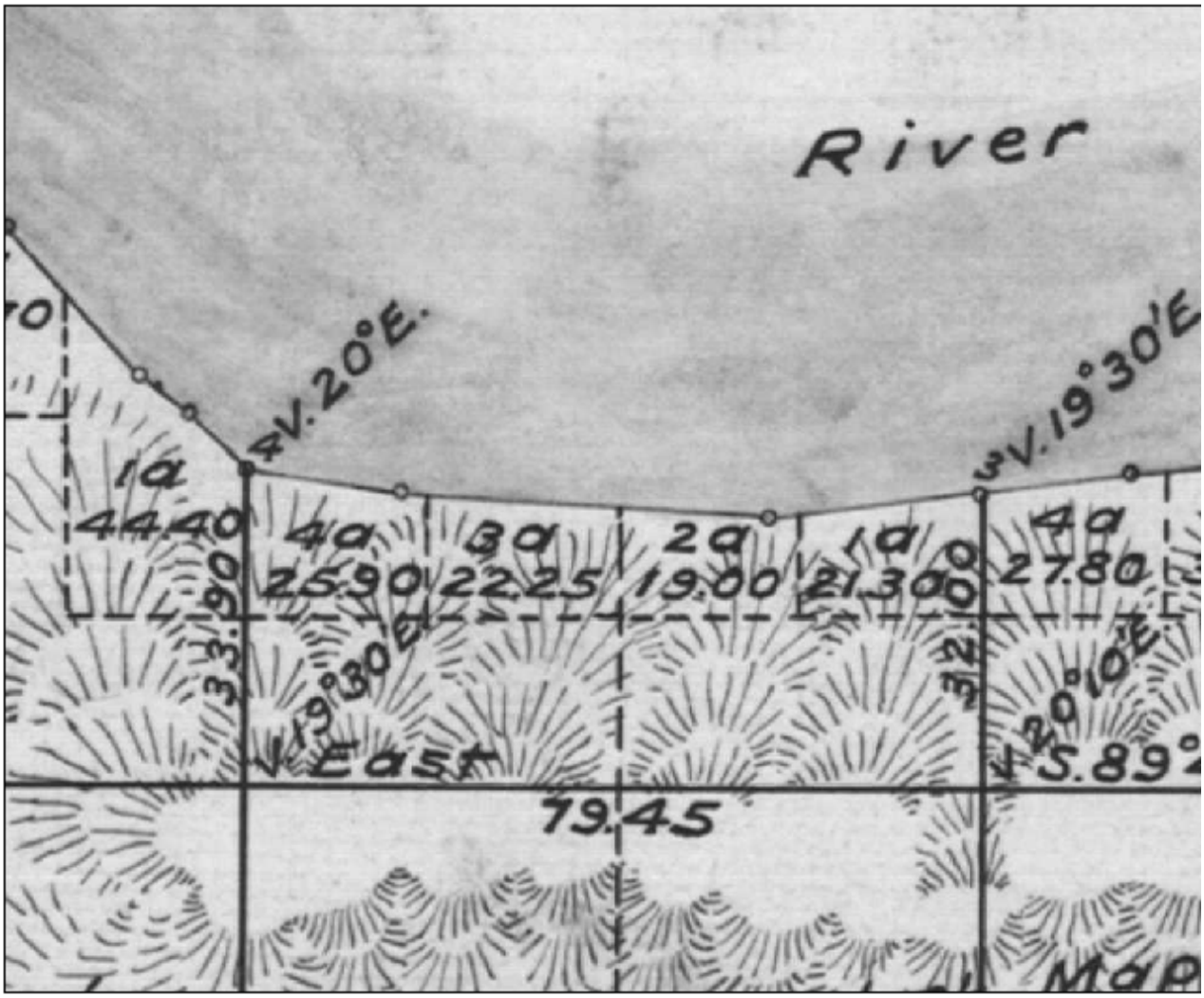
Problem #2
(same section as previous problem)

Regular ☐ **Fractional ☐**



Problem #3

Regular ☐ **Fractional ☐**

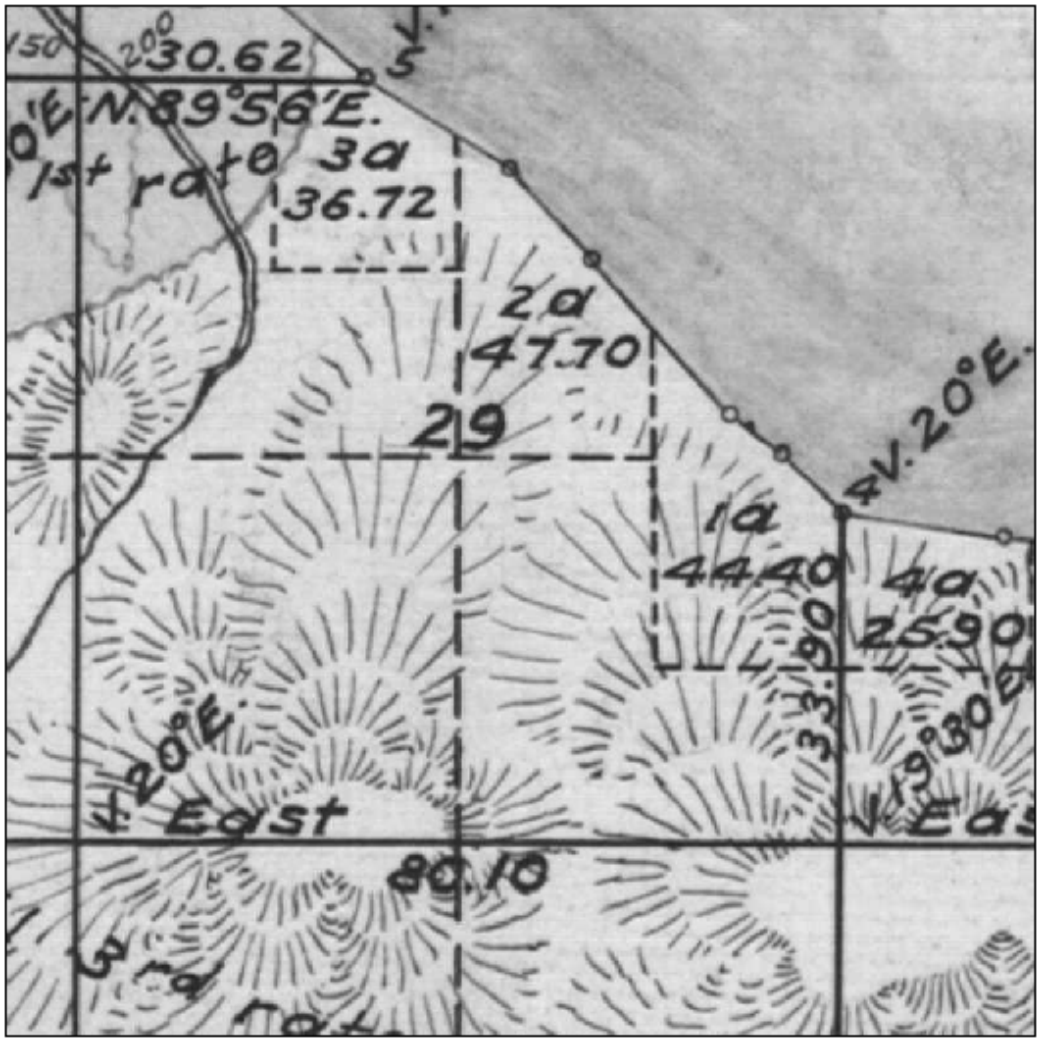


Problem #4

Regular ☐ **Fractional ☐**

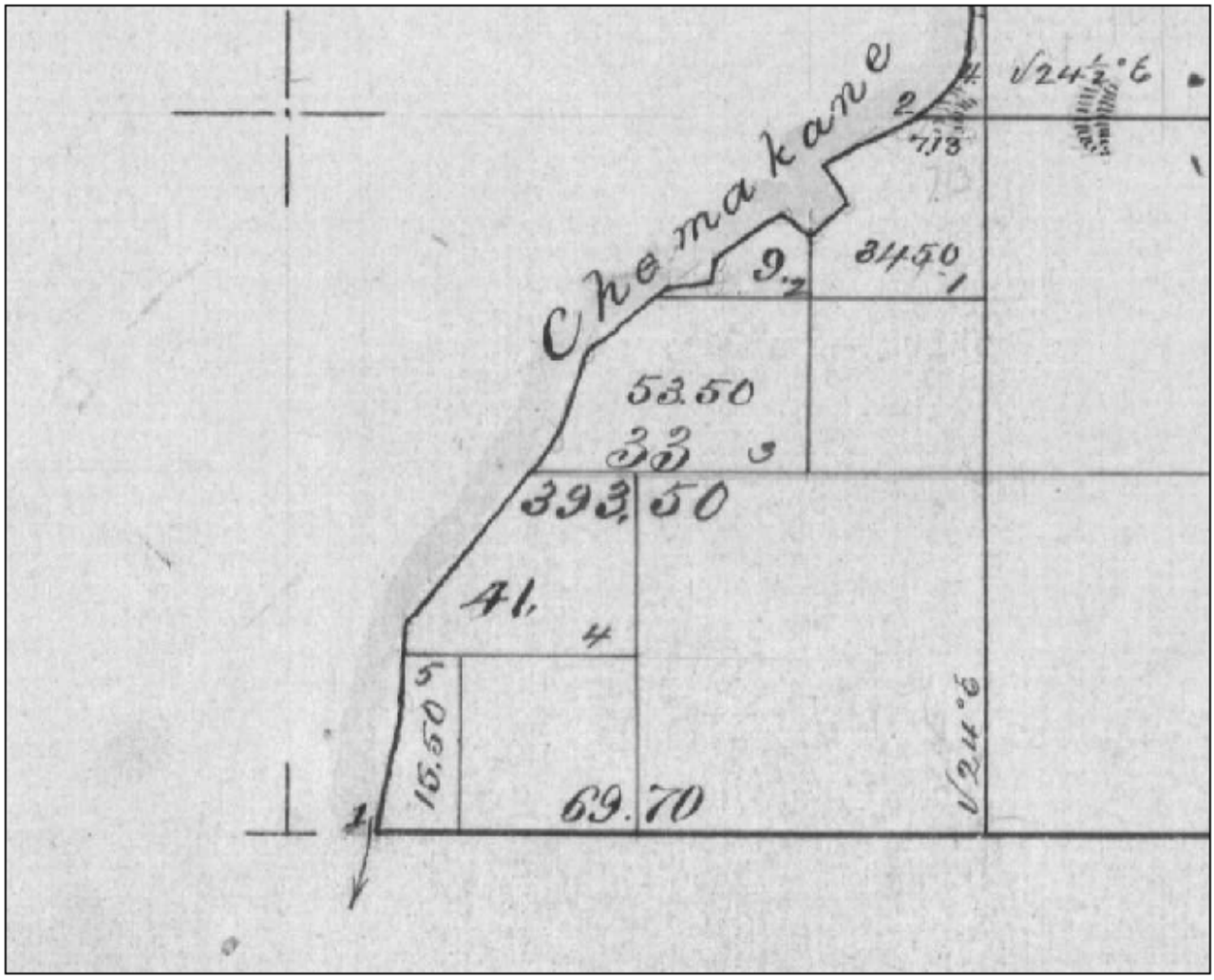
Problem #5

Regular ☐ **Fractional ☐**



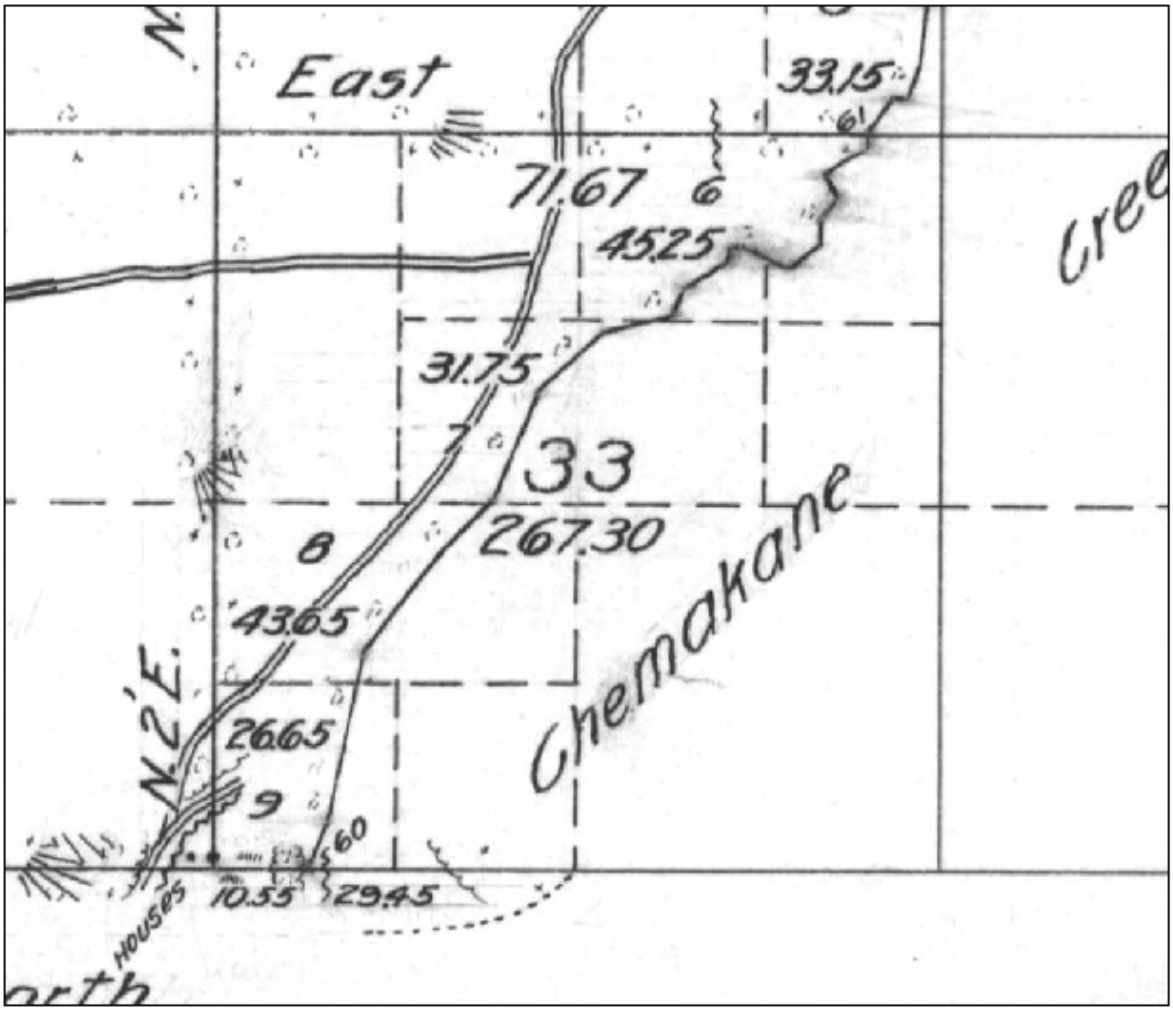
Problem #6

Regular ☐ **Fractional ☐**



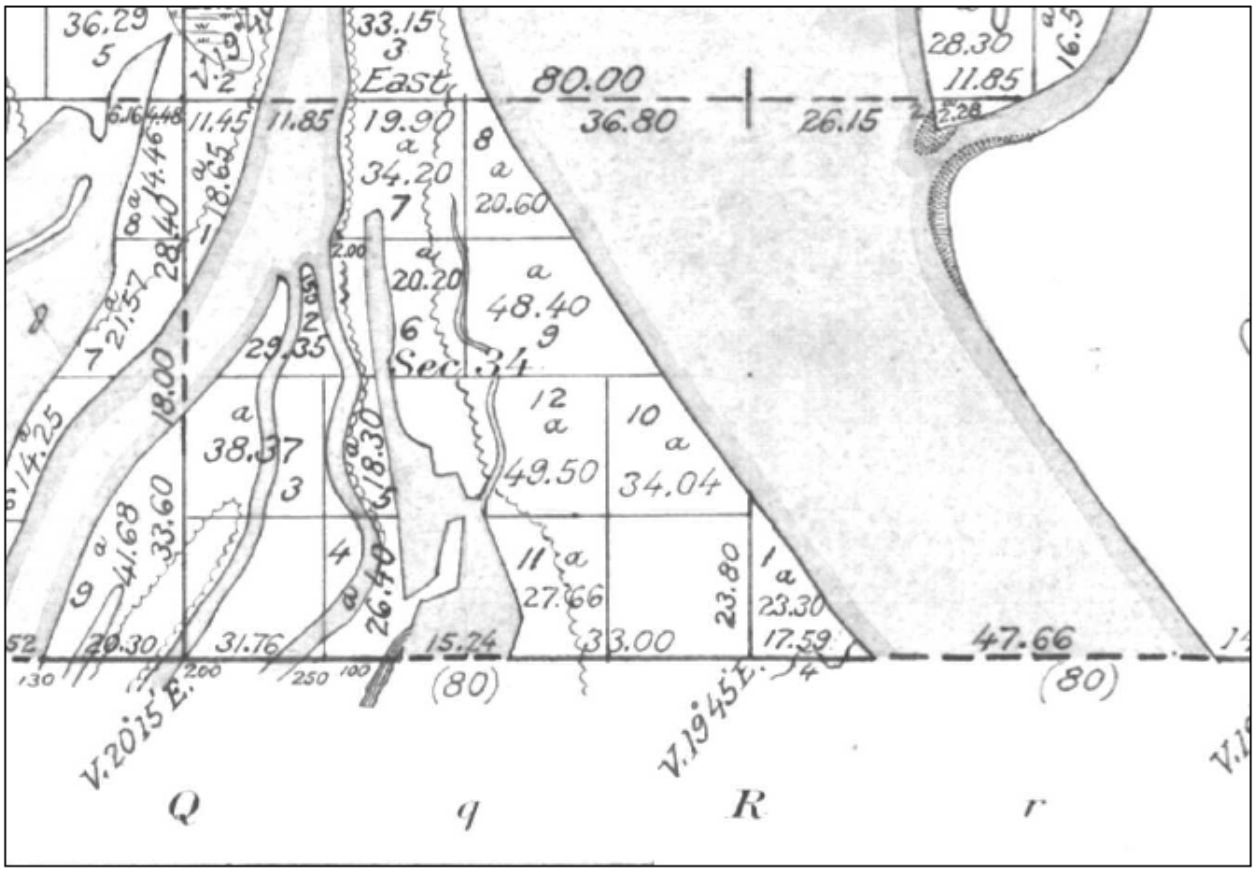
Problem #7
(same section as previous problem)

Regular ☐ **Fractional ☐**



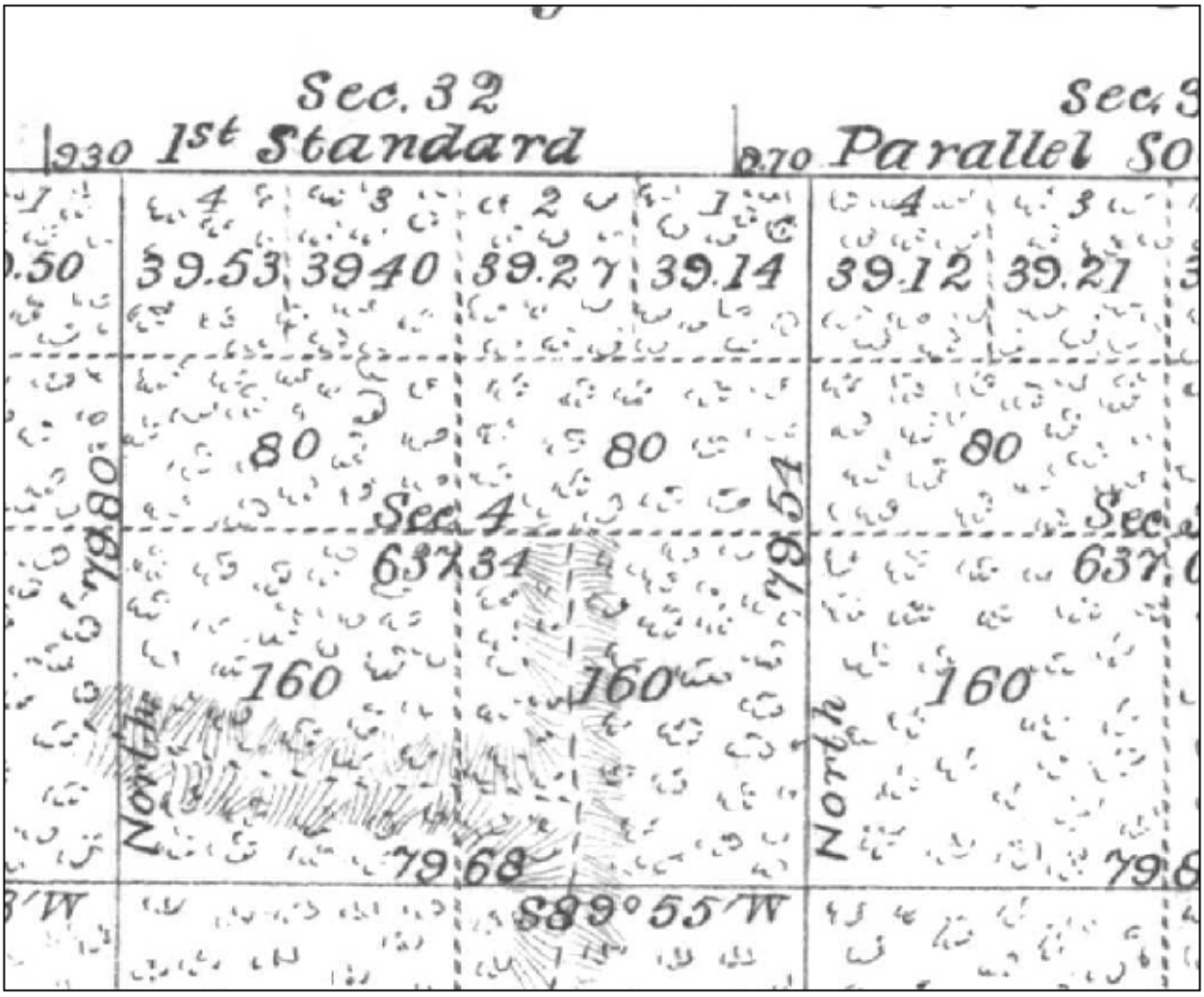
Problem #8

Regular ☐ **Fractional ☐**



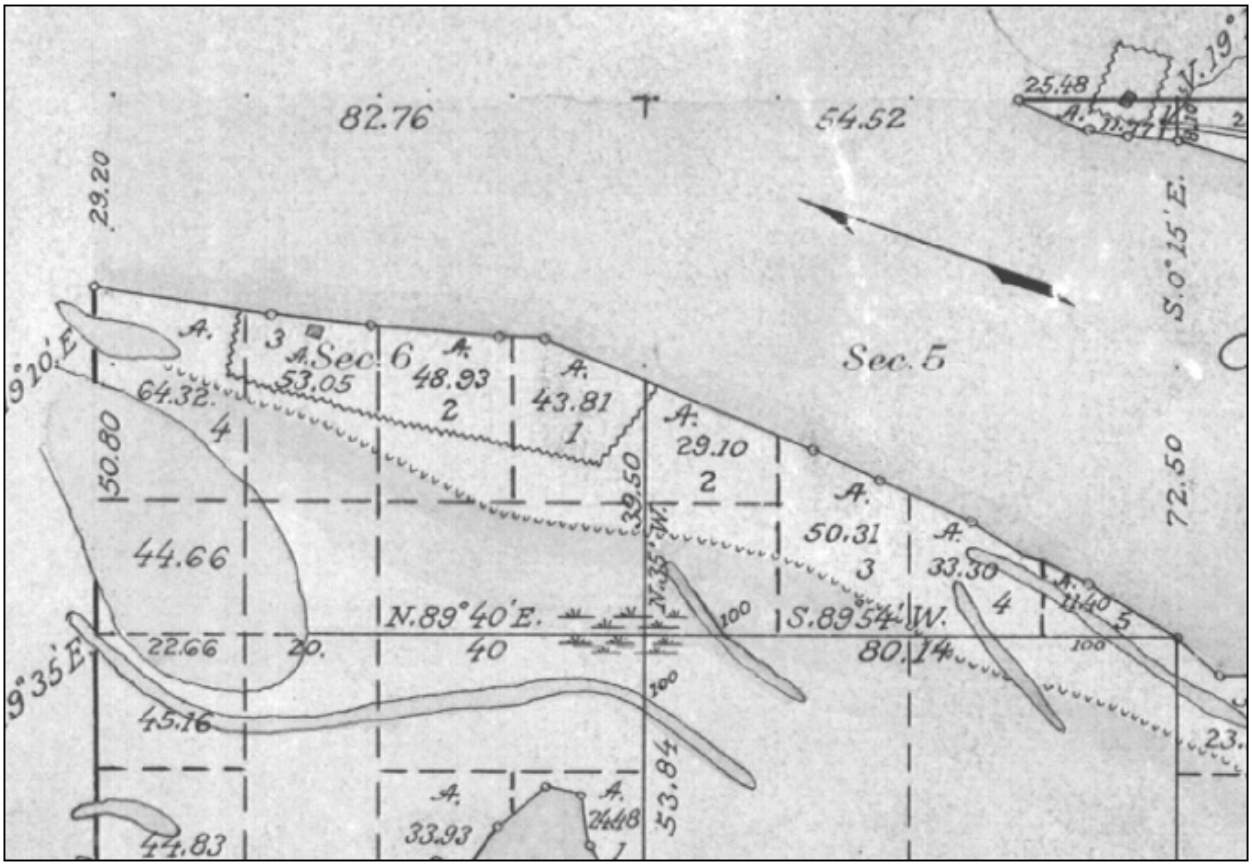
Problem #9

Regular ☐ **Fractional ☐**



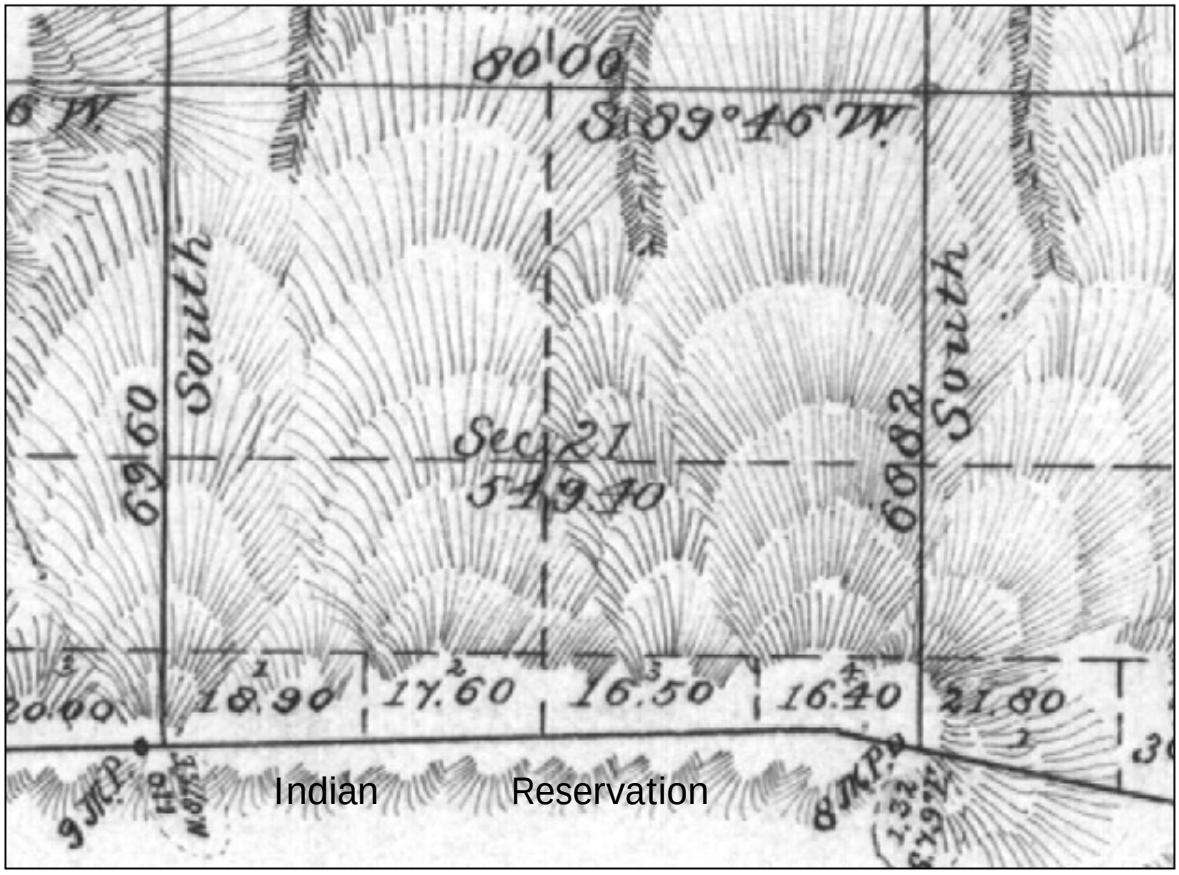
Problem #10
(Section 6)

Regular ☐ **Fractional ☐**



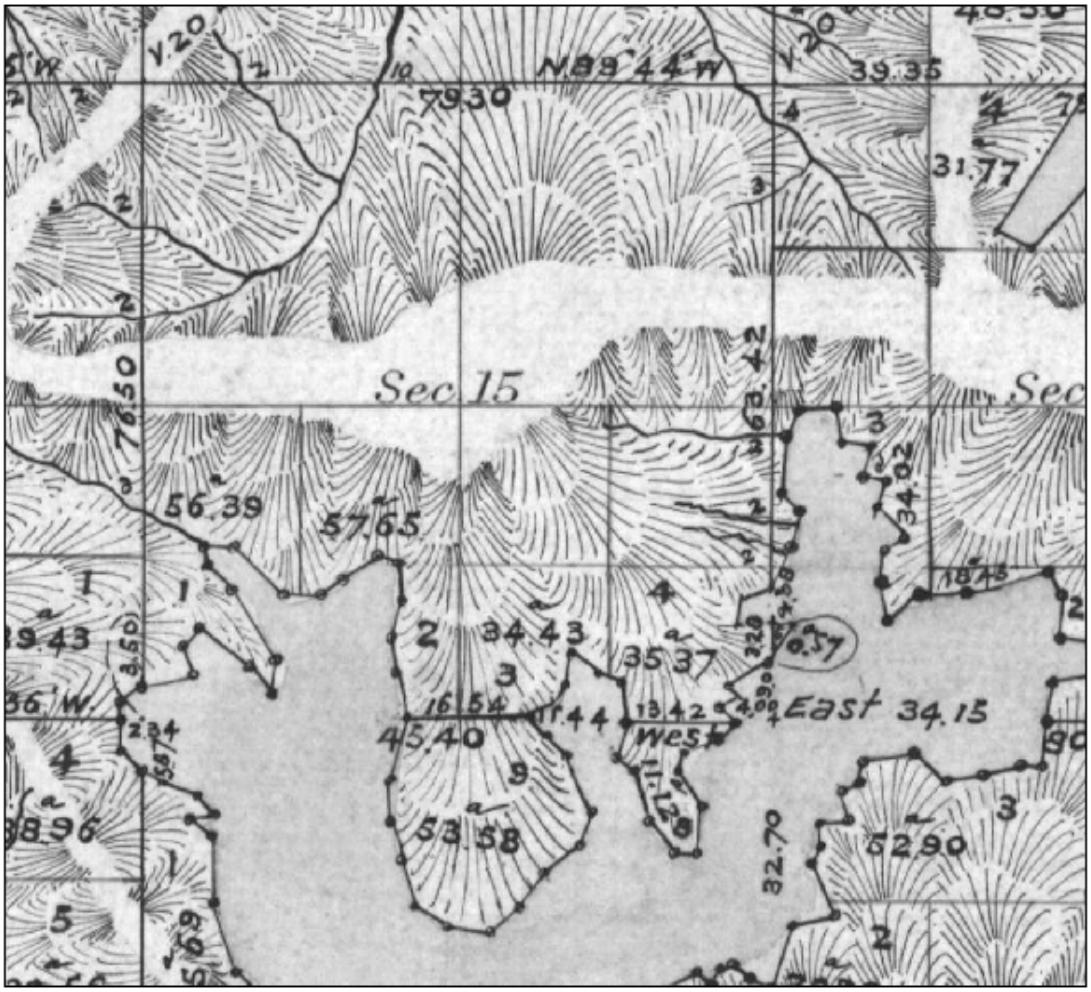
Problem #11

Regular ☐ **Fractional ☐**



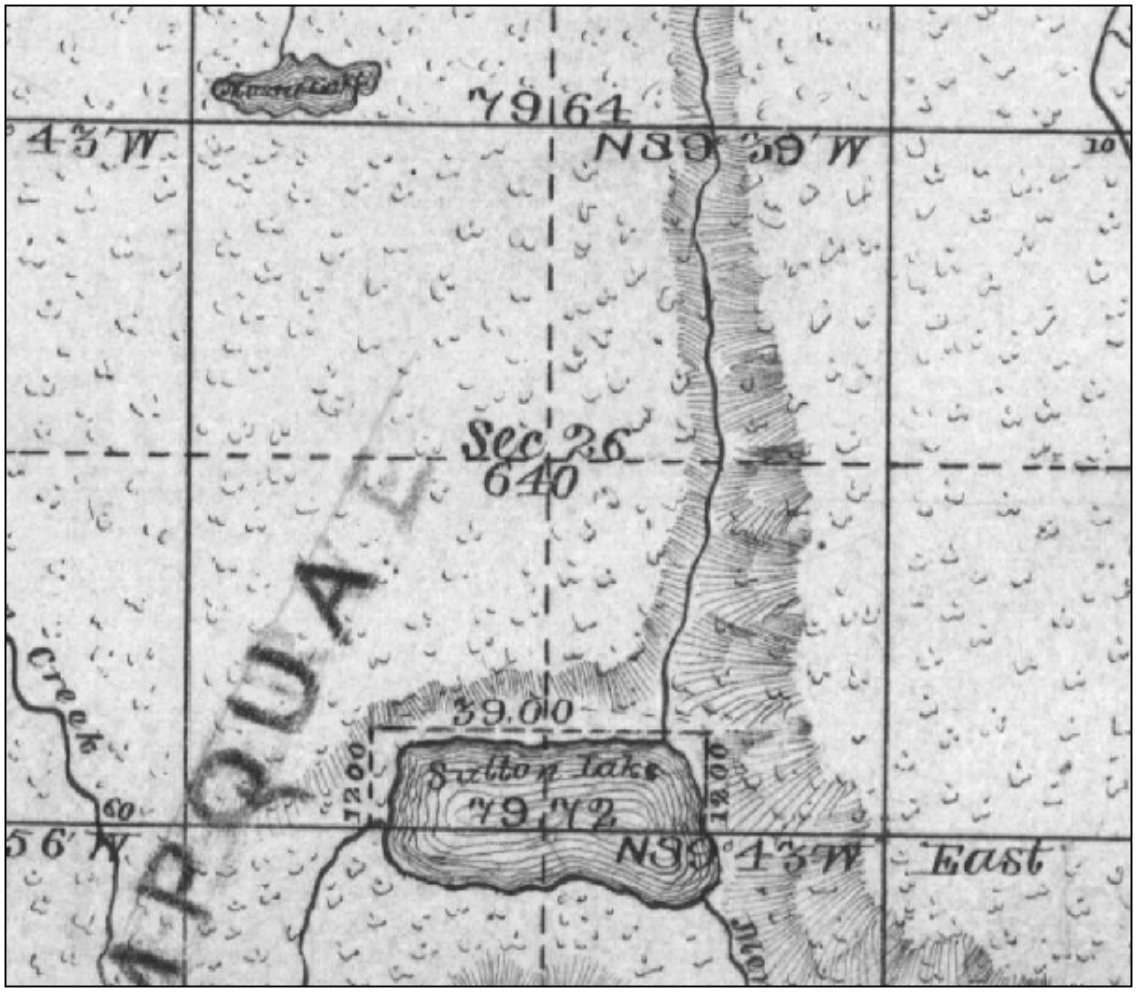
Problem #12

Regular ☐ **Fractional ☐**



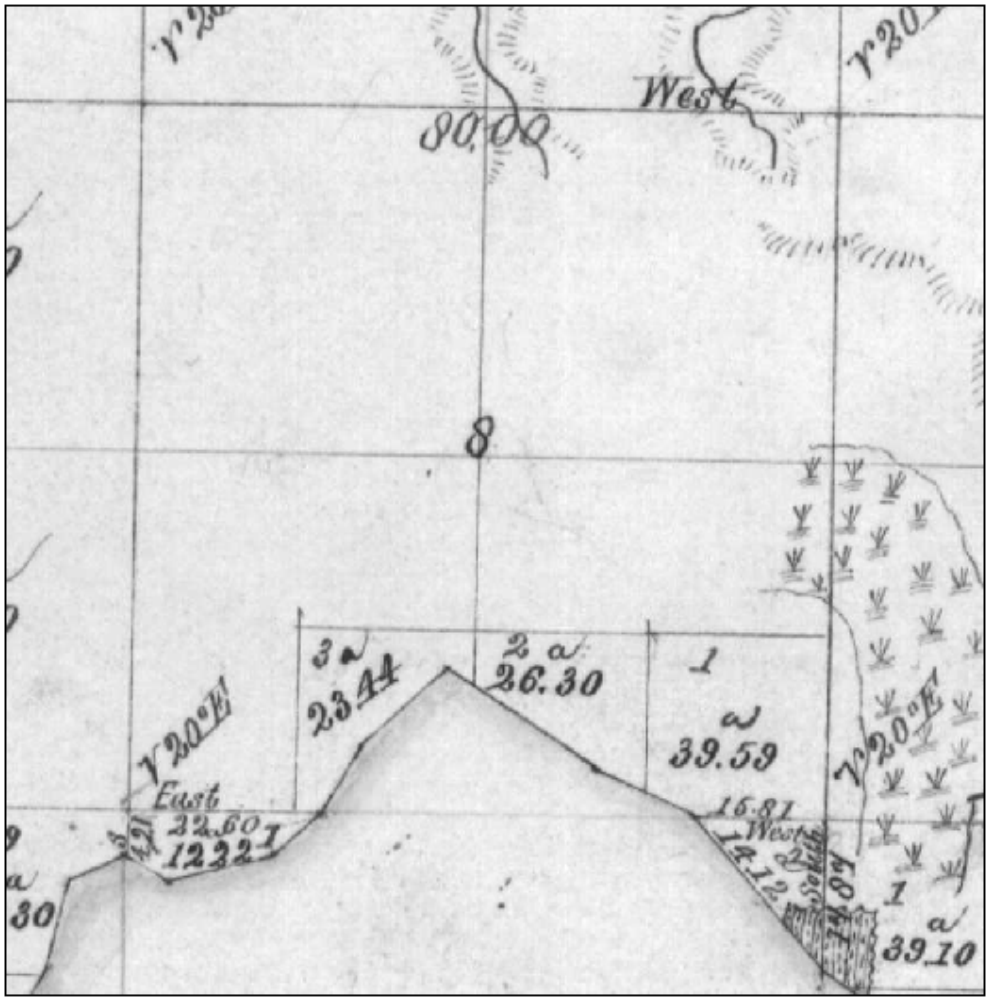
Problem #13

Regular ☐ **Fractional ☐**



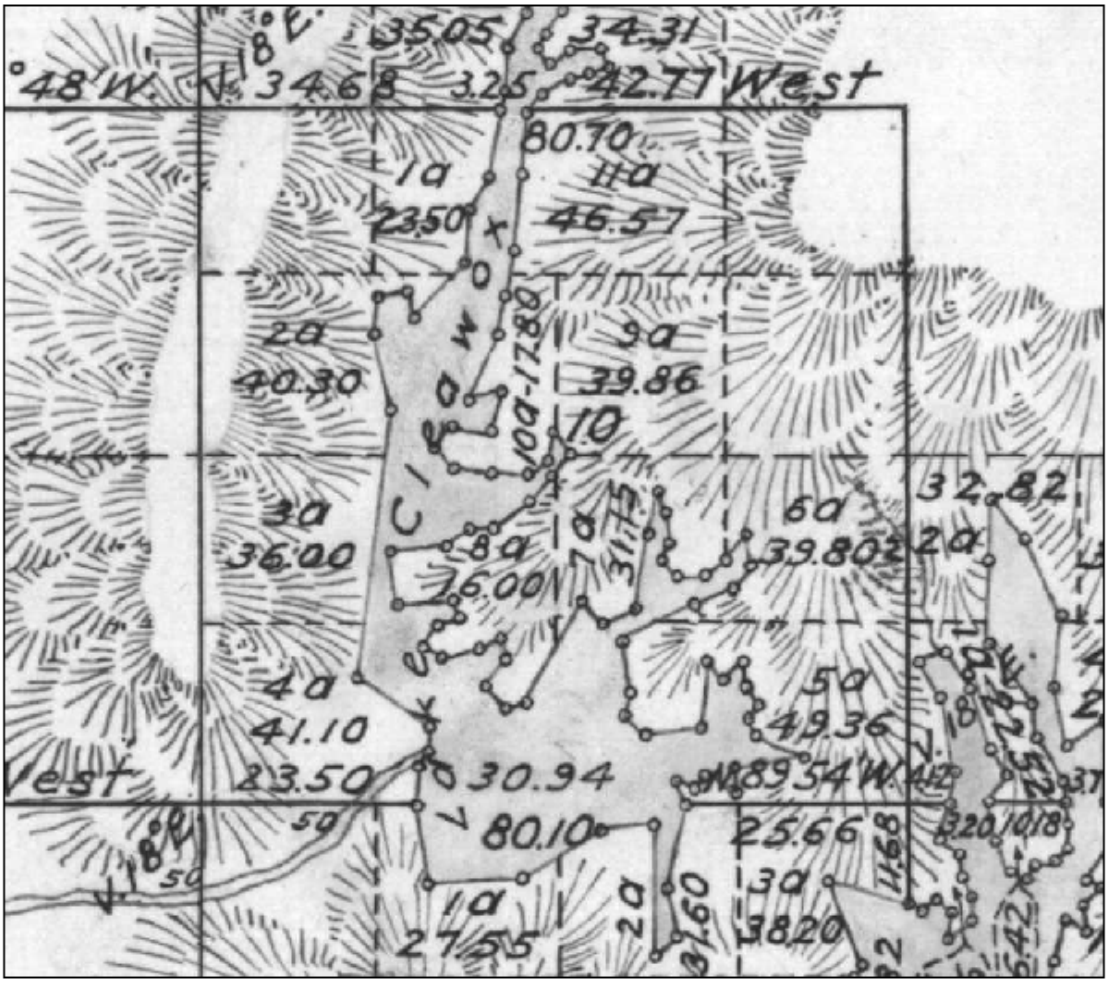
Problem #14

Regular ☐ **Fractional ☐**



Problem #15

Regular ☐ **Fractional ☐**



Course 6: Subdivision of Sections Study Guide

COURSE DESCRIPTION:	This course focuses on the subdivision of sections. It addresses subdivision of normal sections, lotted closing sections, elongated and fractional sections, as well as the unique method known as the "three mile method" on many Indian Reservations and some private lands.
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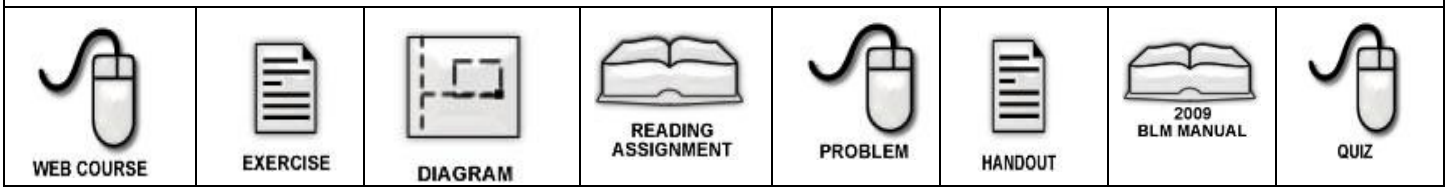
COURSE INSTRUCTOR(S):	Ron Scherler, Bureau of Land Management Dennis Mouland, Bureau of Land Management
VIDEO LECTURE TITLE:	Fractional Sections – Part 2 (77 minutes)

ICON LEGEND



FRACTIONAL SECTIONS – PART 2

Exercise Review

You've completed the exercise. I hope you found that interesting. As I said before we left, Dennis Mouland is going to join us and help us in evaluating this. So Dennis, thank you. Glad to be here. And we are going to begin by looking through each of these sections. We are going to talk briefly about what we think about them. Do we think they're regular, do we think their fractional, and then how we think they should be subdivided. So let's get started with the first one.

Number 1, Section 21

We looked at this the two of us and we both agree that this is a fractional section. We talked about a few issues. We looked at the possibility of completing this section. There's a section in the Manual where it talks about completing sections for protraction, so we could have completed it; but is that what we're really up to here?

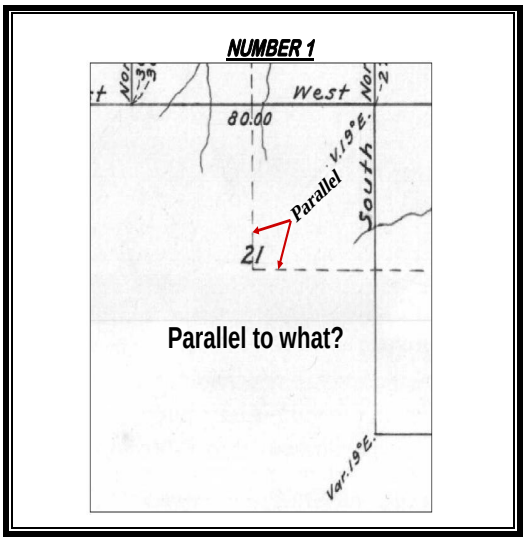


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

We have corners established, we have lines established, we have a plat. Is there any reason to bring anything outside of that plat into this; and I think we ended up saying, no, we don't think there is.

So, if once we've decided that it's fractional, how are we going to subdivide it? Well, let's look at this. How about if we run those lines parallel? The east-west center line parallel with the north boundary and the north-south center line parallel with the east boundary. We run those parallel and we run those to intersection that does a reasonable job of protecting this original plat. We're going to end up with a good area.

It really does a good job of representing what's represented on this plat. Ron, when you do that, is that corner still called the center quarter? Still going to be called the center corner, because we have established it as the southwest corner of the northeast quarter of the section. So it is still the center quarter. Sometimes, we'll see situations where maybe there are two or three corners in there. We'll deal with those individually, but in this case, we would still call this the center quarter of Section 21.

FRACTIONAL SECTIONS – PART 2

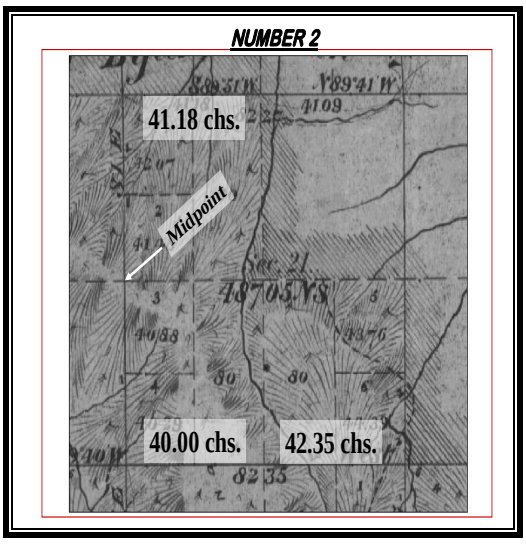
Well let me ask you one more question about this one. If I, let's talk about the south boundary of the quarter section there. If I find the northeast section corner, the north quarter corner, and the northwest section corner, in other words, all three corners on that north line, the odds of those being on a straight line is pretty slim. You know, it's probably going to be a bearing break. It could even be significant sometimes at the quarter corner. So when we say parallel am I paralleling one of those, both of those, or what?

Parallel with what? And, I think normally the best approach is, it's parallel with the entire north boundary, and I can probably see some eyebrows raising up out there and say now wait a minute, wait a minute. You should only be going parallel with the east half of that boundary. No I think we want to go parallel with the entire north boundary. That gives us a good answer.

There is no reason not to use that entire north boundary. Its part of that original plat, and if, for some reason, there's a major discrepancy on that north boundary, some kind of a major bearing break, a major blunder, and then we might change our answer. Otherwise, I think we want to go with that entire north boundary, and the same thing with the east boundary. Any other comments on that one, Dennis?

Number 2, Completion Survey of Section 21

Let's go on to the next one. Number 2. Well, problem Number 2 is actually the completion of problem Number 1. That first plat that we showed you was the original survey of section 21 where the east boundary and the north boundary were surveyed and the northeast quarter was returned. That section was later completed and this is the completion survey. So, now what do we do?



Now we have a completion survey. The section's never been subdivided. We now need to subdivide it. Is this a regular section or a fractional section? Remember before we said it was fractional. What is it now? Regular or fractional? You know, just looking at this plat. Obviously some things are different here. With lotting in places where you wouldn't normally expect it on a Section 21. Plus, can you explain the meaning of the cross-hatch (on the completion survey plat) that's going through that part of the township?

FRACTIONAL SECTIONS – PART 2

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

And Dennis is talking about this cross-hatching around here. Often on the original plats on a completion survey they used cross-hatching to delineate between the surveyed areas that were surveyed under previous plat and the areas that are being surveyed on this plat. So, if we look here, we can see that the northeast quarter of Section 21 was previously surveyed, and all of Section 22 off to the east was previously surveyed. That just shows us that.

So, what are some things that we might look at here to decide if this is fractional or if it isn't? And I think the first thing that we have to do (and I gave you a hint about this before we took the break), sometimes you have to calculate the parenthetical or protracted distances before you can determine if a section is fractional or not. So let's look at what happens when we do that.

First of all, we can look by inspection the quarter corner on the west boundary is at midpoint. You can tell that. In the northwest quarter we've got an 80-acre parcel, in the southwest we've got an 80; and if we were to compute all those areas for lots 1, 2, 3, and 4, we'd find that that quarter corner's at midpoint. Well you could probably validate that with the notes, too. Sure we can look at the notes and find that there, sure.

So let's look at some other things. West half of the south boundary. Forty chains. If you look at the notes and if you look at these areas, you'll find that they're based on 40 chains. East half of the south boundary: 42.35. That was out of limits. Where did we put the excess? On the east half of the section. Is that significant? Well let's see. What else do we have? West half of the north boundary: 41.18. Now remember that original quarter corner on the north boundary was recovered.

So what's happened here? The draftsman has placed all of the excess in the east half of the section. He has an 80-chain west boundary which he has placed the quarter corner at midpoint. In so doing, has he protected that existing northeast quarter? What do you think, Dennis?

Well, I guess it looks like he has when you look at the 41.09. I'm assuming that's a retraced value up there, right? Yes. On the north line of the northeast quarter. So he's pretty close, he's within

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limits I guess, well, he's pretty close on that south-line, the east half of it, so it would, I'm, I'm saying just based on what I see here that he is, he's attempting to protect the northeast quarter in its original position. I believe he has too.

One point I want to make though, is, sometimes on the plat, it'll be protected, but he also on the ground has to protect it in fact, so that if, let's say that west quarter corner, he's got a bust over there, and it's out of position by five chains. North. That north half-mile on the west boundary ends up only 35 chains, or thereabouts.

Well, then he did not protect it in fact, even though on the plat he attempted to, he did not, and if that northeast quarter had been patented prior to the completion survey, we might be looking at a different way to subdivide this section.

Would you fall back to the original method as plat Number 1 showed, and probably hold the parallel lines? In other words, treat it as if it was a senior fractional section. Yeah, I think we would. Yeah I think we would, I think we would, because we need to protect it we need to protect that patent we would probably fall back to that first one.

Are you saying though that if that northeast quarter was not patented, if it was still public domain even with the five chain bust you might not worry about it? I think we probably would not worry about it if it was the federal government doing that survey. I think what we would do is relot the northeast quarter, and show the new areas based on our new subdivision of the section.

Well I've got another question on this one that I think is worth us discussing. The center-east 16th of this section. You know the first plat, that was just a 160 acre normal aliquot part of the north-east quarter was, but, now you've got lotting and aliquot part of the southeast quarter that, at least to me indicate not being at midpoint. Yeah, that's a good point.

Look over here at this center-east 16th and for the north side it's at midpoint. If you calculate those parenthetical distances for the south side, you're going to find that it is not at midpoint. What you're going to find is we have two 16^{ths} there. We have one for the north half, and we have one for the south half. Anytime that

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there is any lotting within a section, we have to be really careful that it has not, we have to be cognizant that it may have created double corners, it may not, but we always have to be aware of that. And in this case, it did.

So even though we may subdivide this section normally, we're going to have some 16th corners on the boundaries that are not at midpoint. These down here on the south boundary. Well this last one is. Just the east 16th on the south boundary is not at midpoint, and then the west 16th on the north boundary is not at midpoint, and we've got two center easts. So, it's a normal subdivision, but then we've got some 16th corners that don't go at midpoint. So we have to be aware of that, and all of that we learn by the areas on this plat. Any other comments?

Well, I just going to ask one more, and it goes down to that southwest quarter there. So we're saying that's 40 chains, and that's midpoint. How do you prove that with those areas? What are you looking at there?

Well, first of all, the notes tell us it's 40. The other thing, as we subtract up, we start with 40, as we talked about in our area relationship class, and, we can just subtract the distance from the area, and work our way up that side; and we're going to find that all those areas work out.

Number 3, Section 28

Let's go on to the next one. And this one looks like it's a pretty straightforward one. It's fractional. I think probably everyone of you got this one with an F on the top of your page that says fractional.

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The reason I wanted this in here is I want to talk about another aspect of subdivision of fractional sections. If this is fractional, then one of the things we're going to do is survey the north-south center line on a mean bearing. We talked about that earlier. So we're going to use, we're going to do a weighted mean between the bearing of the east boundary, using the bearing and distance of the east boundary, the bearing and distance of the west boundary, weighted mean bearing, to survey that north-south center line of the section.

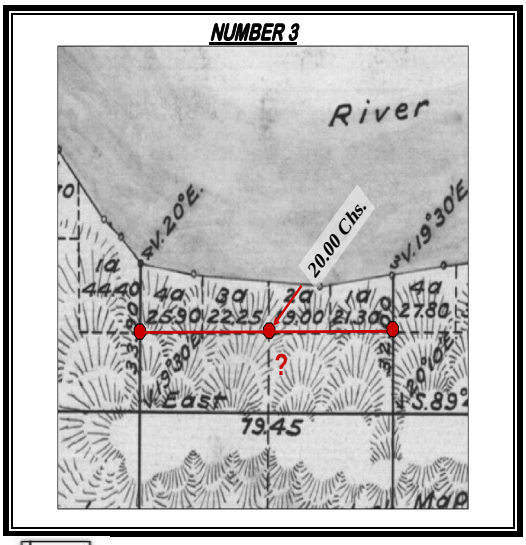

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

But, the next step to subdividing this section is to establish the 16th on the west boundary, and that's relatively easy. We proportion it between section corner and the meander corner. We have corners at either end of that line, so that's a proportion. Same thing with the 16th on the east boundary. We have a meander corner to the north and we have a section corner to the south, so it's a proportion. But, the other corner we have to establish before we can subdivide the quarters is this 16th on the north-south center line.

How do we do that? What are we going to do there? And Dennis and I in discussing this before we came on today; we have a little disagreement here. Let me talk about mine first. I get to go first.

Sure. I believe the proper approach is to establish it at 20 chains. Not a proportionate 20. Just 20 chains and on that north-south line. Now, you might say "why not calculate what the parenthetical distance is up there between lots 2 and 3 and use that?" And that's a good way to approach it, but most of the time, you can't do that when you have a boundary.

If you'll look at these areas, you'll notice they're rounded to the nearest 10th of an acre, or the nearest 500th of an acre. They were probably not computed. They were probably calculated graphically, or some pretty loose calculations; and you're going to have a very difficult time getting a number that works for that line between 2 and 3. So I think that the best approach is to use 20 chains and on that north-south center line. If that gives us a poor answer, then we'll step back and use a different approach.

Now, Dennis has a little different approach to this, and I think both

FRACTIONAL SECTIONS – PART 2

of us are coming at it trying to get the same result. You know there's two issues here while I look at another alternative; and one as you were just saying the acreages for the lots across the north line of the section, or northern part of the section; yeah, their rounded and also let's not forget that they are, they're based on meander line that had been run; and the precision of a meander line being run isn't that good anyway, so even if they calculated these very carefully, the measurements upon which their based aren't that good.

So that's why, you know, it's kind of tough to come up with a…I mean you could probably produce some kind of a parenthetical between lots 2 and 3, but that doesn't work. But then I've got this thing about just running 20 chains, you know. Yeah, yeah. You know that's part of what we all call the 1320 Club. I don't like that, and so you know another alternative with this where you have less than half the section present was to possibly run it as a straight line from the 16th corners on the section lines. Right. Straight across. Right, and wherever that intersects, but, you know, this is where we agree, and that is that if that doesn't look right or there's something wrong, you know and you could have a real funny problem, you know.

Say the south boundary of the section, the quarter corner's got a real significant bearing break. Either way, north or south, there. Well then you might be stealing some people's land there by running that straight. So, you know, then I, then I would look at that 20 chains. Yeah. So the main point here is that we want to equitably divide that area that's in that section. That's right. Based on what we've been shown on the plat. That's what we want to do; and we don't want to just arbitrarily take one approach or the other. We need to look at it carefully.

You know, I think maybe there's a good discussion there for a moment, because a lot of times fractional sections there is more than one reasonable answer. Including what we were just talking about or which lines you're going to use to mean or weighted mean or even parallel, you know, different combinations; and all of these could be moving the center quarter or the 16th quite a few feet and, you know from the retracement point of view that I just mentioned, you know.

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If I go in to do this section or any other and someone else has already been there before me you know I find a pipe there or something there at that 16th or whatever.

You know I'm not just going to go in there and say well my opinion is it should have been done this way; and he did it in another way that's still acceptable, but it's not mine. So I'm not going to use that. I think that's ridiculous. And you know, as far as surveyors, we need to realize there are gray areas. Fractional sections is one of them.

And so when you come in to do a survey you find evidence of a former survey, you need to tie that, you need to do some inversing, you need to run the 2, 3, 4, different ways you can come up with to mean your bearings, or whatever. You know, the odds are if that guy even remotely tried to do it right, you're going to hit really close with one of those methods, and I think unless it's severely impacting people's rights I think it's a good idea to go with what's already there. In other words, it's kind of six of one, half a dozen of the other at that point. We'll take the one that's already there. I think that's a great point.

I think that brings up another point, and that is, if you're the first surveyor there, do a good job of documenting what you did. Help out that next guy, you know. Tell us what you thought about what method you considered what method you decided on, and why. Do a good job of documenting it. It helps that next guy, and it helps us begin to really fix those corners where they are not going to be subject to different interpretations. That's right.

Number 4, Section 5

Let's move on to Number 4. Now Number 4, I think is kind of interesting. Section 5, all four section corners have been established. They're monumented on the ground. Three of the four quarter corners. The north quarter corner, west quarter corner, and south quarter corner, are all there. So, all we have to do, if we need the east quarter corner, is, connect the two section corners. We can calculate that. Connect them, create a position there, and we have a quarter corner to run to.

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You know, you see that often out there with surveyors, whether it's a lake or just unsurveyed portion of the section here and get out there and kind of just play COGO games or whatever you know and just come up with coordinates, but really, that doesn't work very well, you know. There's no, there's no record distances out there, so how do the courts look at that? You know, I think we go back.

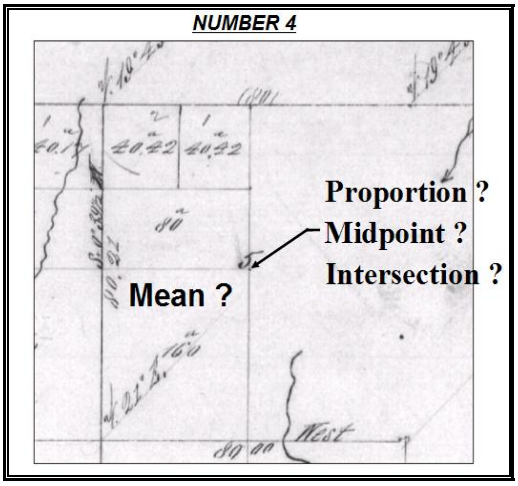

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

Remember what the law said, it said where the opposite corresponding quarter corner has not been or cannot be fixed. The quarter corner in this situation has not been fixed. The line has not been surveyed; therefore, the corner has not been fixed. So, we're going to look at this and say it's a fractional section.

And you're basing that interpretation on the fact that there is no line, there's no distance, there's nothing in the notes, so in other words, that line technically doesn't exist. The line does not exist yet. Yes. In fact, the entire east half of the section has not been surveyed. Right. So, if it's a fractional section, how are we going to subdivide it? Let's think about that.

Well, we're going to establish the center quarter at midpoint on the north-south center line? What do you think about that? Any comments there, Dennis? Well, you know, the center section is in almost every case, the whole system is set by some kind of an intersection. So I have a problem with mid-pointing that or proportioning that in any other way. So you're not going to go midpoint there? I don't think so. We're not going to go proportioning either? Intersection.

And that makes sense. That's the way we establish the center quarter is at intersection of the north-south center line with the east-west center line. So, how does the law tell us to survey the east-west center line? What does it tell us? It tells us to run a mean bearing, does it not? Or parallel. The law, the Manual gives us both. It gives us mean bearing or parallel. So, are we are going to run a mean bearing here, or are we going to run it parallel?

Well, normally, against the north boundary of a township, or against the west boundary of the township, against the north boundary, all of the subdivision lines in a section against the north

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boundary of the township are parallel with the south boundary. They are not necessarily a calculated mean. They are parallel with the south boundary, and we know that because we have lots across the north boundary that show that the two lines are not parallel. And against the west boundary, normally the last section's closing on the west boundary. All the subdivision lines are parallel with the east boundary of the section.

So, here normally, this east-west center line would probably be parallel, but we have something a little different here. Look at lots 1 and 2, and look at the areas in lots 1 and 2. 40.42 acres. 40.42 acres. That tells me that the south boundary of lots 1 and 2 is parallel with the north boundary of the section.

We have an 80 acre lot below that, which tells me that the south boundary of lots 1 and 2 is parallel with the east-west center line of the section. And we have 160 acres below that which tells me the east-west center line of the section is parallel with the south boundary. In this case, the east-west center line that is section 5 should be run at a mean. And it will be run to intersection.

Now, just assume this is exactly the same plat we're looking at. What if the north line you just found had a very heavy bearing on it? Would that change your opinion at all? Sure. If that north line had a really heavy bearing, what we would see is Lots 1 and 2 would not have the same area. Right. It would show that those lines were either diverging or converging. One or the other. It would show that those subdivision lines were not parallel with the north boundary.

They would all be parallel with the south boundary, and then we would use a bearing that's parallel with the south boundary. Gotcha. And we got a couple of examples of that later.

Number 5, Section 29

Section 29 - This is almost a classic subdivision of section, I think. We've got three section corners. We've got two quarter corners. We've got a missing section corner with two quarter corners up there. So, this is a fractional section, and I think almost all of you probably marked this one down as fractional. So there's not a lot of argument about that.

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Just a couple of things I wanted to point out as we look at this one. First of all, the center lines. How are we going to survey the center lines? Almost certainly, we're going to survey them on a weighted mean bearing. For the north-south center line, we're going to use the entire west boundary and entire east boundary, and we're going to do a weighted mean bearing. Survey that to intersection with meander line. For the east-west center line, same thing. This entire south boundary, the entire north boundary, weighted mean, and we're going survey the east-west center line.

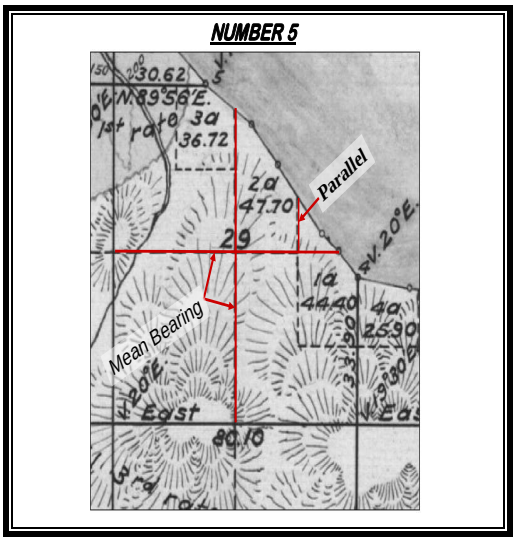

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

But, how are we going to survey this line right over here? The north-south center line of the northeast quarter, or this line between lots? I guess there's… Well it's 1 and 2. So what are we going to do there? We don't have an east boundary, do we?

We have a north-south center line, but we don't have an east boundary. So in this case, we're probably going to survey that parallel with the north-south center line. The reason I wanted to make this point was, here we have a section where we're surveying the center lines on a mean bearing, but the center lines of a quarter end up being surveyed as parallel. Now what would you do with Lot 3 there?

The south boundary of Lot 3? Or, maybe a better question. How would you set the center-north l6th of 29? And we're back to that same issue that you and I sort of disagree on. I would probably go a record 20 chains north from the center quarter. Establish that center-north 16th, and then survey the east-west center line to it, and unless that gave me really distorted answers, then I'd try some other answer.

And would you survey that on maybe a mean bearing across there? Well, I suppose you could from the west line, you're saying of the section across there, yeah. That's a possibility. The mean of the center line on the north line. But again, I'd definitely be very cautious. You know the odds…I mean, there's a possibility with a lake here, assuming the lake hasn't moved. I think that's a lake. That it hasn't moved.

What if things are just way out of kilter here? And going the 20 chains is really robbing somebody of something or vice versa. So,

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but yeah. I think there's a couple possibilities there. And again, here we get back to document what you've done. Document what you've done; and either of those answers is going to give you a, or has the potential to give you a good answer.

What we're looking for is a good and equitable division based on the areas shown there. You know, if you had both of those, and I'm not saying this would always be the case, but if you just had again six of one, half a dozen of the other, there's no survey in there. But you've got a fence that falls within a foot of one of those. I think I'd look pretty hard at that, because the people have occupied in good faith. And with reference to the original survey.

Number 6, Section 33

We do that one parallel so let's…Now Chimkent Creek. This stream forms the east boundary of the Spokane Indian Reservation, and one of the things that you're going to see often is that the boundary of the reservation is surveyed. The land outside the reservation is surveyed first, and later the land inside the reservation is surveyed. That's what's happened here. So, let's look at just the portion outside the reservation first.

How are we going to subdivide this section? Is it fractional?

And I think we agree it is. It is fractional. So what are we going to do? What about this north-south center line? Because if you look at the north-south center line of the section, you'll notice it only goes to the center quarter. It doesn't go into the north half of the section. So what are we going to use to survey parallel with? We don't have a west boundary. We only have an east boundary. So it's going to be parallel. Parallel with what? What are we going to make it parallel with? This goes back to the discussion we had earlier.

Normally our first approach is going to be parallel with the entire east boundary. That's almost always going to give us a good answer. Parallel with that entire boundary. Now, if we have a major bearing break there at the east quarter corner and by going parallel with that entire boundary we're going to get a really distorted answer.

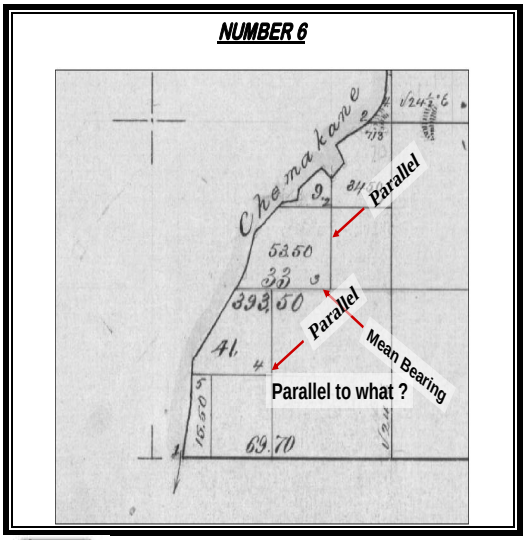

DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

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Then we back off, we document why we aren't using that normal method, and we explain why we are going to only going to use maybe the south half of the east boundary to run parallel with. Normally, though, we're going to go parallel with the entire boundary. You agree with that Dennis? Yeah. I like that solution, and just run it to intersection with the east-west, which we haven't talked about yet, but… Right. Right. Run it east intersection with the east one, east-west center line, mean bearing. Why mean bearing?

We have a portion of the north boundary, a small portion, and we have a portion of the south boundary. So we're going to use a weighted mean bearing as we discussed earlier, survey that line westerly till it intersects the reservation boundary, which is also the meander line of the stream, and where those two lines intersect, we have the center of the section.

One of the things, just a sidelight, in this kind of a situation, where we've surveyed some kind of a boundary that is not cardinal at all, and then we've surveyed up against it from one side. Reservations especially are like this. Up against from the other side, we tend to get into situations where we get two center quarters.

One on one side of the line, and one on the other side of the line. Which can be very confusing. But, when you look at the original plat, it's very clear, that there are sort of two different sections, one on each side. That's right. That shows what they intended.

It shows what they intended. We survey it the way they intended. Let's look also up here at north-south center line of the north-east quarter. Parallel again because there is no other boundary. And let's move on then and look at the completion.

Number 7, Section 33

This is a plat that shows the survey of the portion of the section inside the reservation. Just a couple of things I want to point out. There was a tie across. So the two surveys are tied together, both on the north boundary and on the south boundary.

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You'll notice on the south boundary they even retraced a portion of the old survey. You'll notice that they surveyed all the way to the quarter corner. So that's happened. And it appears that all the lines line up. Yeah, and I know of surveyors who just lay a straight edge on the GLO and plat and just make there decision on that. I don't think that's a good idea.

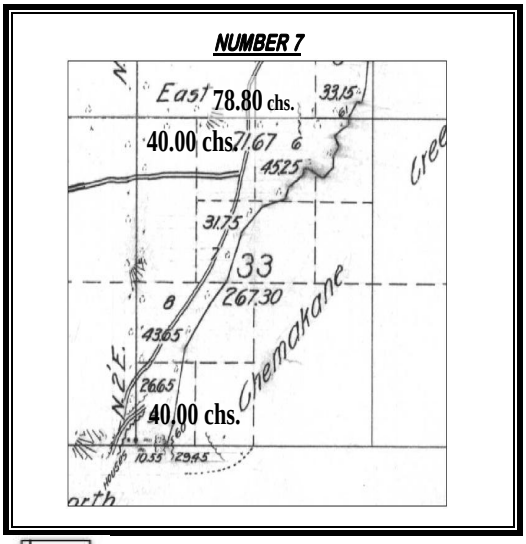
Well, you know, we look up here. Look here at this north 16th line. It appears to cross nice and straight. The section lines appear to. So what kind of things might we look at to help up decide how we're going to subdivide this section. If we're going to subdivide each half individually, or subdivide the entire section as a whole.

A couple things. Again, looking at those areas. Let's see what happens with some of these areas. First of all, that south boundary, the west half of that south boundary. If you totaled that, it's 40 chains. 40 chains. If we look at the entire north boundary, if you add the number from the previous plat, and the distance on this plat, you're going to see that it's 78.8 chains across there.

So there's a fairly significant shortage up there on that north boundary. Well let's see where that shortage is placed. And if we look at these areas, you'll find and if you look at the field notes you'll find that the quarter corner is 40 chains from the west. So, that entire west boundary is complete and the shortage or the deficiency is placed entirely in the east boundary. So, does that protect those areas that are shown on the plat easterly of the reservation boundary? And I think it does not. No it doesn't. It does not.

So, by looking at the areas, looking at where the quarter corners were placed, looking at where the excess or deficiency was placed, we can determine that the completion survey here did not protect the existing survey. Now remember back there in those first two problems that we looked at the completion survey on Sheet 2, on Problem Number 2 protected the survey from the first plat. Here it does not.

So here what do we do? We're going to subdivide each section as if they are fractional. I think that throws some surveyors because it's all still at least in the combination of plats is all one section,



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Section 33. The lot numbers correspond, you know. They pick up with the other numbers on the other side. But in fact, because of just what you're talking about here, these are two separate sections, both fractional. Yes.

And we're going to have to treat them that way. Now, along many reservation boundaries, it's much clearer. The section lines don't line up. The section corners don't line up. So it's much clearer that there are two. Here, it's a little more subtle. But if we look at the areas, and we look at where the excess or deficiencies are placed, it's clear that these two should be subdivided as two separate sections. I'm curious, you know.

The boundary along the (how did you pronounce it?) Chimkent Creek. Chimkent Creek. Where is this? Spokane Indian Reservation. Oh. I'm just wondering why. Well it was… it was obviously a…I'm going to assume traversing down the center one of the banks of that creek for an Indian reservation. Easterly bank. They included this entire creek in the reservation here.

So does that make this a fixed and limiting boundary then across the middle of this? And you know that could be confusing. Fortunately here, they called it a meander line. They called it a meander line. So I think that clears it up. If they had just traversed it, and maybe even monumented it, then it might get confusing. Looks like there's numbers up through those angle plats. I was wondering how they treated that. This was a meander line so it is ambulatory. Gotcha. It moves with the stream.

Number 8, Section 34

Well, here we have all four section corners. Maybe. Sort of. We have one quarter corner or maybe we sort of have three quarter corners. What do we have? Well, first of all, is it fractional?

Let's look at a couple things. First of all, we have ties across the water down here on the south boundary where the quarter corner falls in the water. We have a tie, that line is measured across there. The same thing on the west boundary. We have a tie across there.

FRACTIONAL SECTIONS – PART 2

Now in the field notes, it does not call a distance to the quarter corner. Sometimes we'll see notes that do, sometimes we don't. Here they do not. But there's a tie across there which gives us the number and the distance for where that quarter corner should be. Yeah, it's still 80 chains. It's still 80 chains. On both of those lines.

So we know it has fixed the position for the quarter corner. Now to set those Ron you're not going to, for instance just take the west boundary of the section? You're not going to midpoint that between the two section quarters? No. You got some controlling intermediate monuments. Yeah. We're going to use the closest monuments, which hopefully we're going to recover those two meander corners. Yeah. Yeah. Same thing on the south boundary. So those two, we've got taken care of.

But look over here on the east boundary. That line is not surveyed. In the field notes, there's nothing there. It has not been surveyed. It has not been established. Therefore, the east quarter corner has not been fixed. Fractional. Sure looks fractional to me. Fractional section.

The north-south center line. That's going to be surveyed normally. But what about the east-west center line? So, what are we going to do? Let's look at a couple of things. We're going to proportion in those two quarter corners that are missing. Right. Fix those positions out in the water.

We aren't going to go out there, dig a hole under the water and set it but we're going to fix the position for those two. Then, we're going to establish that east-west center line on a mean bearing. But again we're back to this mean bearing of what.

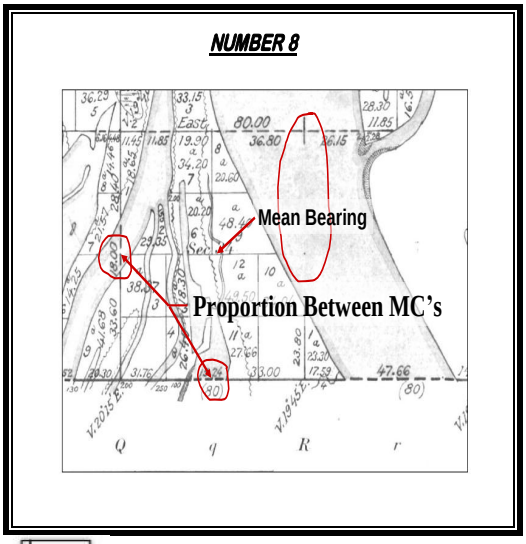


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

FRACTIONAL SECTIONS – PART 2

What portion of the north boundary should we use to calculate the mean bearing. Because we have this portion of the boundary that goes out into the water, gives us a position out in the water, and then continues on across into the other side of the river. So what portion are we going to use for the boundary?

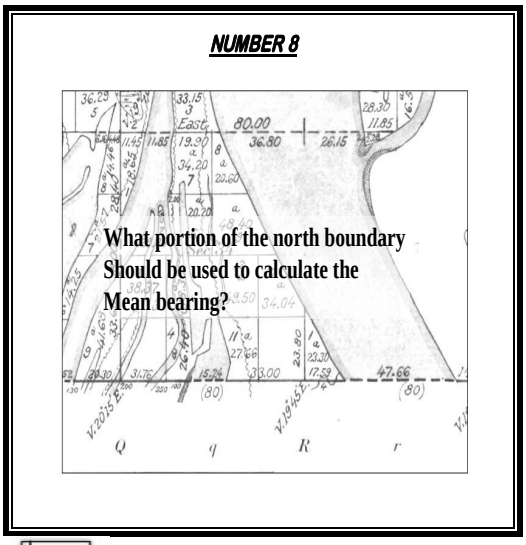


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

What do you think, Dennis? Well, you know, I've got one of those theories about when these start getting longer and longer distances out there across whatever it is, in this case water, that they start getting dangerous. I suppose if I found the meander corners on both sides of that river, whatever that is, and measured across there and I was pretty close to a record, I guess it might not matter, but, yeah that's a long way.

Here's my biggest problem, though, Ron. When you go past that section corner, it's not monumented but it's been established, then you're using 26.15 chains of a line that has nothing to do with the Section 34 where we are working in.

So I don't think you can include that 26.15 depending on the circumstances you find out there I don't know if I'd even include the 36.80. I agree. I believe, let's stick to the corners that define the fractional section we're dealing with. What corners, monuments on the ground? Why go to calculated positions out on the water when we have a monumented meander corner, we have a monumented meander corner and then we have section corners and quarter corners all the way around? Why go to some theoretical point out in the water that might cause a great deal of distortion to the section?

Let's stop right there at the meander corners and subdivide the section based on that. Yeah. I think that's good advice. You know, since this has come up a couple times here, maybe we ought to talk for a minute. Just go on across these large bodies of water or anything else where they couldn't chain. Where they couldn't actually chain it. And of course you can find out what size chain they were using many time just reading in the first pages of the field notes. They'd tell you what they were out there with, that sort of thing.

But, we just need to remember that process was one of triangulation, and that wasn't very well, it wasn't very precise,

FRACTIONAL SECTIONS – PART 2

when you're out there running with the kind of instrumentation. Even the double or triple chain there base line and they meaned it. But, the angles they were turning and then their risk of messing up the computation.

I get really nervous using anything that's more than just a few chains across a river. Obviously we've got 18 chains and 15.24. We need to use those. That's what this plat was built on. Yes. Yes. But that 36.80 and that 26.15. There's really good chance that you could have a much larger error between the record and measure across that water on the upland there. But, that's just a word of advice.

And we may have to use those to reestablish the meander corners. You might. That's right. But we just need to be careful with that.

Number 9, Section 4

Let's look at Number 9. First of all, I just want to point out a couple of things about this.

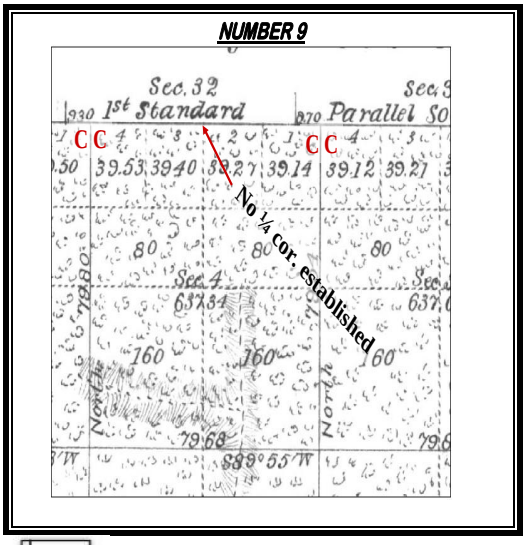


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

Notice that the north boundary here is a standard parallel. That's Number 1. Notice that there is quite an offset here. With 8.7 chains on one side and 9.3 on the other side, between the closing corners for the south, and the section corners, the standard corners for the north.

If we are to look at the field notes here, what we will see that when the standard parallel was surveyed, the quarter corner was established at 40 chains, it was marked as the standard corner for Section 32. If we are to look at the field notes for Section 4 what we're going to find is the closing corner was established where the line between Section 3 and 4 and 4 and 5 intersected the standard parallel. But, the line was not retraced and a new quarter corner for Section 4 was never established.

It's simply a platted position. It has not been established. So, has the quarter corner been fixed? We could say no, but maybe we need to read a little section out of the Manual here. And actually there are a couple.

FRACTIONAL SECTIONS – PART 2

One is in Section 3-114 where it says, "In subdividing such sections, new quarter section corners are required, so placed as to suit the calculation of the areas that adjoined the township boundary." That's one place. We have a process. We have a method, and over here in Section 7-21 it says, the quarter section corner of sections on the side to which the closing corners refer were not established in older surveys. The correct position are as protracted on the plat of those sections. So we have a method in place for how to establish that corner which makes it fixed. So, what we really have is a fixed position for that north quarter corner even though it has not been monumented. It hasn't been established.

The position for it is fixed because we have a procedure in the Manual for how to establish that. So this section is not a fractional section. Right. Folks this is what we call the quarter corner of minimum control. This one that's facing Section 4 in the quarter corner of the standard parallel, it's serving Section 32. That's what we call a quarter corner of maximum control.

Although we cover this elsewhere in the course, about the setting of these, I just want to mention, you know that first of all, and I believe it's the 1881 Manual is when we started to require that quarter corner to be set in most surveys, which means the majority of the lower 48, they weren't set. Well I won't say that.

Prior to that time, if GLO had money to do it, well they set them and then other times they said don't set them. And so it was, depending on what that guy's contract was. I've had surveyors come in to my office and say, " man, we've been out there looking for that all day and we can't find it." And I say, "Well did you get the notes?" And if you get the notes you'd probably know. Hey, it was never set. So you're looking for something unset. And also, again, covered elsewhere, but, you know, the offsets on those closing corners, the 8.7, the 9.3, that's fine.

But, you know that is, that can give you a good idea of where you're going to be. You know your quarter corner, your two quarter corners are going to be about 9 chains apart, but you don't use like a mean of those to set that. And also, don't forget. No. You notice how the Manual worded it there in 3-114 and 7-21. It didn't say go midpoint, right? Because why is that?

FRACTIONAL SECTIONS – PART 2

Well, first of all, most section 6's won't go at midpoint anyway, but there's a lot of portions of the country, especially the Midwest and the South where even on the non-section 6 situations the quarter corner of minimum control is very clearly shown, at 40 chains from one side or it's some other distance from one side. So, you know, it comes right back to same old bottom line.

What does the plat tell you to do? Yes. Yes. And here, it would be at midpoint, because the plat has told us that. Right. Right. It would be at midpoint between the closing corners, and on the standard parallel line. The standard parallel is still going to control alignment. The closing corners are going to control the east-west position. So, this one is not a fractional section. Right.

Number 10, Section 10

And this is an interesting one, Dennis. Yeah, this is a little different here. Got some numbers out in the water. Yeah, we like somebody out there wading around measuring out there. Well, let's look at this one and see what kind of things we have. First of all, we do.

We have these, we have these numbers out in the water. Another thing we have that I want to point out to you is right down here, we have this lake that shows up, but it's not a meandered lake. Look at this area here. There's an area there. That's not a meandered lake. Look at this area. 64.32 acres. Clearly that area includes that lake. It has not been segregated. So, that is maybe a little confusing in looking at the plat. So, fractional, not fractional?

Well, we got distances in a lot of places, but again, we're missing at least one. Right. And we've got several distances that are just out in the water. And, you know, in some parts of the country I guess they actually show these numbers like that, but it's what the draftsman was just using to help figure out his areas. Right?

In fact, these are not a result of actual measured survey returns. Yeah. They are not…this is the middle of a river. They are not out there surveying. I know in the Midwest in places, they surveyed in the winter on the ice. Oh yeah. And so they did actually

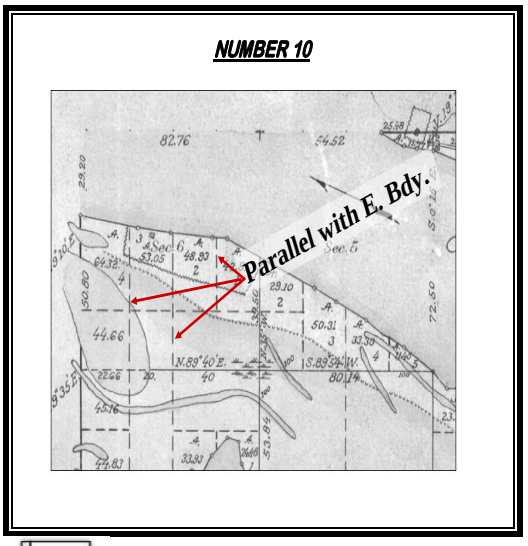


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

FRACTIONAL SECTIONS – PART 2

measure…I suppose so, yeah.

However, even if they had, even if that's taken place, think about what we're doing. What is the evidence that we have left of where this section was? That's really what should control. And the evidence we have is a couple of meander corners and the section lines. Yeah. Right? That's what we have. So we're going to look at this and say yeah, this is a fractional section. How are we going to subdivide it? Well, hmm. Look at this. I say parallel for all those north-south lines. And why am I doing that? I'm doing that because this is Section 6.

Remember earlier we talked about all the lines, actually all the lines in a township are parallel with the east boundary, until we get all the way here at the end and then all the excess or deficiency is placed up against that boundary. So, normally, that last 16th line is not parallel with the west boundary of the township. But it is parallel with every other line in the township.

Well what you're saying there is if you were to do a weighted mean, or just mean, whatever, of the north-south center line, you're going to take what the plat told you is supposed to stay in the lots in the west and you're going to spread it all the way across the section. Right? That's right. That's what we're avoiding. That's exactly right.

So, but looking at this. How do I know, just from this plat that west 16th line is not parallel with the west boundary? A quick, just a real quick check. Look at the area. 44.66. Look at that area. Bad circle. 44.66. Look at the distance on the south boundary of that lot. 22.66. If those two lines were parallel, those two north-south lines were parallel, the area of that lot would be double of 22.66, or 45.32, if I did that right in my head.

FRACTIONAL SECTIONS – PART 2

So, we can tell right away that the west boundary is not parallel with that west 16th line. Therefore, all of these lines are platted parallel with the east boundary and are not to be computed on the mean. And that's a really good example of protecting the plat, you know, a concept we talk about that means, as we said before, you do what the plat tells you to do.

You did what you did last that time you did it to section 6 or whatever else. You do what the plat says. And I just have another example, here. This was not in your handout or one of your examples. But I thought this made it a little clearer, because we can look at these areas here, and you can see 35.28, 35.45, 35.62.

It's clear that these two lines are not parallel. They're diverging. Right. That's a real good example I think of why we're going to put all these kind of lines parallel with the east boundary of the section. Right, and, you know, we might step back and just think about some things you've heard in earlier segments of this program of this course, and that is that, you know, you have some places where the townships are run backwards or we had, or when we were doing a township we retraced the east line and found it to be out of whack for alignment or for distance. Yes. And so we end up with lotting sometimes on the east side or the south side.

So, you know again, it's do what the plat says. Normally what we're talking about here occurs down that west side of township sections 6, 7, 18, 19, 30, and 31. But there is the possibility it can occur on that east boundary as well. So, pay close attention. Remember. Here's how I do it. Every section's unique. Doesn't matter what. Every section's unique. Yes. So, we're going to survey that it's parallel with the east boundary. Alright. Let's go on to the next one.

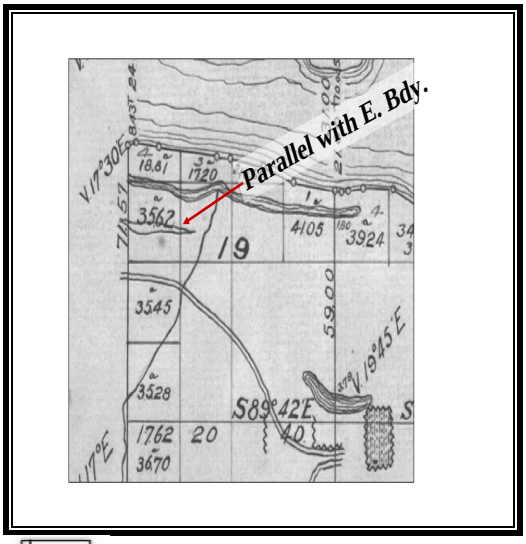


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

Problem 11, Section 21

Section 21 is again against the reservation boundary. That south line there is a reservation boundary. section 21 is outside the reservation south of the line is within the reservation, and, to this day, the land inside the reservation has not been surveyed. So this is the only plat.

FRACTIONAL SECTIONS – PART 2

There has been no completion survey inside the section, or inside the reservation. So, how are we going to survey 21? Are we going to set a quarter corner on that reservation boundary? A south quarter corner? What do you think? Well, on the two section lines, what are we calling those? Are they closing corners, right? They're closing corners. But they're not really section corners, are they?

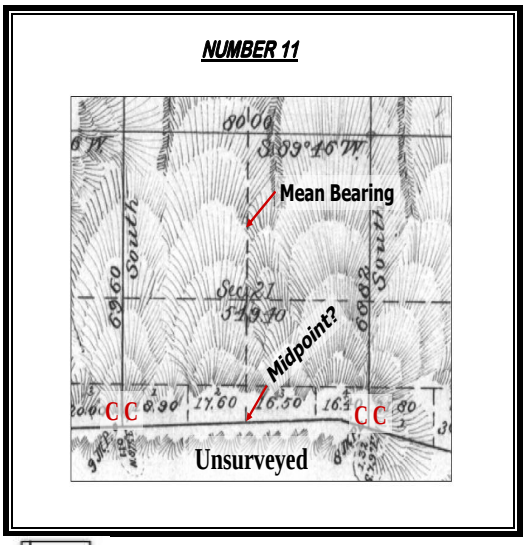


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

You know, as a normal closing against the township line. They really haven't gotten to a township line. Right. Haven't gone far enough. So, yeah there's a temptation to say well, I'll just treat that south quarter corner as a quarter corner of minimum control, but it's not really a quarter corner. No, and I'll tell you, when I look at this, I start thinking, how am I going to defend this? What am I going to tell the judge? What am I going to tell the judge when they say, "why did you put it at midpoint?" That's a tougher argument to make than you know, this is a fractional section. It has been.

There is no fixed quarter corner and by law I am supposed to survey this on a mean bearing. Right. And so I would survey this north-south center line on a mean bearing and…let me catch up here a little bit…not at midpoint. Right. Not at midpoint on a mean bearing. And I would justify that because the south quarter corner has not been fixed. Therefore, we're going to survey it on a mean bearing to intersection with a reservation boundary. It's tempting here because almost all of Section 21 is there. Right. It's not as tempting if this reservation boundary was somewhere up in the north half of the section, you know. But really it's the same situation. So, again, fractional section, mean bearing to intersection with the reservation boundary.

Now just a for instance or what if there, Ron. If that reservation boundary was further south, in other words we got almost 20 chains or maybe even a little over, would you treat it differently or would you still treat it as fractional because that's not a township line.

It's not a public lands boundary there. I think it makes sense to continue to treat it as fractional, until such time as we've surveyed there on the other side. Because one of the things that you can end

FRACTIONAL SECTIONS – PART 2

up with then are two quarter corners. Right. One for the south boundary. If we surveyed a new south boundary at 21 out there on the reservation, there's going to be a quarter corner of 21 and whatever's below that. Something. No. 21 and 28.

And then there'd be this quarter corner on this reservation boundary. Right. That's going to be really confusing. So, mean bearing to intersection with the reservation boundary. Yeah. I like that.

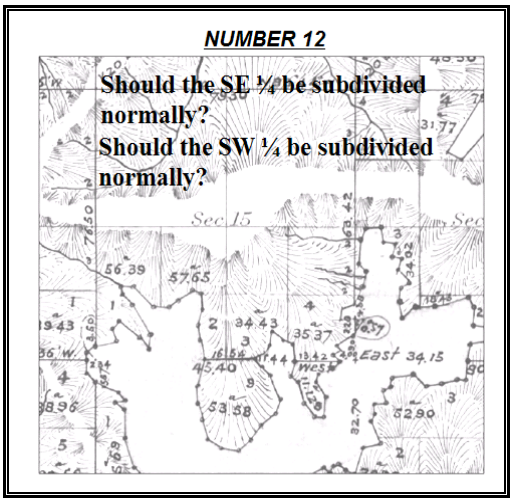
Number 12, Section 15

We're moving through these pretty good. Fractional or not fractional? Well let's start out. We have two of the section corners have been monumented. The other two are in the water, but they have bearings and distances shown to them. But look at this.

All four quarter corners are monumented. So we can run straight lines between the quarter corners. So, what does it matter if the section corners are there or not? So is this a fractional section or not? All four quarter corners are there. We can run straight lines between them.

What do you think? Well, I agree with you on the setting of that center quarter. We can go that far, and in three quarters of the section we can also go. But that south-west quarter, we don't have any kind of a distance across that south line on the south-west quarter. So, to get the center quarter it's not fractional, but to get, to do anything in the south-west quarter, seems to me that it's fractional. So what we're saying is, we can have a section that we're going to call fractional, yet the center lines are all run normally.

Because all the quarter corners are there. Really the only part that's fractional is a southwest quarter. And so, I think I would, I think I would say this is a regular section, but the south-west corner is fractional. Yeah. That's right. Yeah. That's maybe mixing words, mincing words a little bit. So let's look at a couple of things. Should the south-east quarter be subdivided normally? You'll notice that the north-south center line of the south-east quarter intersects the water down here.



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FRACTIONAL SECTIONS – PART 2

Over here, we do have a position for the south 16th on the ground. That's another one to establish would be between the controlling intermediate monument to the south there, right? Yeah. We got a meander corner to the south. We've got a quarter to the north. So we can establish that. Down here on the south boundary we have a distance across the water. That gives us a position so we can establish the position for the east 16th on the south boundary. Yeah.

So we're going to establish all those positions, and then subdivide the south-east quarter normally. So, that leads us to the southwest. And as Dennis already said, we don't have a distance across that south boundary, of the south-west quarter. If we don't have a distance the 16th corner has not been fixed. You know, the law talks about has the opposite corresponding quarter corner been fixed.

Well, it applies also the opposite corresponding 16th corner. And here it hasn't because the line has never been run. If the line has not been run, then it has not been fixed. And some people may look at this and say well wait a minute. The line across the water wasn't run. No, but it was measured, and it's shown on the plat, and it's reported in the field notes. It gives us a measurement to base our numbers, and we have a procedure then for fixing that quarter corner position.

Here we do not have a procedure or a measurement for fixing the 16th position. So would you run that, you're going to set the center west16th at midpoint? Yes. On that, and then, you're saying you'd run south on a weighted mean bearing of the center line of the section and the west corner section. That's the way I would do it.

Number 13, Section 26

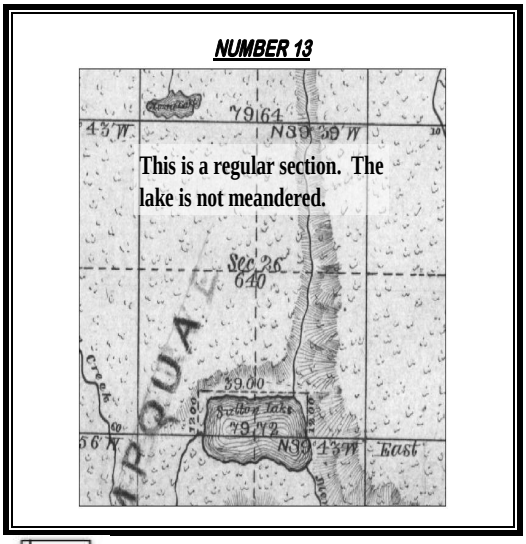
This is a little trick maybe. Is this fractional? Well, if you look carefully here, you'll notice that the section has 640 acres in it, and all four quarters are normal. They each have 160 acres. So no, this isn't fractional, because the lake was not meandered. It's shown on the plat.

FRACTIONAL SECTIONS – PART 2

The surveyor offset around it, and he didn't set a quarter corner on the south boundary, but it's not meandered. It's returned as surveyed, and so this is not a fractional section. That quarter corner on the south boundary is going to go at midpoint. There are no meander corners. There are no controlling, intermediate monuments. It'll go at midpoint between the section corners. Right. Now if the lake had been meandered, how do you see that different?

Now if the lake had been meandered and we had a distance across, then we can fix it. Still a normal section. Still a normal section. If there's no distance across, though, then we're going to look at that and say no, we haven't fixed that quarter corner, then we're going to subdivide it as a fractional section.

So that one's a pretty straightforward one. So this is a regular section, the lake's not meandered.



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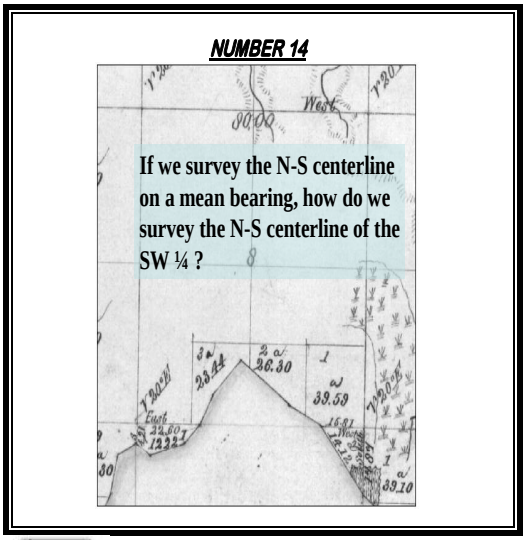
Number 14, Section 8

Let's look at number 14 now. The subdivision of Section 8. What are we going to do here? Well, let's look at Section 8. First of all, we can notice that there is no distance across that south boundary. Right. We've got that situation again. So probably, what are we going to say?

The north-south center line is going to be surveyed on a mean. This is a fractional section. I think so. I think so. So, the north-south center line is probably going to be surveyed on a mean between the entire west boundary and the entire east boundary.

How about the north-south center line of the south-east quarter? We look down here and we see that it intersects the meander line. It doesn't intersect the south boundary. So probably that's going to be a mean between the south half of the east boundary an the south half of the north-south center line, because we're dealing with the quarter then. Alright.

You know a method I've seen by folks at times, which I don't think is correct, maybe I'll mention that. They would set the south 16th on the east line of Section 8, and whether they go 20 chains or



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FRACTIONAL SECTIONS – PART 2

whatever, set the center-south 16th; and then go midpoint to set that south-east 16th. That's going to create and angle point at the 16th, which is not correct.

That needs to be a straight line from the center-east 16th all the way down to the lake. Yeah. Because that south-east 16th is an intersection. That's right. By definition, it's an intersection, and it needs to be set. Yeah and the fact that this is fractional or partially fractional doesn't change that basic rule of subdivision of sections. No. And really it doesn't change our approach.

First of all, we run the center lines to establish the quarters. Then we establish the 16th corners on the exterior of the quarter, and then we run the center lines and at intersection established the center of the quarter. That's our basic approach. Now sometimes, because of the fractional section where the water is, some of those corners don't exist, they're out in the water, but that's still is our basic approach.

So once we've got those two though, let's look at the southwest. If we survey the north-south center line on a mean bearing, how do we survey the north-south center line of the south-west quarter? Just look at that for a minute.

How are you going to do that? The north-south of the south-west. Well, you might think to begin with well that's a mean too. We're going to survey a mean there. But wait a minute. Remember that we have a meander corner here. And we have a section corner here. So, we have a section corner.

We have a meander corner. We have corners on either side. That's proportionate. You can proportionate the west 16th in. And then we're just going to connect the west 16th on the south boundary with the center west 16th. It's a straight line. Right.

So this is a fractional section, but the only two lines that really have to be surveyed on a mean are the north-south center line of the section, and the north-south center line of the south-east quarter. Right. That's a good example. Yeah. I think that about covers that one. Let's go on to this one.

FRACTIONAL SECTIONS – PART 2

Problem 15, Section 10

Cleawox Lake here in the middle of this section. This is a lake that's out in the sand dunes. That's where we got this really irregular shape here.

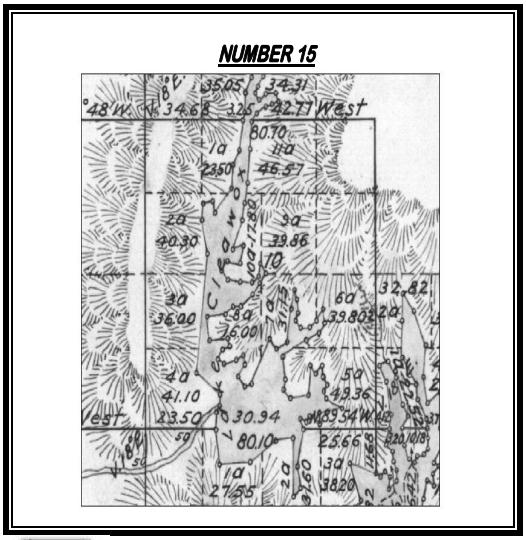


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

So, is this a fractional section or not? It's invaded by water, a considerable amount of it is taken up by water. But if we look, what do we see? We see a distance across that north. We see a distance across the south. It is not fractional. No. I think you've got everything you need here.

Even though water takes up a large percentage of this section, even though we have a lot of subdivision of section lines that close on the water, we still this is a regular subdivision. And, sometimes we can tend to look at the picture and say whoa! Look at all that water! Look at all that's been invaded. But, when all is said and done, it's not fractional. It can still be subdivided as a regular section, because we can establish every 16th corner and every section corner around the exterior, based on this survey and based on these numbers.

Now you notice there on Lot 11 of the section, that there is no north-south center line of the section. Are they telling us something there? Well, you know, there is, however, a quarter corner up there on that north boundary. And, of course, I think what they're telling us is if we created a lot, if we extended that north-south center line and created a lot there, it would be a poorly-shaped lot, and we don't want to do that.

Right. Yeah the bottom line is the fact that that line doesn't continue through there doesn't mean that something's different or wrong with the center section, or excuse me the mid-section line. Because in fact the north-south center line is defined by the two quarter corners, and you have both quarter corners from the same survey. Yes. Yes. And even though last 20 chains of it doesn't show up on the plat, it still is controlled the same.

One more question. On the very south line there, we've got 30, almost 31 chains across the lake. I mean obviously that could start really being a potential problem. Is there any circumstance there where you might look at this section differently? You know, I

FRACTIONAL SECTIONS – PART 2

think there is, and I think we have our next example maybe might kind of clarify that or help.

Because obviously, any time we identify blunders, it's going to change our method. Or may change our method. We have to start looking at modifying how we look at things, and protecting the plat, protecting the rights, and trying to put the blunder where the blunder occurred. Exactly. So, that might happen.

Well, I want to look at a couple more things on this plat that really don't have to do with how it's subdivided, but they have to do with a little bit of riparian issue. So I want to show you something. If you look at the center quarter of this plat, you will find that the lake invades all four quarters and that the center quarter falls in the lake.

Well, when this section was surveyed, we found that the center quarter did not fall in the lake. And actually, an inspection of the record found that when the draftsman plotted this lake on the plat, he left out a course, and that got the shape of the lake wrong. So, when we actually subdivide this, the center quarter does not fall in the water.

So what do we do? What about this south-east quarter of the section? I think it was Lot 7 originally. Right. The north-west of the south-east. Lot 7 originally. What do we do about that? On the original plat, it's shown as being riparian. Touching the lake, it has rights to the water. But now we subdivide it and survey it, and it doesn't touch the lake. What happened to those rights? Are there some riparian rights? This is going in maybe to a little bit different subject, but, it's something that when we deal with fractional sections, we deal with all the time. So I think we need to talk about it here.

FRACTIONAL SECTIONS – PART 2

One of the principles is, a lot is riparian if it is riparian in fact.

Remember, that all of these lines are protracted on here. Not everything is measured, and when you start protracting water and protracting sometimes even mining claims or grant boundaries, and then the subdivision of section lines. We don't always get the picture right on the plat.

So the rule that we live by is, if it's riparian in fact, then it's riparian. In this case, it was not riparian in fact, so it is not riparian. Now, so what are you going to do with that little triangle that's suddenly been created that wasn't on the plat at all? Yeah. What do we do?

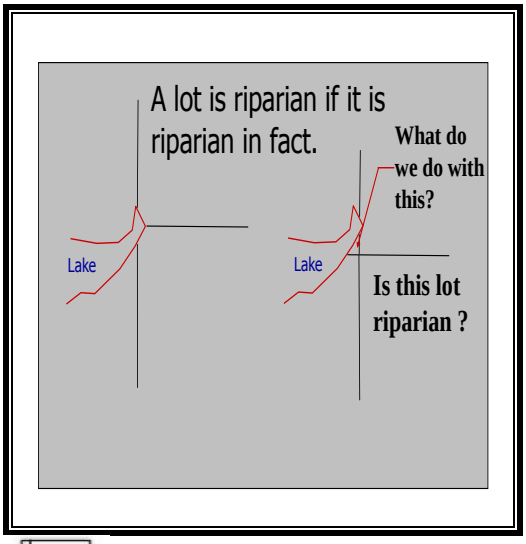


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

Well, we've got to attach it to somebody's lot because we've surveyed all this, right? Well, we don't normally lot across the center line, but we do on occasion. Here, we have the east-west center line and the north-south center line crossing.

We will normally lot along that north-south center line first and cross the east-west first before we would cross the north-south. So what we ended up doing is making this little triangle part of this lot down here. And, that took care of the problem.

Now Lot 7 is not riparian now and it looked like it was, but it's not riparian in fact when we subdivide this section. So that's just something I wanted to point out that was kind of unique to this particular one. And I might say that when this survey was done, the Washington office was consulted on this. So there was a lot of thought went into this.

There was quite a bit of discussion about how that should be done. And there's the final plat and you'll notice right here that there's a new lot created, and to make it clear there's a land hook across there that shows that that lot down there to the south now it's new Lot 15, contains that little triangle. So in the future we know. It's not confusing.

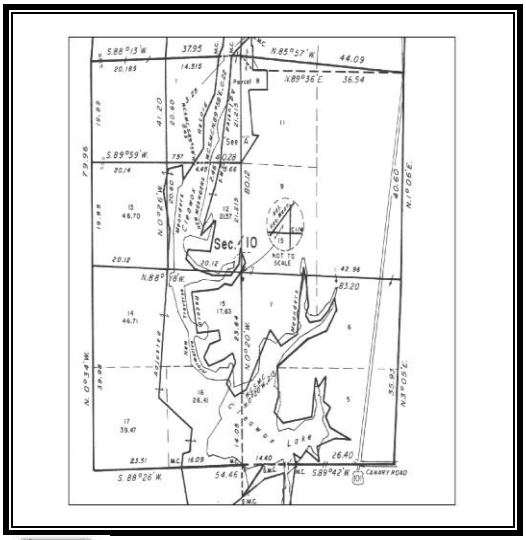


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

FRACTIONAL SECTIONS – PART 2

Number 16, Section 33

And here again we have a lake. This one's interesting because we have all four section corners. They're monumented and on the ground. We have two of the quarter corners are monumented, and the third on the west boundary, we have a distance across (for the east boundary) on the east boundary. Thank you.

On the east boundary we have a distance across. So the only place that we're missing something is the north boundary. But, again, we have nothing. No bearings and distances. So, fractional. It's fractional. The reason I wanted to look at this one though in a little more detail was I wanted to talk a little bit about how we're going to subdivide it.

Because again, Dennis mentioned the difficulty that these surveyors often had getting distances across water, and sometimes even bearings are not very good where they cross the water. So let's look at this. We say that it's fractional, so normally we would survey the center lines of the section on a mean bearing and so forth.

Well, let's look at this line right up here, and how would we survey that? And, I think we would have to look real hard. In this situation, because of the lake and how extensively it invades the section. The fact that we have no tie across the north boundary, and a tie across the south boundary, I think we might look at subdividing this maybe parallel with the north boundary. Yeah.

What you're saying is, treat the two halves, well they're not halves, but the two portions of the section 33 actually independent of each other, right? Yes. Yes. Two fractional sections, essentially. And I'm not saying that's the way it should be done. What I'm saying is, when we're dealing with fractional sections, we have a lot more latitude and we need it.

We need more latitude to get the section subdivided equitably, and that's what we're trying to, we are trying to subdivide it based on the numbers on the plat; and, there's a real good likelihood that the land east of the water and west of the water really don't relate very well. And if we try to survey center lines across that water, we're going to distort one side or the other.

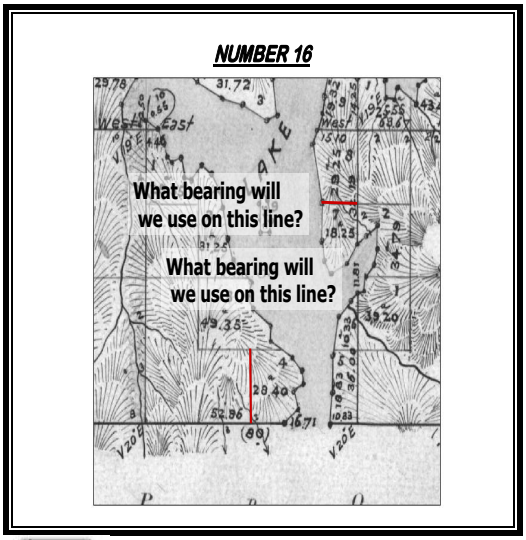


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

FRACTIONAL SECTIONS – PART 2

So what you're saying here is that the east quarter, you're going to go ahead and you would establish that position for work on the east side of the section. But even though you have that position, you would not use it for the east-west center line. Yeah. I may not. I understand. I may not. Yeah. Yes. And the same thing with this. Well what's the bearing will we use for this line?

Well in looking at this originally, for the north-south center line, what would we normally see? A mean between the east boundary and the west boundary. Yeah. Here, you might consider, be aware, that maybe parallel with the west boundary might be the most equitable solution, because of how extensively this section is invaded by water, and that mean might not give you a good answer. So, I wanted to put this one up here just so that we got that discussion in there. When it's fractional, we have a lot more latitude in how we want to approach it.

We want to approach it though in a logical process, the way that the law tells us, but we also want to protect this plat in the areas. With latitude, with more ways to do it, with more judgment involved, comes the responsibility on our part to document. And so any time you're dealing with a fractional section, there should be a lot more documentation.

I think we want to leave a good trail for that next person. That's right. You know I've always said, you know, people may not agree with what I did, but they'll be no question in their mind what I did. And why. And yeah, and so you can't leave a better legacy than that, and frankly just the odds are people will accept what you've done before if you've documented it, even if it isn't their favorite solution. You've thought it out. So and that's something in the private sector.

I know, having worked there many years myself, you just don't document anything, you just, you know. Everything's just slam, slam, slam; and, you may think, you may come with a really great solution, but, especially on a witness stand, if somebody says, "but did you consider this?" You want to be able to say, "yes, I did." And I chose this other one because of that, rather than say no I never thought of that. So documentation's the best way. Yeah.

FRACTIONAL SECTIONS – PART 2

When I first started surveying, I thought I'd remember every survey I'd ever done, but about halfway through the career there, they're all lost. Yeah. You know, I want to make another point, and that is that Dennis and I come from very different backgrounds. Dennis has experience with the Forest Service and in the private sector.

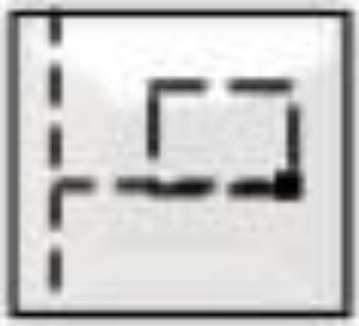
My experience is almost completely with BLM. But when we sat down and looked at these 16 examples, we agreed completely each time on which one's were fractional and which one's weren't, and the prcedures, with the one exception where we had a minor disagreement.

And one of the things that I want to make a point about, if you begin to have a logical approach, to how we should be evaluating these, how to determine if they're fractional, and then how they should be surveyed, you're going to find that you agree with your neighbor's, with your other surveyors, fellow surveyors, and we're not going to run in to a lot of the problems that we have when we start setting multiple monuments and we do things differently.

So. Well. Thank you. I've enjoyed it and I've learned some things and these are some great examples. I think they're great for the CFedS and for anybody to take a look at these definitions. So, thanks and I hope you have enjoyed it.

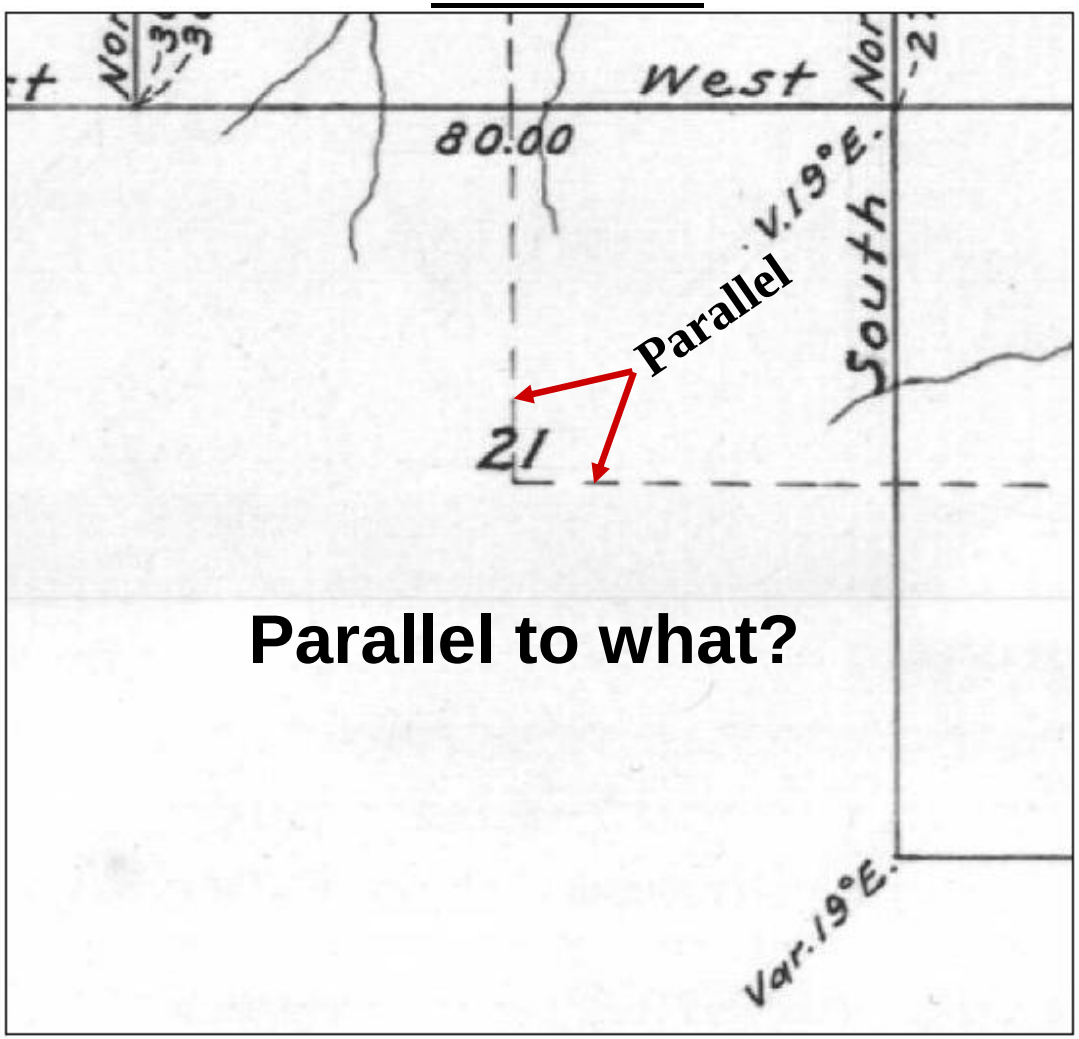
Dennis is going to leave us now and we'll take a short break, and then we're going to continue with just a couple more subjects, and then we'll wrap up our subdivision of sections.

Before moving on to the next topic, complete the "Determine Proper bearing for N-S and E-W Center Lines" problem which you can access from the course description page.



DIAGRAM

NUMBER 1



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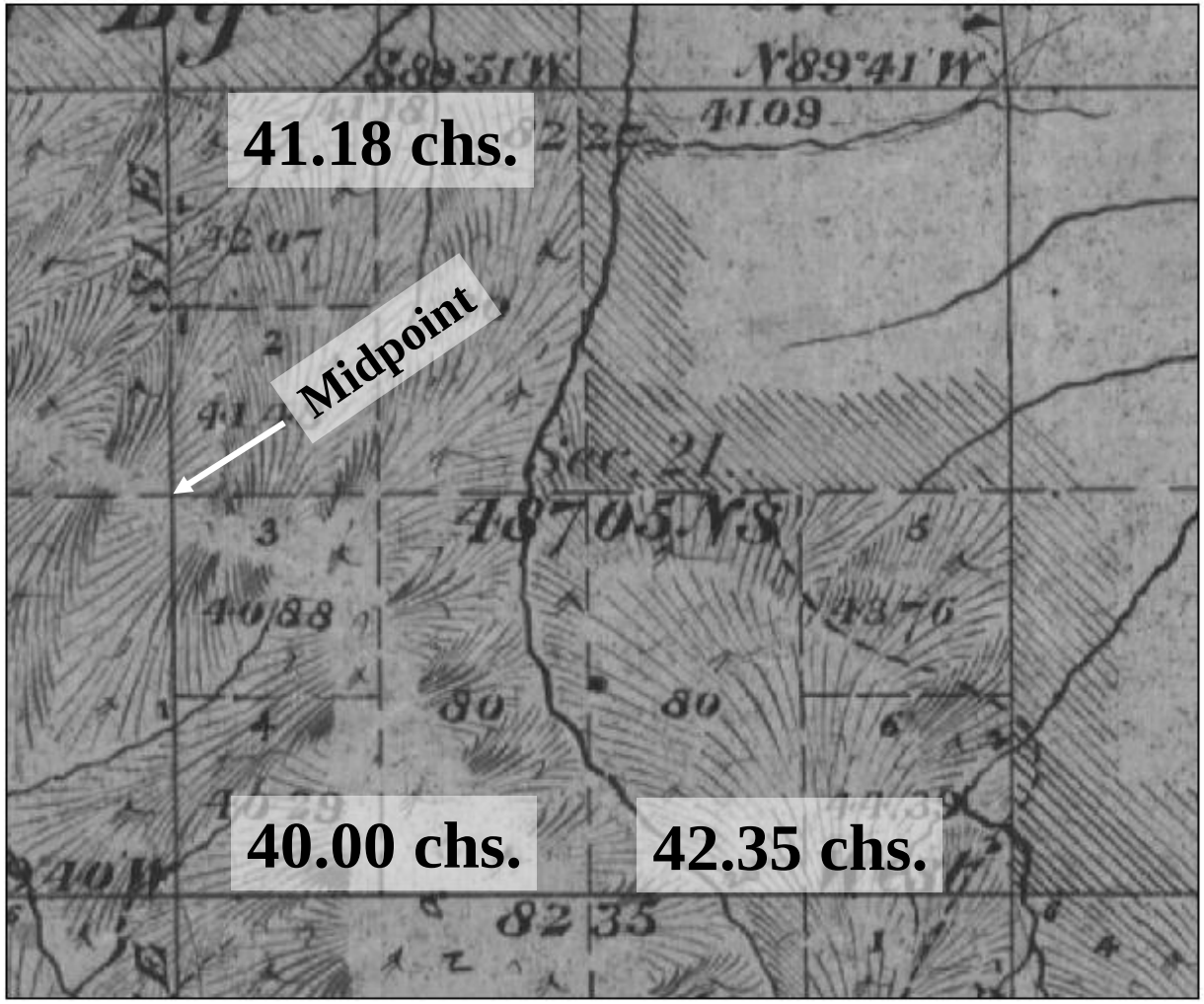

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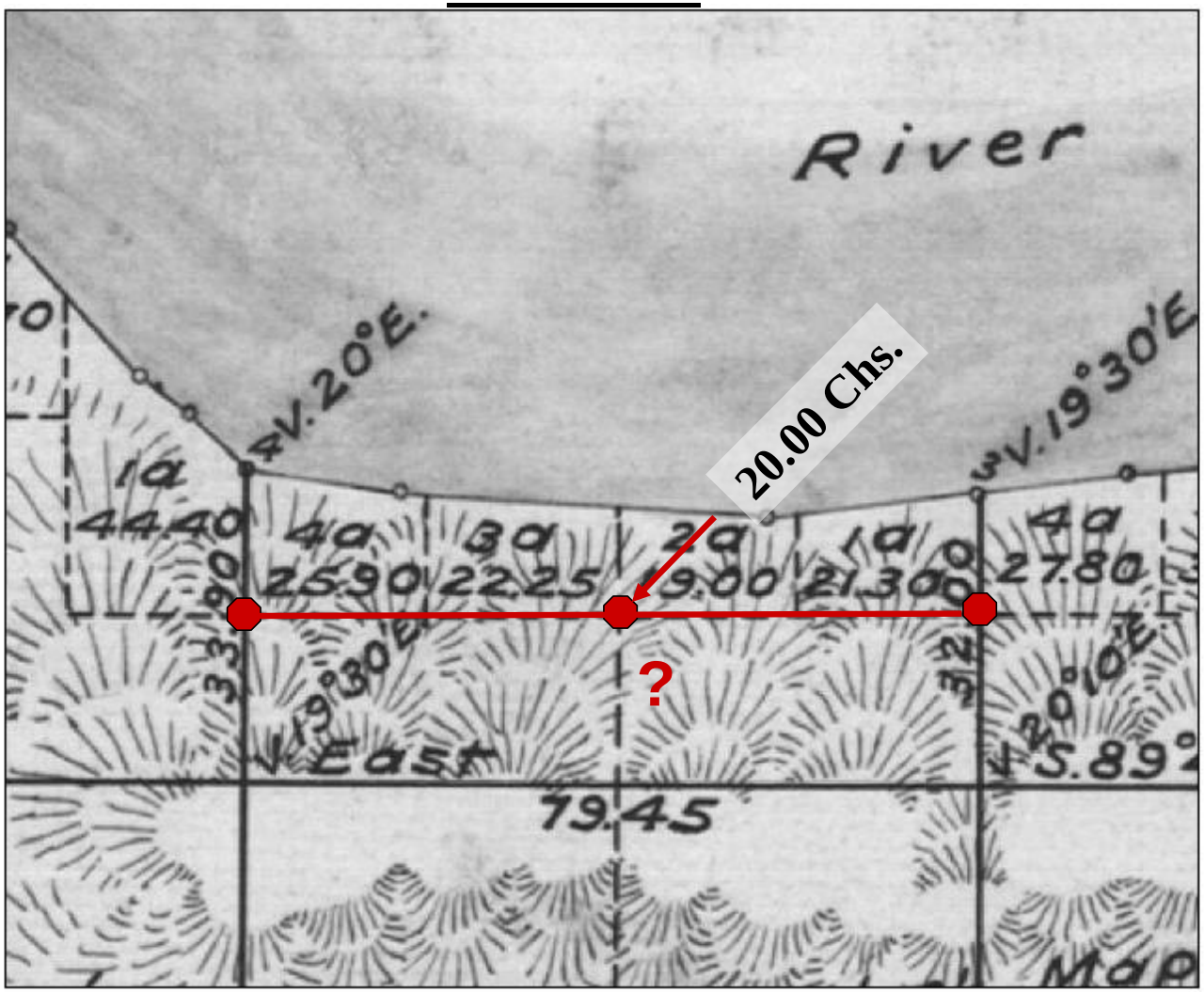
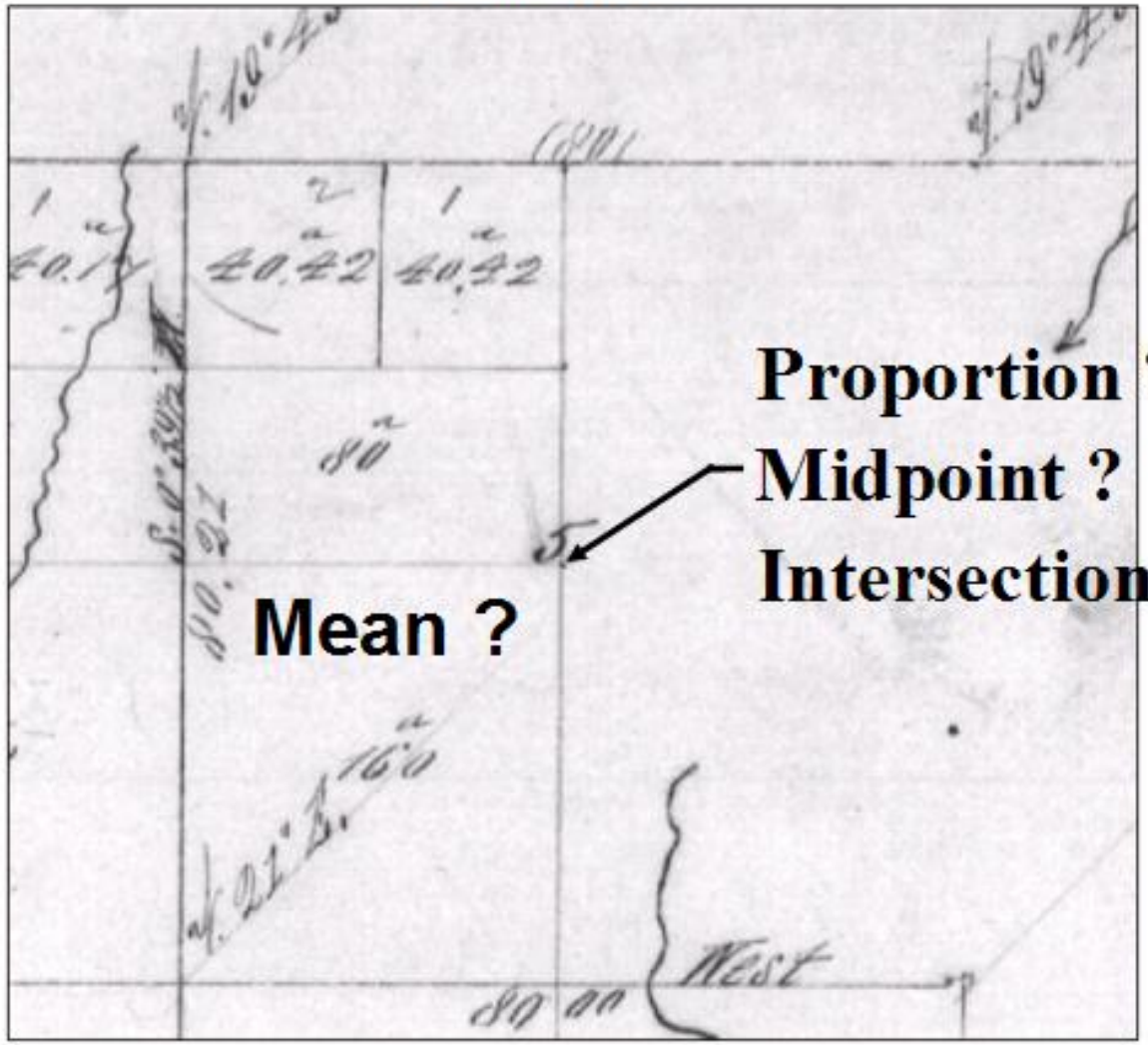
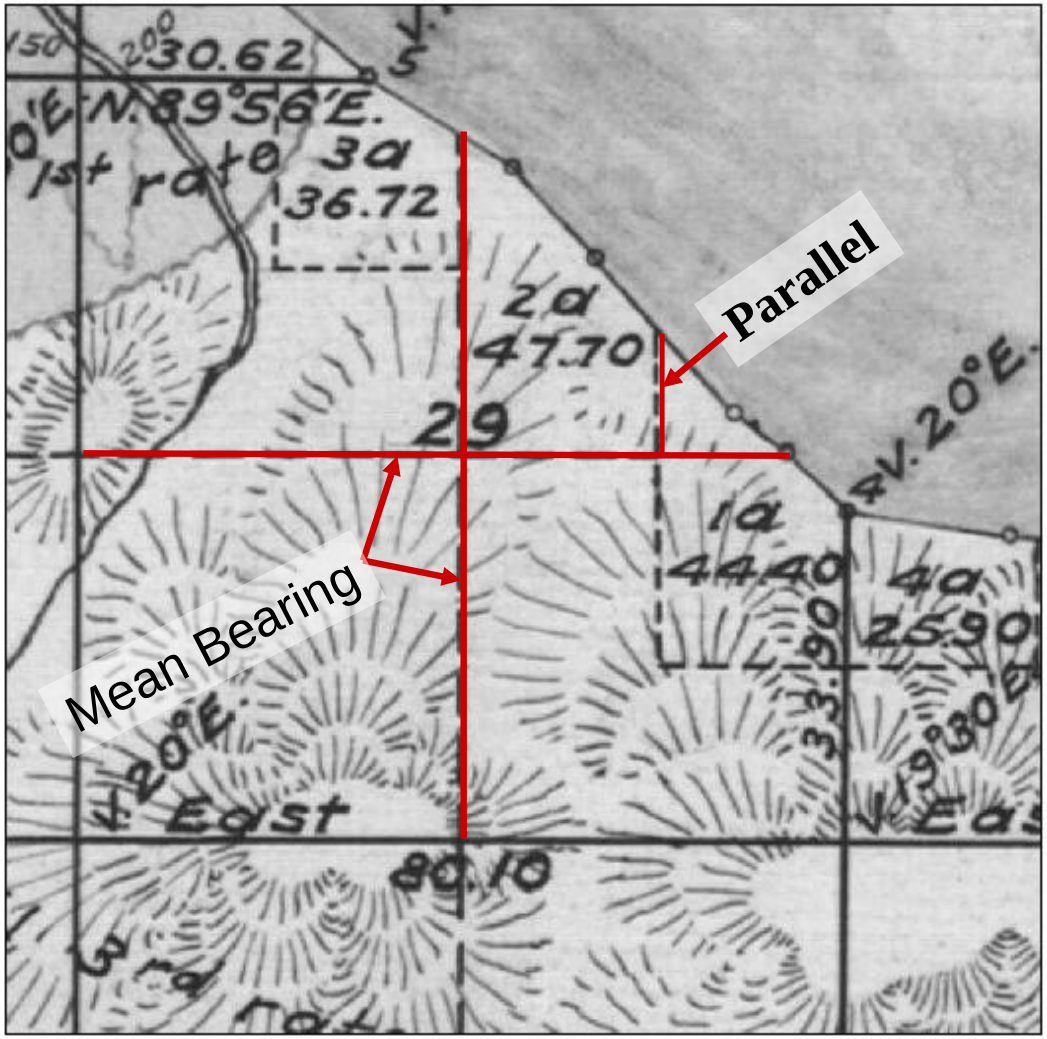

River
20.00 Chs.
4V. 20°E.
3V. 19°30'E
1a
44.40
4a
25.90
3a
22.25
2a
19.00
1a
21.30
4a
27.80
?
East
79.45

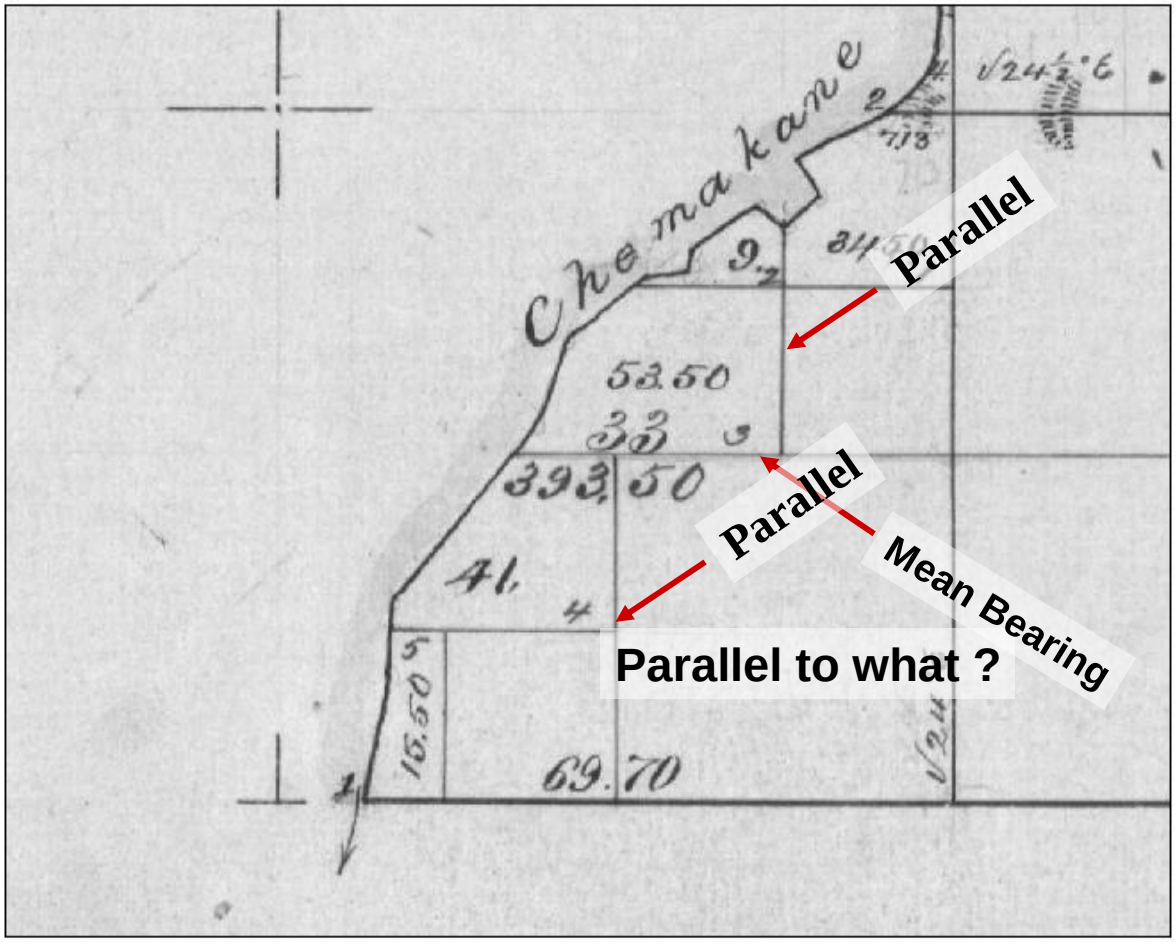
NUMBER 4



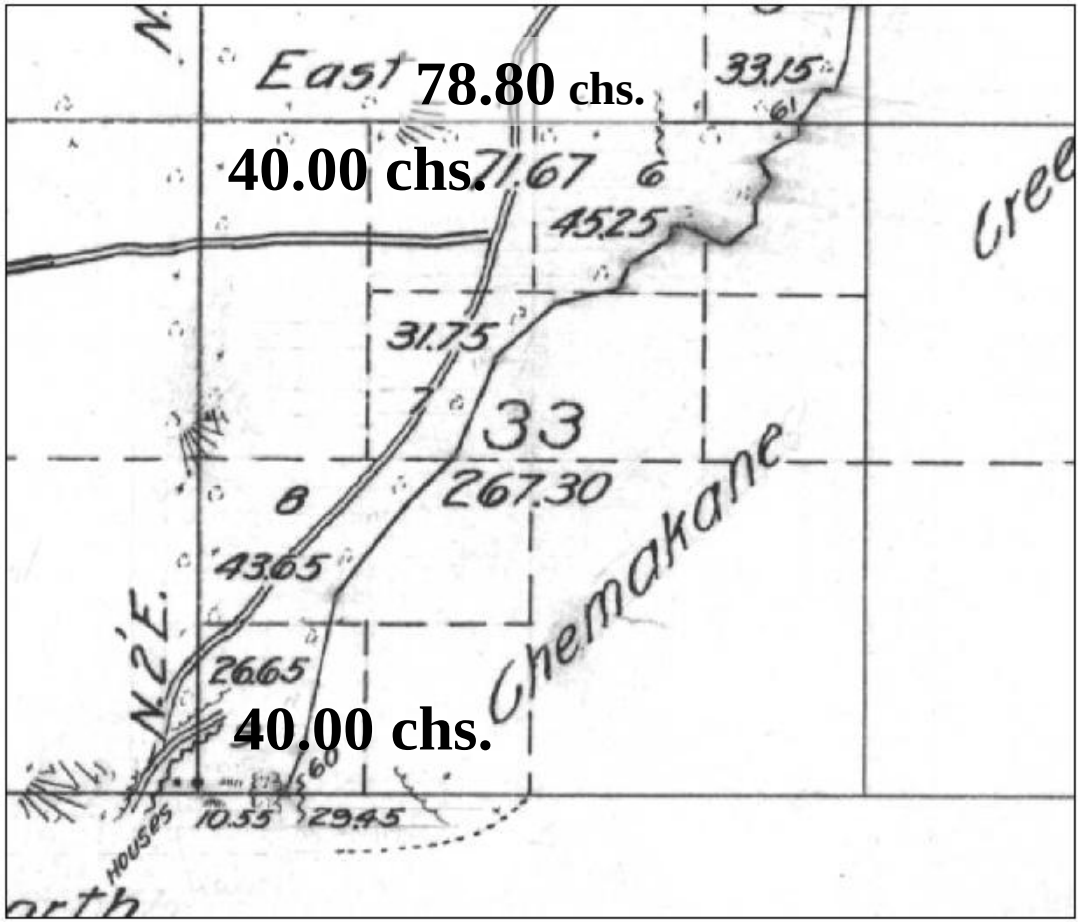
NUMBER 5


30.62
N.89°56'E.
36.72
2a
47.70
29
Parallel
Mean Bearing
1a
4a
East
80.10

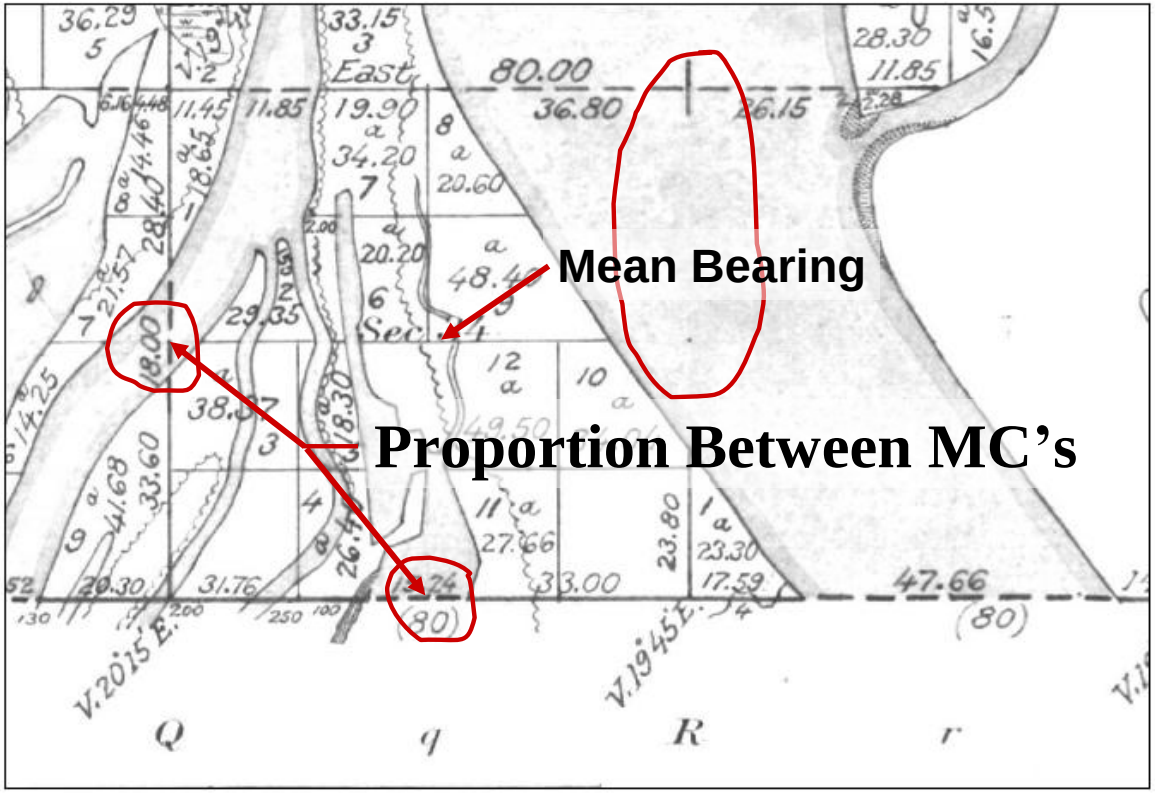
NUMBER 6


Chemakane
Parallel
Parallel
Mean Bearing
Parallel to what ?

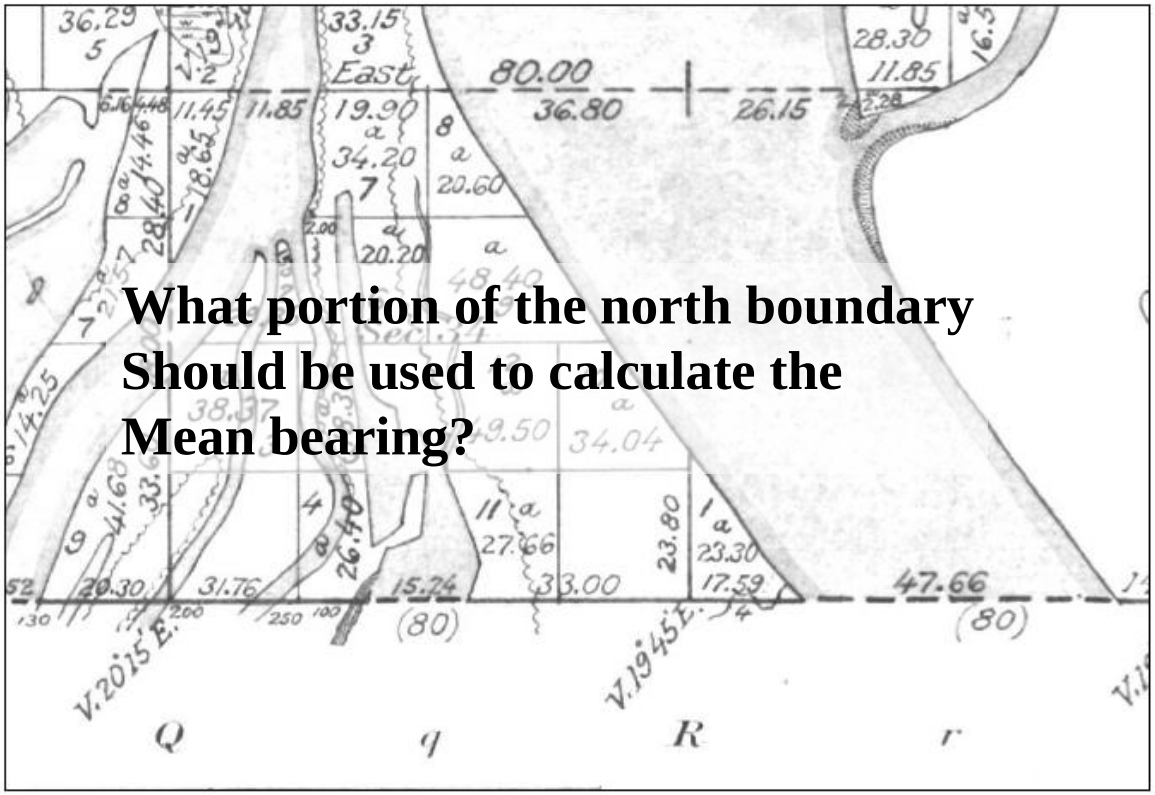
NUMBER 7


East 78.80 chs.
40.00 chs.
40.00 chs.
33.15
7.67
6
45.25
31.75
7
33
8
267.30
43.65
26.65
N.2'E.
Chemakane
10.55
29.45
HOUSES

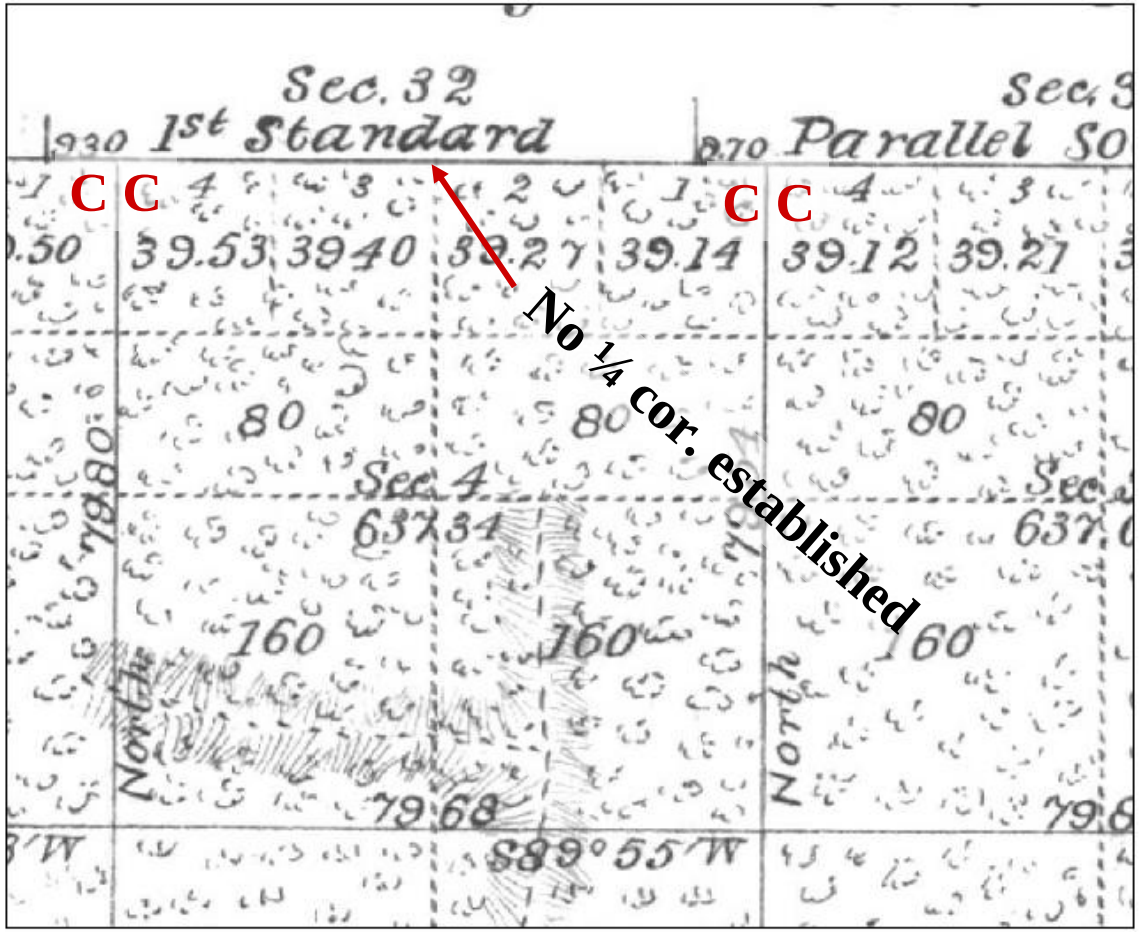
NUMBER 8


Mean Bearing
Proportion Between MC's
80.00
36.80
East
Sec
47.66
(80)
Q
q
R
r

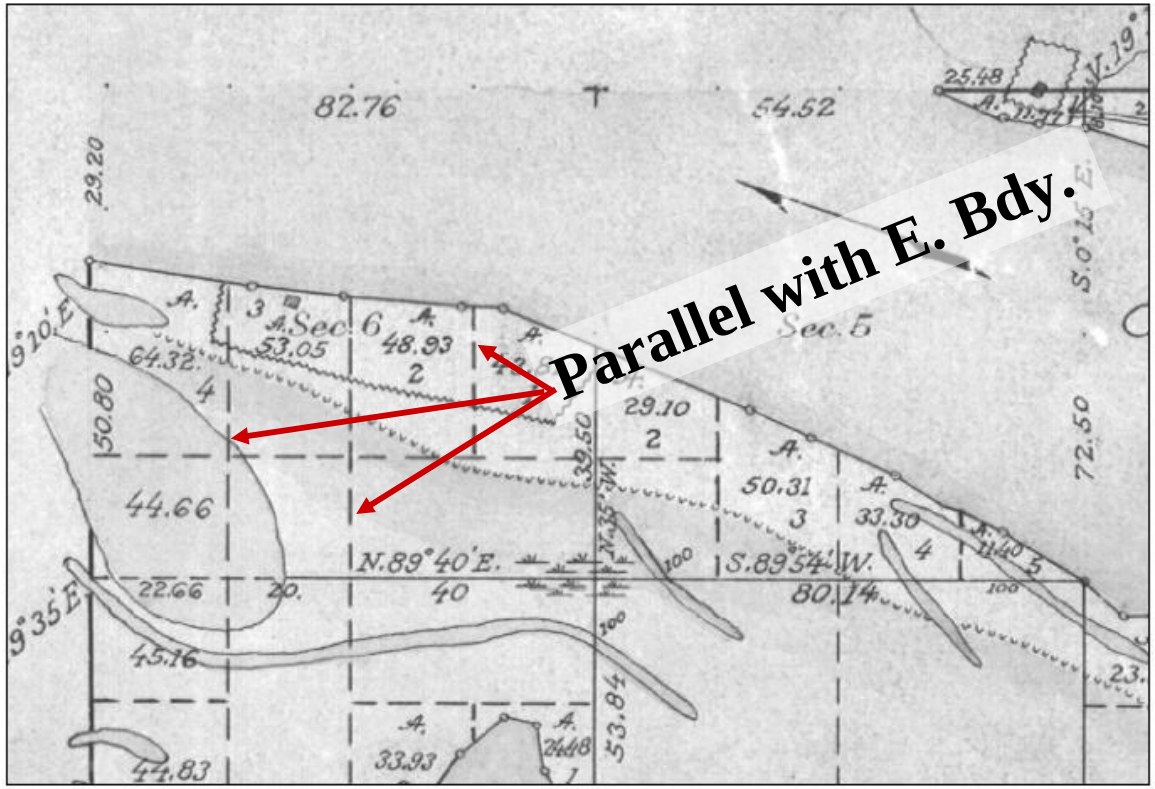
NUMBER 8

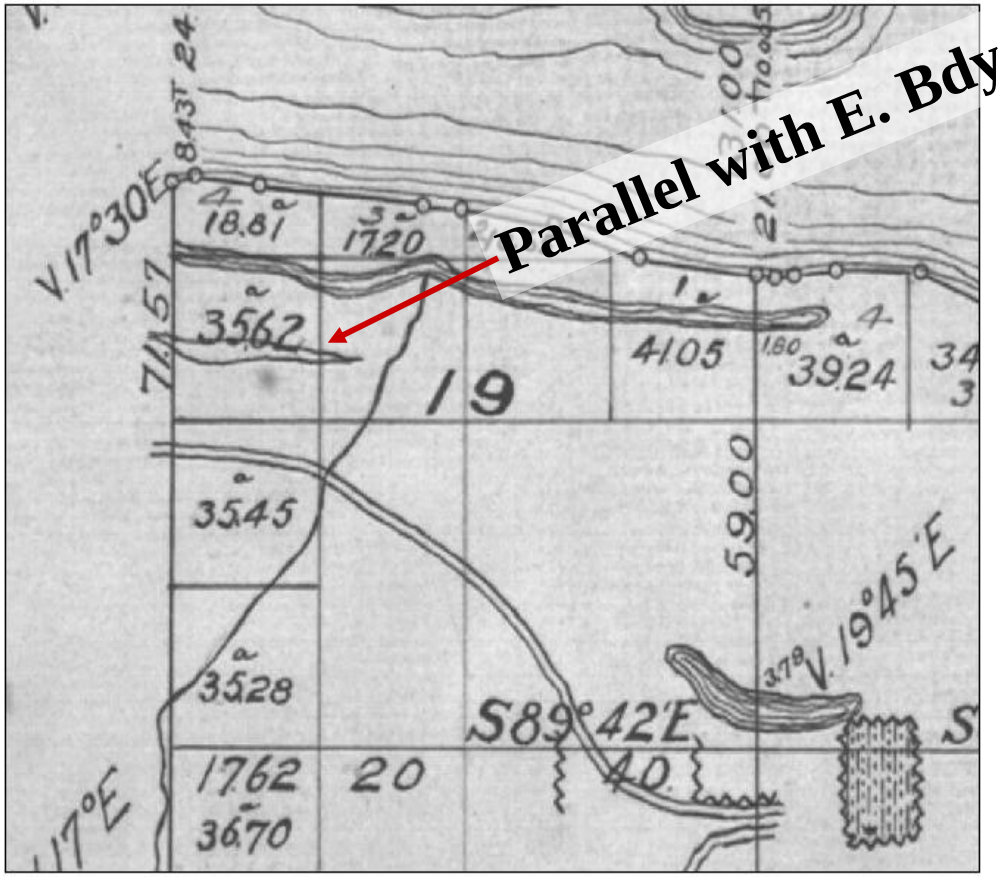

What portion of the north boundary
Should be used to calculate the
Mean bearing?
80.00
36.80
26.15
47.66
15.24
33.00
(80)
(80)
Q
R

NUMBER 9

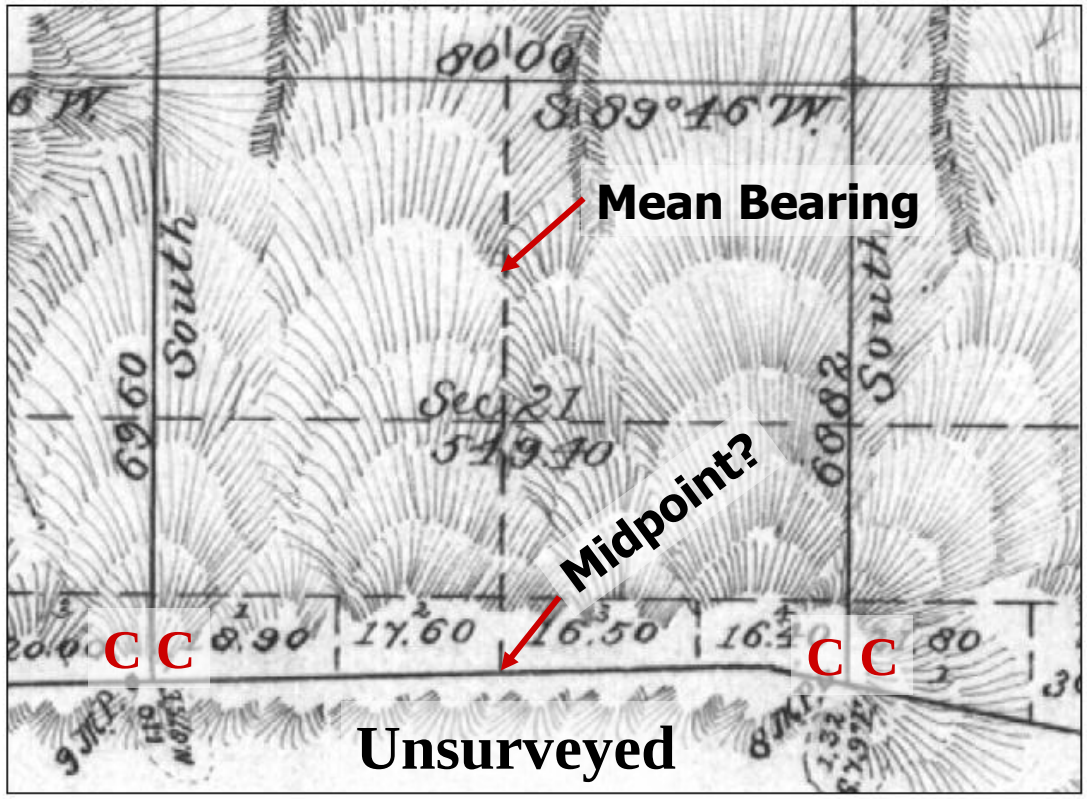

Sec. 32
1st Standard
Parallel
C C
C C
39.53
39.40
39.27
39.14
39.12
39.21
80
80
80
Sec. 4
637.34
637.
160
160
160
North
North
79.68
79.8
S89°55'W
No ¼ cor. established

NUMBER 10

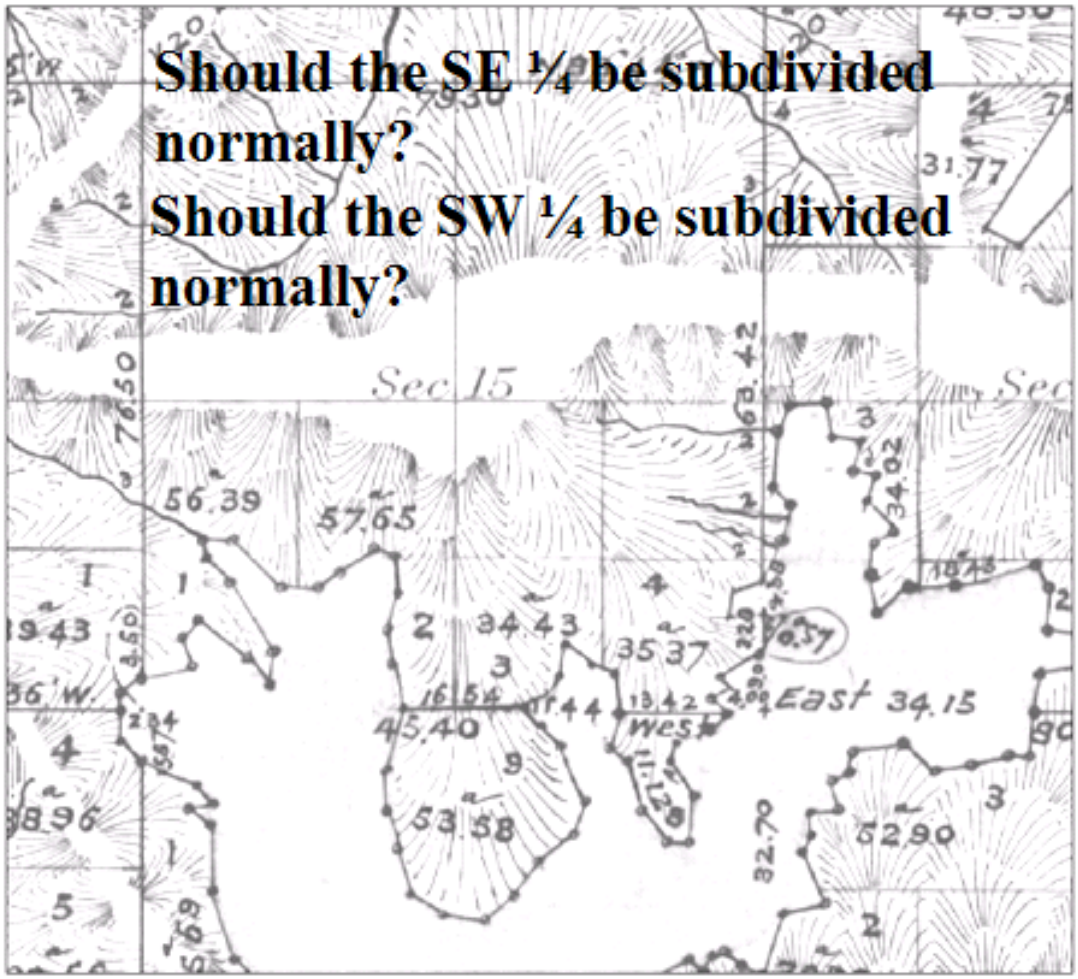

Parallel with E. Bdy.
82.76
54.52
25.48
29.20
Sec. 6
Sec. 5
53.05
48.93
64.32
50.80
44.66
29.10
50.31
33.30
72.50
N.89°40'E.
S.89°54'W.
40
80.14
22.66
45.16
44.83
33.93
53.84


Parallel with E. Bdy.
V. 17°30'E
843.24
18.81
17.20
35.62
74.57
19
41.05
39.24
35.45
59.00
V. 19°45'E
35.28
S 89°42'E
40.
17.62
20
36.70
17°E

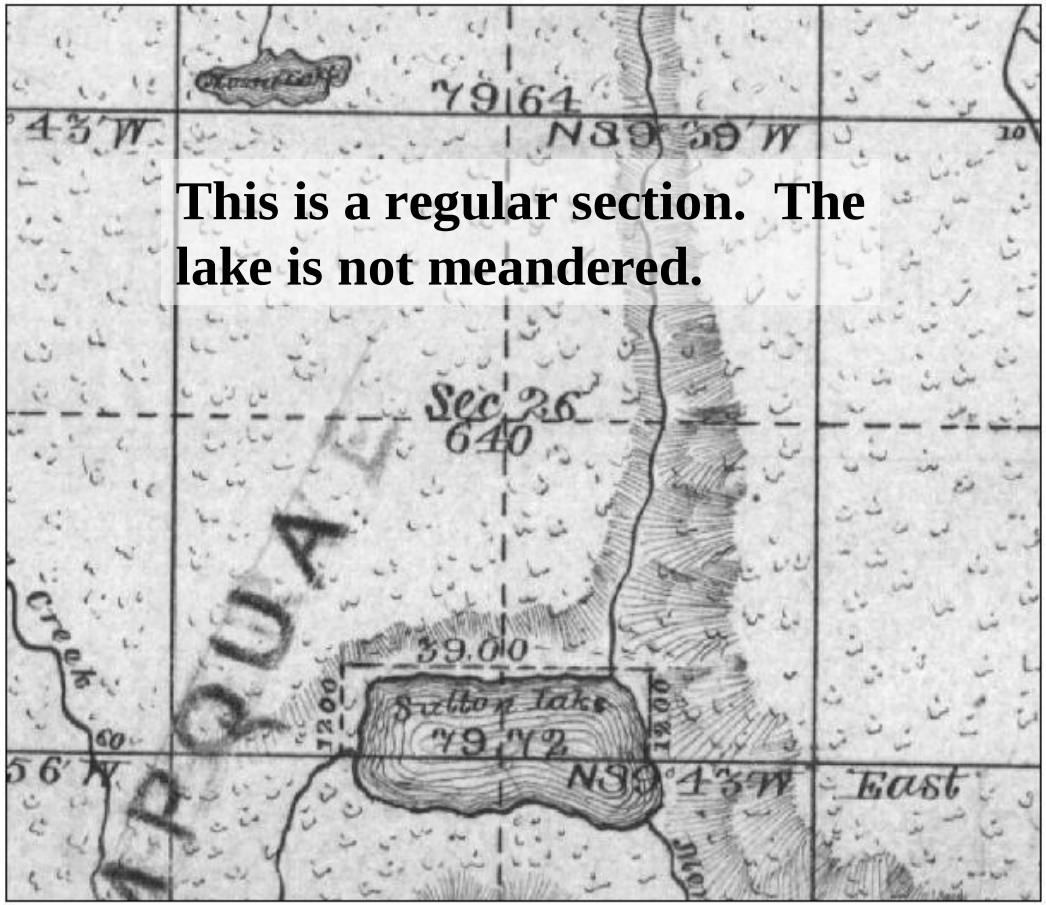
NUMBER 11


80.00
S.89°16'W.
Mean Bearing
South
69.60
Sec. 21
5149.10
6882
South
Midpoint?
C C
8.90
17.60
16.50
16.5
C C
80
Unsurveyed

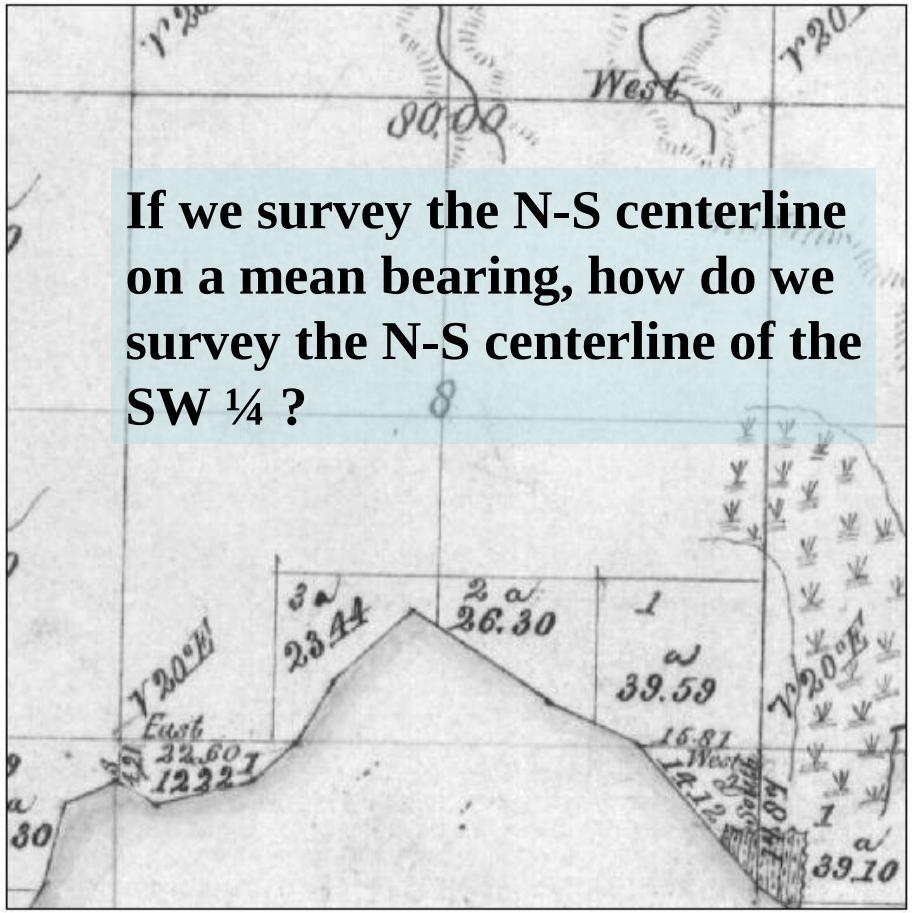
NUMBER 12


Should the SE ¼ be subdivided normally?
Should the SW ¼ be subdivided normally?
Sec 15
56.39
57.65
34.43
35.37
East 34.15
West
45.40
53.58
52.90
31.77
34.02
32.70

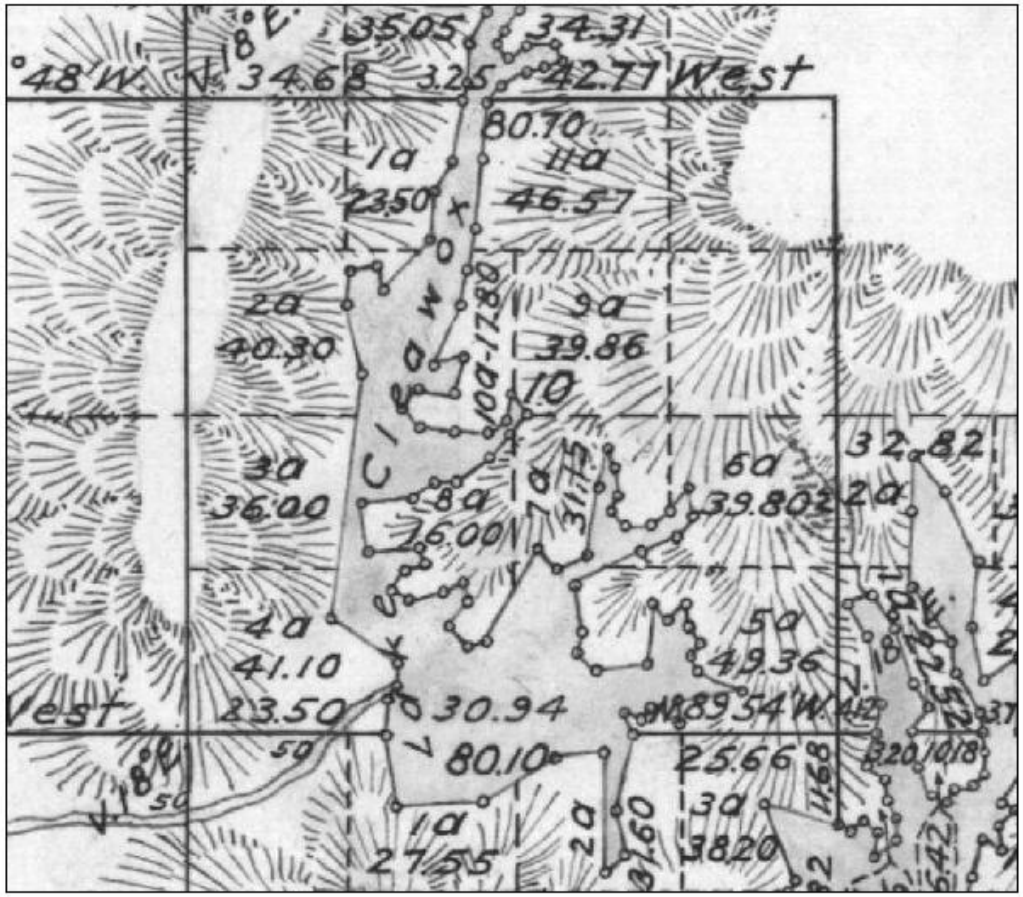
NUMBER 13

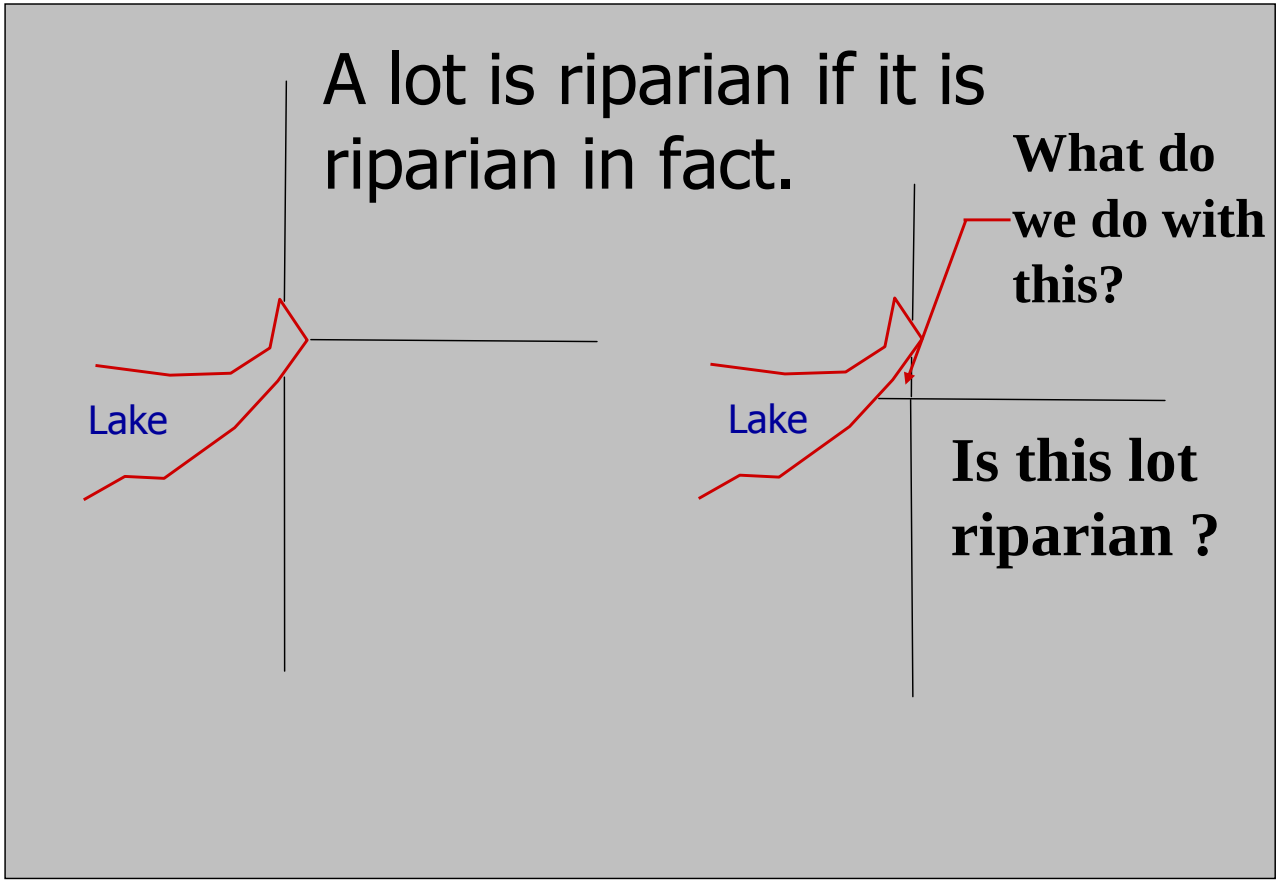

79.64
N89°39'W
This is a regular section. The lake is not meandered.
Sec 26
640
39.00
Sutton Lake
79.72
N89°43'W
East
Creek

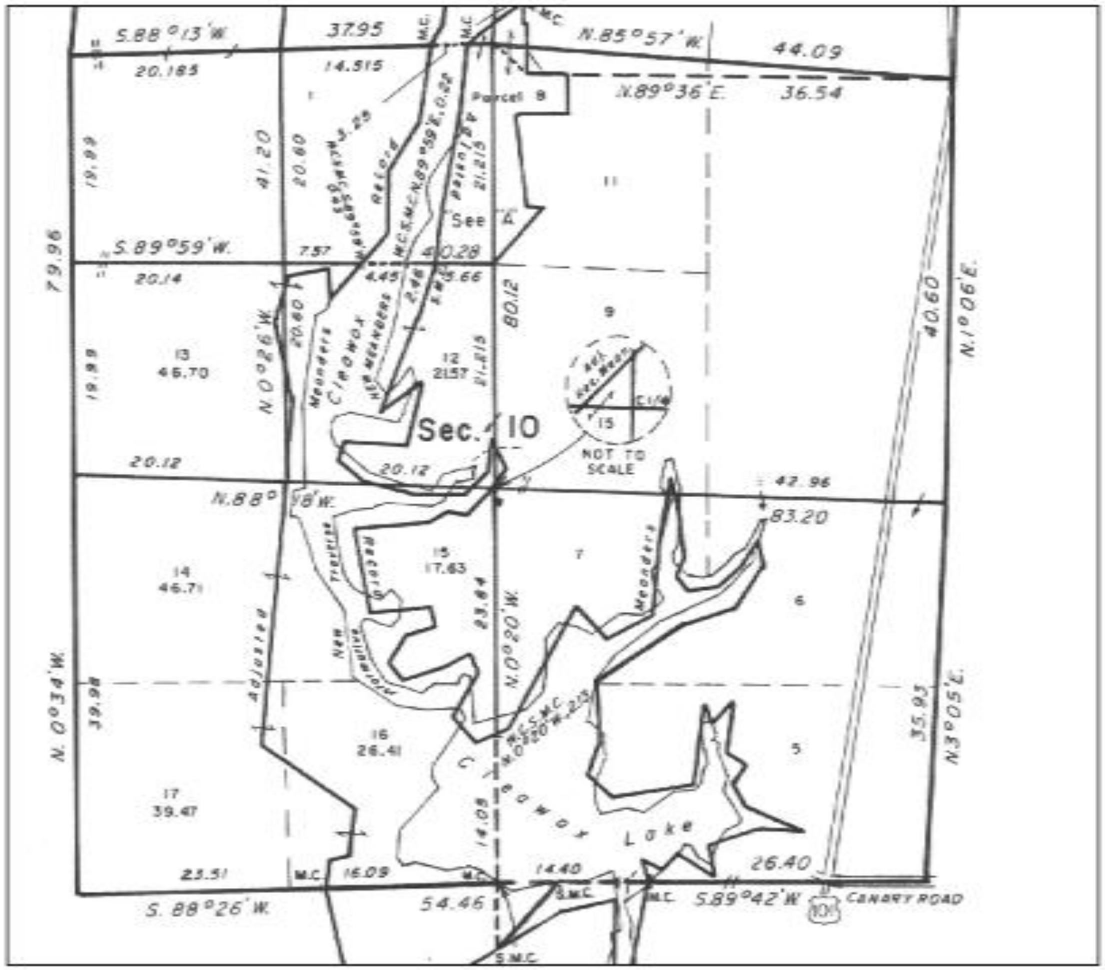
NUMBER 14


West
80.00
If we survey the N-S centerline on a mean bearing, how do we survey the N-S centerline of the SW ¼ ?
3
23.44
2
26.30
1
39.59
East
22.60
16.81
West
14.12
1
39.10
30

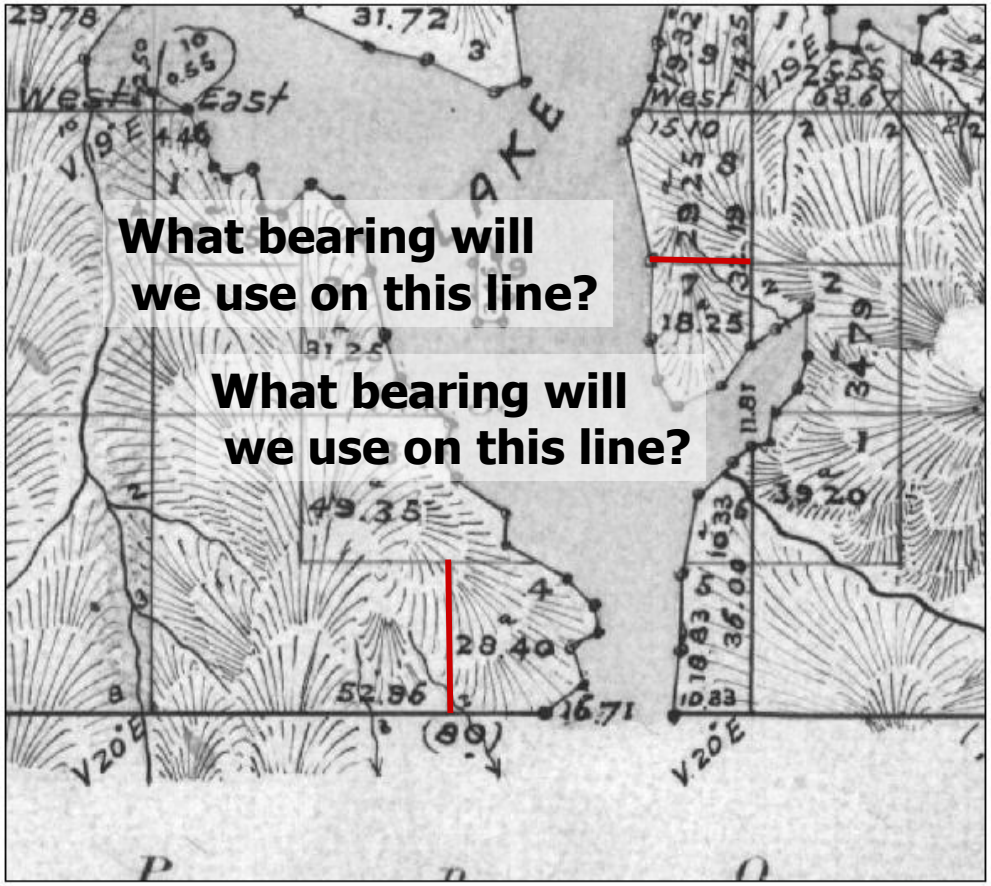
NUMBER 15


35.05
34.31
°48'W.
N. 34.68
3.25
42.77
West
80.10
1a
23.50
46.57
2a
40.30
39.86
10
3a
36.00
8a
16.00
6a
39.80
32.82
2a
4a
41.10
23.50
5a
49.36
West
30.94
N89°54'W.
80.10
25.66
1a
27.55
3a
38.20


A lot is riparian if it is riparian in fact.
Lake
What do we do with this?
Lake
Is this lot riparian ?


S.88°13'W.
37.95
M.C.
N.85°57'W.
44.09
20.185
14.515
Parcel 9
N.89°36'E.
36.54
19.99
41.20
20.60
Record
Patent BV
21.215
See "A"
11
79.96
S.89°59'W.
7.57
40.28
20.14
4.45
2.46
5.66
80.12
9
20.60
13
46.70
N.0°26'W.
Meanders
Cirowox
12
2157
21.215
Sec. 10
NOT TO SCALE
C1/4
15
40.60
N.1°06'E.
20.12
20.12
N.88°18'W.
42.96
83.20
15
17.63
7
Meanders
6
14
46.71
Adjusted
New
23.84
N.0°20'W.
N.0°34'W.
39.98
16
26.41
5
35.93
N3°05'E.
17
39.47
14.05
Lake
26.40
23.51
M.C.
16.09
14.40
S.88°26'W.
54.46
S.M.C.
S.89°42'W.
CANARY ROAD
101

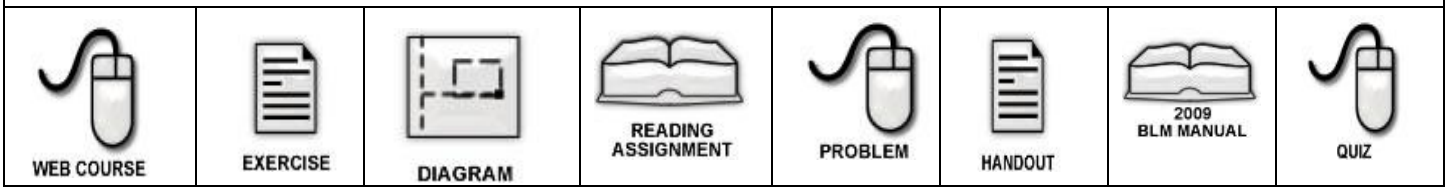
NUMBER 16


What bearing will we use on this line?
What bearing will we use on this line?
West
East
West
31.72
49.35
28.40
52.86
16.71
18.25
39.20
36.04
V.19°E
V.20°E

Course 6: Subdivision of Sections Study Guide

COURSE DESCRIPTION:	This course focuses on the subdivision of sections. It addresses subdivision of normal sections, lotted closing sections, elongated and fractional sections, as well as the unique method known as the "three mile method" on many Indian Reservations and some private lands.
COURSE OBJECTIVES:	Upon completion of this course, students will be able to: • Learn to properly subdivide regular sections • Identify exceptions to section subdivision rules • Demonstrate an understanding of area relationships on GLO/BLM plats • Identify and deal with fractional sections
COURSE INSTRUCTOR(S):	Ron Scherler, Bureau of Land Management Dennis Mouland, Bureau of Land Management
VIDEO LECTURE TITLE:	Fractional Sections – Part 3 (13 minutes)

ICON LEGEND



FRACTIONAL SECTIONS – PART 3

Section 21, 5 Chain Blunder on the South Boundary

There are about two or three things that I'd like to cover. Kind of little additional issues that come up and I'd just like to tuck them in here in this last part of the course.

First of all, let's look at 43 USC 752. "All the corners marked in the surveys returned by the Surveyor General shall be established as the proper corners of section or subdivision of section which they were intended to designate, original corners."

43 USC 752

"All the corners marked in the surveys, returned by the surveyor-general, shall

be established as the proper corners of sections or subdivisions of sections which they were intended to designate."

(Original corner)

That pertains to not just section corners, not just quarter corners, it pertains to closing corners, meander corners, witness corners, all of those things this statement pertains to. I want to look at an example where we begin to have a little problem. And it's a subdivision of a fractional section and when we look at the section.

First of all, the original survey – And here's the lines that were surveyed in the original survey. The distance across the south boundary was 38.50. The resurvey found the original section corners, the meander corner up there on the north, found the quarter corners. And down here on the south, we found the original meander corner also. But, instead of being at 38.50, it was at 43.50. Five chain bust long there. It had not been moved. The river has not moved. It actually fits the river just fine.

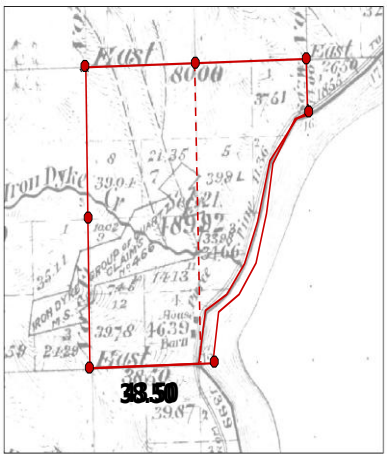


DIAGRAM **A full size version of this can be found in the Diagram section at the end of this study guide.**

There was a five chain error there. Well, look what happens when we try to subdivide the section. If we subdivide the section to a point that's 40 chains, we protect all of the section to the north except that lot 4 it loses its riparian ownership. And in this particular section, when we did the resurvey, the original survey was very good.

Everything was very good except that south boundary. So if we survey to a point that's 40 chains, we protect all the areas in that section except lot 4 because lot 4 had riparian ownership. And

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remember what we just read. That the corners marked by the Surveyor General are going to be the corners that they're marked for. We have a meander corner that we've recovered out here and the quarter corner is supposed to be 1 ½ chains east out into the water.

If we change our north-south center line and we move it out into the water, look what it does to the rest of the section. We have a blunder, we have an error, we have a fractional section. This may be a situation again where we modify our subdivision of section. We may do something where we survey the north/south center line to the north half, basically on a cardinal line or pointing towards that point 40 chains down. And then the south half of the north-south center line we may actually run to that point out in the water. Or run some kind of a mean.

This is a situation where we may have to actually compute a point out into the water to protect the integrity of the plat and the intent of the original plat. That was what I wanted to show you. In all of our examples so far, Dennis and I kind of talked about we don't want to get to these computing points out in the water. Well sometimes you may want to though. And this is one of the times when something like that might happen. When there is a major discrepancy here. Just wanted to bring that to your attention.

Again, with fractional sections, often we have to modify our methods. But we always want to document it, we want to come up with a method that protects the plat that's equitable to everyone in the section and a good documentation to what happened.

Portions of the Section on Opposite Sides of a River do not Line Up

Let's look at some things. Often, maybe not often, but on occasion, sections on opposite sides of the river that on the original plat are shown as being very regular with just a stream going through the middle.

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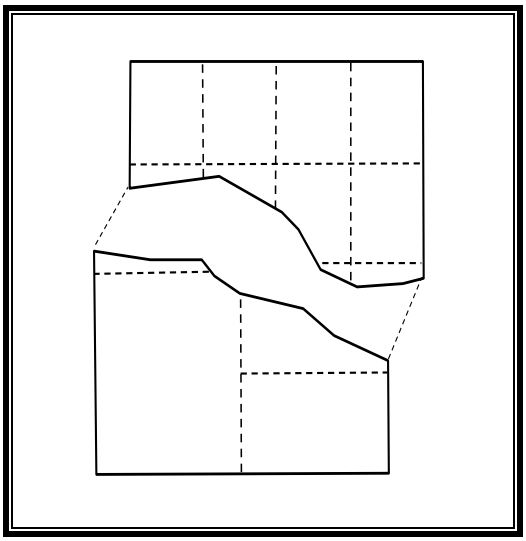
When we actually survey them, they look like this. The north and south halves don't line up. That north of the river does not line up with that south of the river. And this often happened because the river was very difficult to cross when the Deputy Surveyor was there and he may have only crossed it once. And then surveyed everything north of the river and surveyed down to the river and surveyed everything south of the river and surveyed up, but never made the connections across. Because he couldn't cross the river easily.



And if he got some kind of an error where these lines did not line up and he couldn't find his monument on the other side, no connection was ever made. When we have this kind of a situation, we may want to treat this as two separate fractional sections.

Even though we do have a quarter corner on the north, we have a quarter corner on the south, we may not want to survey a straight line between them. We may want to survey a mean bearing north of the river and a mean bearing south of the river. Again, what's the intent of the plat? And what actually happened on the ground? And how do we best protect those areas and patents that are based on it? So this is just a situation that comes up sometimes that I wanted to make you aware of.

In subdividing sections fronting on a meandered body of water, it's necessary to establish an adjusted meander line prior to developing the subdivision line. We really haven't talked about that. We've looked at meander lines, we've mentioned them. But really if we're going to subdivide a section and we're going to close up against that meander line, we have to re-establish it. And how do we do that?

In subdividing sections fronting a meandered body of water it is necessary to establish an adjusted meander line prior to developing the subdivision lines.

Following establishment of the meander corners, the meander lines are adjusted in accordance with Sec. 7-53.

The adjustment is a compass rule adjustment.

We establish the meander corners first that were established in the original survey on the section line and then following the establishment of the meander corners, the meander lines are adjusted in accordance with Section 7-53 of the Manual. And basically that's a compass rule adjustment.

So what we would do is re-establish the meander corners on the boundaries of the section and then take the original meanders and adjust those meanders to fit between those established or re-established meander corners. We're going to get adjusted record

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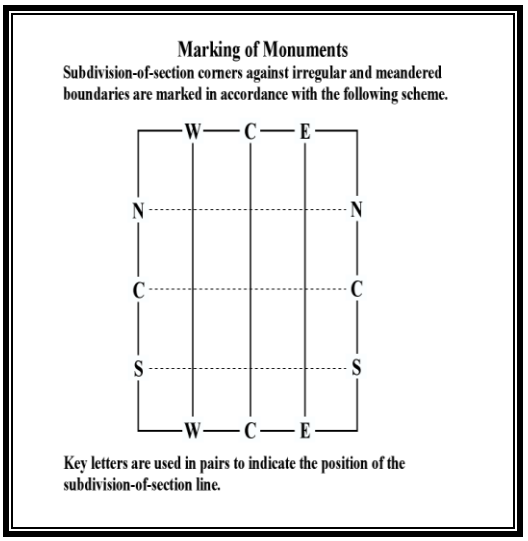
meanders that way and they could be a fairly significant adjustment or a fairly slight one. But that's all done with a compass rule adjustment. We then have that meander line re-established and when we run our subdivision section lines, they'll close on that meander line and we'll establish our corner there.

Corner Markings

I want to talk a little bit now before we finish up about how we designate that corner, how we mark that corner, what we call it.

First of all, when we're marking subdivision of section corners within the section, we have designated these different lines. This east line over here, we're going to put an EE. If we're doing something along that line, we're going to put an E on the north and an E on the south for east. It's the east 16th line.



If we're surveying this center line, we're going to have a C on the north and a C on the south on our brass cap because it's the center line of the section. Over here, if we're surveying that line, we're marking a monument on our brass cap, we're going to show that line with a W on the top and a W on the bottom, that shows that we're on the west 16th line. Up here, an N and an N for the north 16th line. Here a C and a C for the east-west center line. And then here an S and an S for the south 16th line.

We've designated those so that on our brass cap, when we show a line and we're marking a corner, immediately you can tell what line we are on. I'm going to show you a couple of examples now.

First of all, subdivision of section lines that close on a meandered line are called special meander corners. Meander corners are on the section line, special meander corners are on the subdivision of section line. And where those subdivision of section lines intersect the meanders, we're going to set special meander corners. I just want to show you a couple of examples of how we might mark those.

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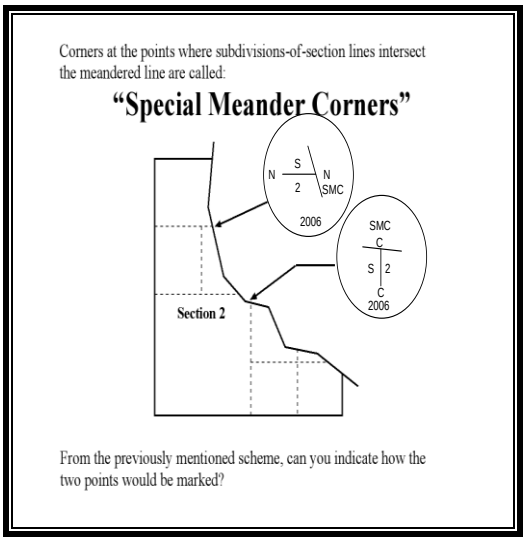

First of all, on the north-south center line of the section where it intersects the meander line, we would mark it similar to this. First of all, we would have a date, a date at the bottom. Then we would have some lines that represent the meander line and the north-south center line of the section. We would then have CC, a C to the north, a C to the south, that shows that this is the north-south center line of the section.

Next, we'll have the section number, section 2, we know where we are. So now we know that we're on the north-south center line of section 2. And then we'll have an SMC to show what kind of corner it is. It's a special meander corner. And if you look in Section 4-45 and Figure 4-74 in the Manual, you can see several examples of this. I just wanted to go through a couple.

If we're going to do the corner up here on the east-west center line of the northwest quarter, it may look something like this. First a date, then the lines. And this one, because it's the north 16th line, is going to have an N and an N, we're going to have section 2, and we're going to have special meander corner (SMC). The MC or SMC, either, always goes in the water. It doesn't go on the land, so it doesn't go on the upland side, it goes on the water side.

Just a couple quick examples of how we might mark these corners. They're special meander corners, what we are going to call them. And just a reminder about how we establish that meander line and how we adjust it with a compass rule adjustment.

Conclusion

Well, this completes our entire segment on subdivision of the section. And in this last section I hope that we have covered what we said we would at the beginning. We said we were going to determine when a section should be subdivided in accordance with section 3-120 of the Manual. I hope we've done that. We've looked at 16 different sections.

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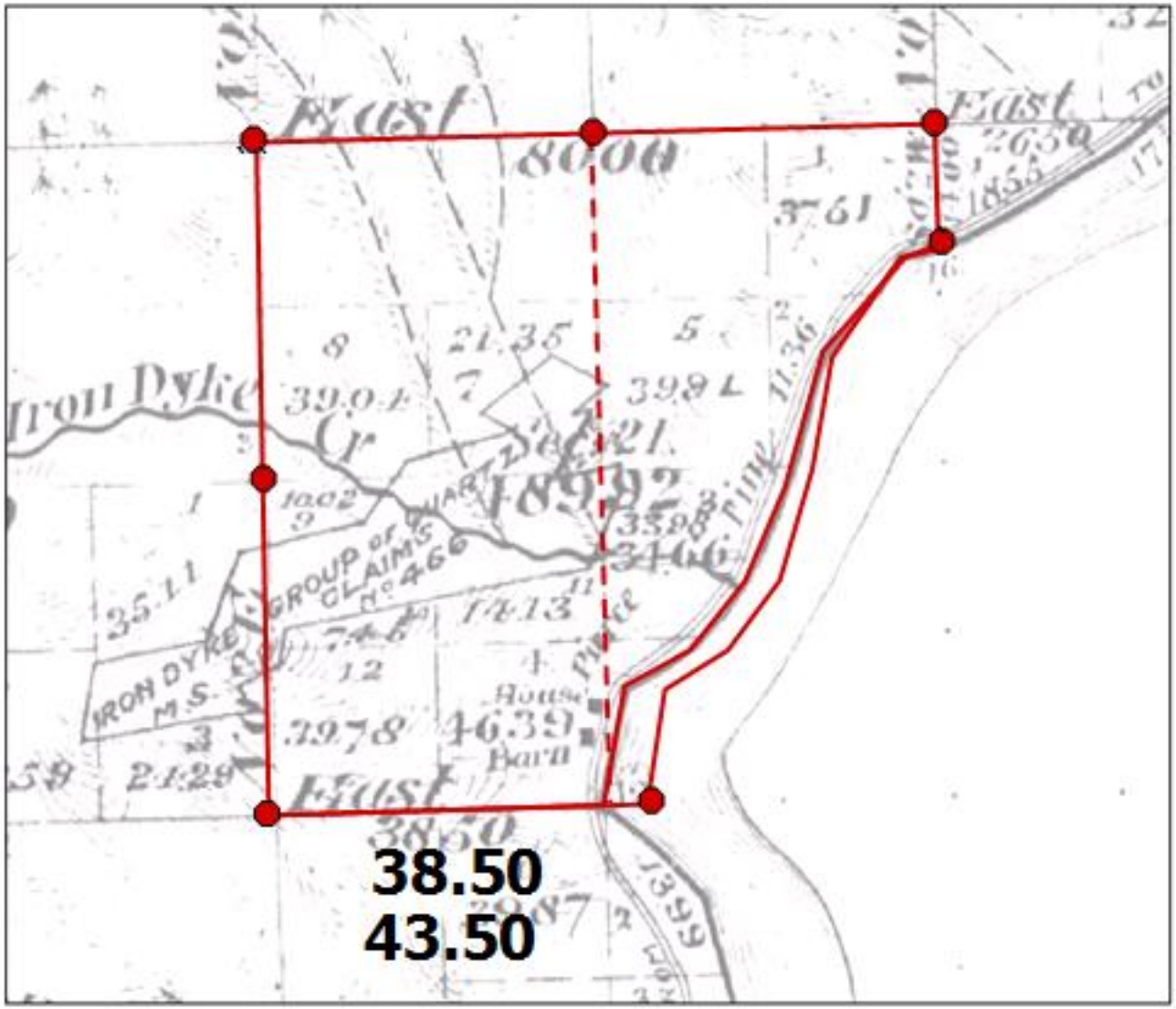
We've talked about is it fractional, is it not fractional. And I think we've done a pretty good job of defining when we should be using this section and when we should not. And then we've looked at really some of the principles and how we're going to do it. I think we've done a good job of that also. We've looked at parallel lines and looked at when we're going to use mean bearings, when we're going to use maybe straight lines, center lines of a section and then end up with mean bearings or parallel lines for the quarter and when we're going to re-establish corners that fall in the water because we have a line that crossed, when we're not because there is no survey line that crossed.

So I hope we've done a good job of covering this. And you'll have some other examples to work with, a problem in some of your coursework to follow. So this wraps up and completes our section subdivision segment.

- Determine when a section should be Subdivided in accordance with Section 3-120 of the Manual
- Discuss how the principles in Section 3-120 should be applied

It's time to take the Course 6 Quiz which you can access from the CFedS website.

DIAGRAM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