



Relictions in the Public Land Survey System

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Introduction

Hello and welcome to this course entitled Relictions in the Public Land Survey System. This course is presented by the Certified Federal Surveyors Program as a continuing ed effort there and it is also open to other surveyors through the Public Land Survey System Foundation and all of this under the guidance of the BLM Cadastral Survey Unit. My name is Dennis Mouland, I will be your instructor for this course, and we will be looking at a number of factors about relictions and dealing with how that affects uplands. It is a complex subject, as you may know with any kind of water boundaries, riparian rights and that sort of thing it is a pretty complicated subject because of the function of Federal law, state law and that sort of thing.

Textbooks

The textbooks that we will be using are the usual. The *2009 Manual of Surveying Instructions*. If you do not have one that would surprise me at this point in your career but if you do not have one, there is a website that you could go to listed there. Then we will also be referring to the *Public Lands Surveying Casebook* which we will be working with Case D5 and you will find it in your course material. That is the one about reliction of Flagstaff Lake, which the *Manual* also references.

Course Objectives

As with any course, we have to have course objectives. They are simple here even for a complex subject. We will keep the objectives simple and that is:

- Given a relicted lake and we have a need to apportion the relicted portion of it, all or part, the student will be able to apply the five accepted methods of apportionment.
- And then we will also be able to look at these methods and analyze which ones best serve a situation.

Again, it is pretty complicated but there are some basic principles that once we see those and understand those they really help us make some proper choices as to the method to apportion those relictions.

Course Pathway

So besides the objectives, now let's just lay a pathway of where we are going to go. We will have a reading assignment after we discuss a couple of issues. There will be an exercise on terminology and principles then we will look at the particular project that we are looking at --the history of it, why the survey was necessary. We will look at the five methods there then we will have a COGO based exercise on a place called Deer Lake for you to work and that will help us figure out which of the methods best protects the rights of the individuals as well as the Federal interest lands that may be in the area. So that is kind of the direction we are going to go, the pathway that we will follow for this course.

Threshold Questions

As with many things in surveying, there are some threshold questions that have to be asked and answered before we can deal with this. Of course these are water boundary related projects. Relictions being generally a lake that has completely relicted or dried up or partially relicted, but most of the time they completely relict. Flagstaff Lake was completely relicted by the time course case that we are going to study is done. But it has water in it again now at least at the present moment. But I know of several lakes like that here in Northern Arizona where I live.

When the GLO was there was no lake at all so they the surveyed it all. Now there is a couple feet of water out there so it is kind of the opposite if you will but there are a lot of places especially even here in the desert or water country where lakes dry out for one reason or another. We are not really talking about dry lakes in the desert, talking about things that might have been a lake for some time and then have dried up either because of seasonal things or just other actions that have gone on around it. But we have to ask those questions, so let's take a look at each of those now and discuss what they mean for relictions in particular.

The first question is really one of the most important and that is -- What is the land status of the land that is involved that includes the adjoining properties? You may be just surveying one parcel but what is going on with the other. Of course land status is a Federal term talking about the ownership, the rights that a parcel has. Even in the private sector, land status could be what you might find on the title commitment, who owns the land, are there easements, liens or this that and the other. This is from a Federal perspective as to who owns it. So the first thing we ask is if it is Federal land that we are dealing with, is public domain land which in this context means it is always been in Federal ownership. If it is, then it will be treated by Federal law.

But if it is acquired land -- if it is land that the Federal Government bought back or exchanged, or it was donated to the Government -- doesn't matter how it came back, the point is that it left Federal ownership, it was out in private ownership for some length of time then it comes back into Federal ownership. It is now acquired land and does not take on public domain status. So if it is acquired then we're going to have to consider if, not always, if state law is going to affect the survey. That is a big question because the states all have varying laws about different things about where the shoreline is, is it high water, or low water or did they give up their ownership of

navigable beds and all that kind of stuff so we have to deal with those things and that brings us to this second part of this question. If it is non-Federal, then state law can and will affect that survey. Sometimes that is more difficult to track down because it could be in statute which sometimes it is, or it could be in case law or it could be in both. So these questions have to be asked regarding any water boundary subject and frankly just about any kind of survey even if it is not water boundary because the land status does affect it. If it is Federal if it is its public domain or acquired and if it is it neither, is it private land, then how does state law affect it because there are big differences between state laws and Federal laws or nuances sometimes that aren't all that noticeable but we must take notice of them when doing a survey.

A second question which may not be all that applicable to most relicted lake situations but – Is that lake tidally influenced? If so then it falls under a whole different set of laws and rules which we are not covering in this course. Is it influenced by the movement of the tides and rarely would that actually be a reliction situation but I suppose it is possible especially in Alaska a lot of things are possible. But the bottom line is if it is not tidally influenced then it is considered an inland water body and the things that we will discuss in this course will apply to your situation. So that is our second one is the tide influencing it.

Then our third question is – Is it navigable, since it is relicted, was it navigable or considered to be navigable for title to the bed purposes? Let's understand that navigability is an issue that has many different definitions depending on what laws and what principles we are talking about. We, in cadastral are generally talking about navigability as defined for the title to the bed, who owns the bed. In other words, upon statehood the states were granted, or assumed, or took over, ownership of those beds. Under the constitution and the equal footing doctrine, and so the states owned it.

If it is navigable, then does the state claim to the high water mark, or do they claim to the low water mark or somewhere else. Or have they like three or four states have done completely relinquish all their title to the beds. Maybe not other navigability issues such as commerce or fish or that sort of things like the clean water act (that is a Federal deal) but you know; have they relinquished all their claims for title to the bed. So that is multiple question there. If they claim it elsewhere, then how does the state law affect it. Is it at the ordinary low water mark? We are going to look at high water mark since that is the Federal law and that is where most states leave it but we need to think about that.

Now if the lake is nonnavigable for title to the bed purposes, then is the division of it going to be governed by Federal law or state law. Of course that ties us back to our previous question, or questions, especially about status. The ownership of the bed and the ownership of the uplands as well because if it is a nonnavigable lake then the upland owners are probably going to own out into the lake but how will that be divided. That can sometimes be a question of state law.

Relicted Lake Beds and Bona Fide Rights

Now the 2009 *Manual* has some excellent discussion on the subject of good faith rights or bona fide rights and technically speaking only private lands or lands that are alienated (left Federal ownership) have bona fide rights. There could be some argument made that Federal lands at least under certain circumstances have bona fide rights, but either way we need to think about the fact that relicted land is real property. It is not somehow secondary or subtitled, it is real property. If the relictions took place before entry, they may remain in Federal ownership. We will talk about that in a little bit.

Our task is to resurvey and protect the private rights as well as the Governments rights (whether you want to call them bona fide or not) to the lands that are out there in the lake. What right the adjoining properties, have the uplands have to what is out there. So as you know bona fide rights, when we are talking about surveying, is limited to the location. It is not about the quality of it. The first paragraph or the first bullet, here on this slide and I am trying to emphasize that this is real property.

At the time you will see in this case when the BLM came in to do the resurvey and deal with the relicted Flagstaff Lake it was being farmed, so it was real property producing real money for a farmer or rancher. We need to recognize that. As far as the law goes, reliction and accretion are treated quite similarly as you will see.

There is an aerial view of Flagstaff Lake that is only a couple of years old it was taken in the winter time. As you can see it has filled back up with water. It is only a few feet deep and it's not a recreation site or anything. It is a nonnavigable lake as you will see. The upland owners, be they Federal or private interest, still own land out in that lake because it was nonnavigable.

The surveys stands either way, so we are dealing with a relicted lake that is nonnavigable in our case and therefore the state has no interest or rights, although the State of Oregon attempted to have that as we will see in the reading and mention that in discussion. It is an interesting case, a great case and interesting just to see the lake from an aerial view that has filled back up again at this time.

Source of Law

So as you can imagine, the answers that we come up with in our threshold questions, and whose rights and what it is we are talking about in the status of the land whether that becomes a discussion of the source of law. And again the 09 *Manual* has much more discussion on that subject than others and some of those are listed here. I encourage you to look at 1-7 and 8-57 through 8-60 of the *Manual* about source of law. We should also understand the effect of state law on Federal acquired lands, because remember when the feds buy land or get it acquired it, however they do it, from some private party, the private party can only convey the quantity and quality of land and title that they have to give. And so there may be limitations on that based on state law. So that is something we need to remember.

Land status again is the condition of the title that is something we are interested in because that helps guide us where we may be going for the law. The laws differ on Federal land from state land but there is also some Federal land that we do not discuss in this course, but on Federal Indian trust land or restricted lands there is even some additional guidance on those and that is just a heads up on that. The *Manual* 8-37 talks about these different meanings of navigability and the various applications and that is discussed there. Again we are focusing on navigability for title of the bed purposes, and that is all we do in this course.

But recognize that something may be nonnavigable for title of the bed purposes, but maybe navigable under other definitions for jurisdiction and control, or improvements and that sort of thing in the water way. Keep that in mind so that is just a general discussion of the source of law, it really is a big topic once we answer our land status questions.

Limitations of this Course

Some of this maybe a repeat, but it is important that we just be upfront with what the limitations are on this course as well. We will be discussing relicted lake nonnavigable situations. If the lake was navigable for title purposes to the bed at statehood, then the boundary would be at ordinary high water mark unless the state has claimed or relinquished somewhere else. In states that have granted the beds of navigable bodies of water to the adjoiners, in other words they have relinquished all interests, this course can still provide guidance on those further divisions.

We do not discuss in this course, omitted lands, fraudulent meanders, and some of those other definitions of navigability. I have already mentioned some of that. We are just focusing on the most common situations and that is a relicted nonnavigable lake and we are going to deal with it on an ordinary high water mark situation.

One final thing that we need to recognize and that is any discussion about title and ownership of the surface when we are talking about the bed of the water body has to recognize that there is a connected discussion regarding the subsurface estate below that bed of the water body. That is not included in this course, I am just making sure that we realize that there is a connected issue, but it is just not in the scope of this course.

Reading Assignment

So here is your reading assignment and I strongly suggest that you stop the course and actually do this reading and pay attention to it and underline stuff, color it whatever you do, but it is listed there for you to take a look at in the *Manual* as well as the D5 Case that is in the *Casebook*. If you are new to riparian or just need a refresher, the Introduction to Chapter D of the *Casebook* is included in this course and we are calling it Appendix A (*access it from the course map*), so you may want to go there too. It has a great write up that is just general about riparian and water boundary surveys. I will leave this up for a few seconds here so you can either write it down or print it however you are getting that data. Get into that reading assignment which we strongly suggest you do.

Exercise 1 Introduction

With the reading assignment now done, it's time to go to Exercise 1. There is a document by that name and we suggest you go through it and then complete it and compare your answers with the answer sheet that is also provided. On the answer sheet, it will give you the citation in the *Manual* or you may have to go back to the Chapter D of the *Casebook*, the Appendix A that we have but you will have an opportunity to review your answers and the correct answers.

Terminology and Principles Exercise #1

1. Reliction is when the water:
 - a. Moves away from the shore of a river
 - b. Cuts into the edge of a lake
 - c. Is only there after a substantial rain, as where a lake bed is normally dry
 - d. Recedes from its record position in a lake

2. When dividing a relicted lake bed, the lines which delineate changes of ownership are called:
 - a. Dividing lines
 - b. Section subdivision lines
 - c. Partition lines or division of reliction lines
 - d. Reliction lines

3. Federal law will be used to determine boundaries where a lake has relicted and:
 - a. The land is in front of a public domain holding
 - b. The state has relinquished its rights to the relictions
 - c. The land is federally acquired land
 - d. The lake is defined by OLWM

4. The meander lines of inland water are best described as:
 - a. Fixed boundaries between uplands and beds of water bodies
 - b. Approximations of the mean low water line
 - c. Approximations of the ordinary high water mark
 - d. Fixed lines for state ownership on navigable streams

5. The title to the bed of a navigable water body is vested in:
 - a. The state
 - b. The upland owners
 - c. The Federal Government
 - d. The state unless reserved or relinquished

6. The term “ancient bank” generally refers to:
 - a. Where the lake was at the time of acquisition by the United States
 - b. Where the lake was on the date of the original survey
 - c. Where the lake was on the date of statehood
 - d. Where the lake is as of the date of your survey

7. What type of corner is set where the partition line intersects the adjusted record meander line?
 - a. AMC
 - b. WCMC
 - c. MC
 - d. SMC

8. Land Status refers to:
 - a. Ownership and encumbrances of the land
 - b. Marketability of the land
 - c. Quality of the soil
 - d. Availability of the land for homesteading

9. Meander lines which do not mathematically close are adjusted by what method?
 - a. Grant boundary method
 - b. Angle points of meander lines method aka compass rule
 - c. Single proportion method
 - d. Irregular boundary method

10. Why is the round lake method applied to a generally circular lake?
 - a. It is the simplest
 - b. It is generally equitable and meets the “in front of” requirement
 - c. It is the most equitable
 - d. Other methods may create gaps between the partition lines

Terminology and Principles Answer Key

1. Reliction is when the water:
 - a. Moves away from the shore of a river
 - b. Cuts into the edge of a lake
 - c. Is only there after a substantial rain, as where a lake bed is normally dry
 - d. **Recedes from its record position in a lake (See 8-84)**

2. When dividing a relicted lake bed, the lines which delineate changes of ownership are called:
 - a. Dividing lines
 - b. Section subdivision lines
 - c. **Partition lines or division of reliction lines (See 8-132)**
 - d. Reliction lines

3. Federal law will be used to determine boundaries where a lake has relicted and:
 - a. **The land is in front of a public domain holding (See 8-115)**
 - b. The state has relinquished its rights to the relictions
 - c. The land is federally acquired land
 - d. The lake is defined by OLWM

4. The meander lines of inland water are best described as:
 - a. Fixed boundaries between uplands and beds of water bodies
 - b. Approximations of the mean low water line
 - c. **Approximations of the ordinary high water mark (See 3-159 and 8-2)**
 - d. Fixed lines for state ownership on navigable streams

5. The title to the bed of a navigable water body is vested in:
 - a. The state
 - b. The upland owners
 - c. The Federal Government
 - d. **The state unless reserved or relinquished (See 8-127)**

6. The term “ancient bank” generally refers to:
 - a. Where the lake was at the time of acquisition by the United States
 - b. Where the lake was on the date of the original survey (See 8-133(1))
 - c. Where the lake was on the date of statehood
 - d. Where the lake is as of the date of your survey

7. What type of corner is set where the partition line intersects the adjusted record meander line?
 - a. AMC
 - b. WCMC
 - c. MC
 - d. SMC (See 8-134)

8. Land Status refers to:
 - a. Ownership and encumbrances of the land (See 1-13(n) and course slide 6)
 - b. Marketability of the land
 - c. Quality of the soil
 - d. Availability of the land for homesteading

9. Meander lines which do not mathematically close are adjusted by what method?
 - a. Grant boundary method
 - b. Angle points of meander lines method aka compass rule (See 7-53)
 - c. Single proportion method
 - d. Irregular boundary method

10. Why is the round lake method applied to a generally circular lake?
 - a. It is the simplest
 - b. It is generally equitable and meets the “in front of” requirement (See 8-139)
 - c. It is the most equitable
 - d. Other methods may create gaps between the partition lines

History of the Project Site

Let's begin to talk about the actual project that we are discussing in D5. Of course you have read that, so you are familiar with it so I won't go into a lot of detail. Warner Lake used to be called Flagstaff Lake. It sits in three township so it is kind of complicated from the survey history. It was thought to be part of a chain of lakes. It's not. Today the lake holds the same water but it does dried up at times and has been farmed at times. So the relevant history of it though that really applies to what we are doing with the survey is listed on the following slides.

As you saw in D5 the history of surveys is laid out there, and so here it is again summarized. These first two surveys by McCall and later by Wheeler, neither of which meandered the lake. It wasn't until 1887, that Neal surveyed the south boundary of township 34 south, range 24 east and meandered a portion of Warner Lake. Then in 1915 Mensch retraced some of that stuff, meandered the lake, he extended the section line between two and three, but what is interesting in particular here there is a side lesson here; he meandered the lake in its new position. It was partially relict and that is the lesson we can learn that a lake can partially relict. We usually talk about them completely relict. So that is what Mensch did. He ran new meanders of the lake at the position at the ordinary high water mark as of the time of his survey. So a little bit of a lesson there about ownership and the movement of the boundary even in relict lakes.

The history then continues with the Draper survey. He did a number of things there which are listed here and also in the *Casebook*. He sets some meander corners, one in particular that created a double corner situation in section 31 and that is described here. That is not totally relevant to our solution for dealing with relict lake, but it is a part of what was done. That is more history of what was going on.

Here is figure 1, from the *Casebook* D5 and it just kinds of shows you the final result, if you will, of the original surveys that had been done in the area. It shows you that there were some other lakes in the areas that were part of that chain of lakes. You can see down the south side of Flagstaff Lake a double line indicating where the first meander had been done and then the second one. Also this is showing us land status. The blackened areas are patented lands. Of course on Flagstaff Lake, we only have two over on the west end that we will be dealing with. Now, as we continue to look at the history of this, we see that an investigation was made in 1948 because there were several lakes that were investigated by the Department of the Interior to talk about navigability.

On the next slide we will see what motivated that. But the report by Interior came back said that Flagstaff Lake was nonnavigable and the State of Oregon was informed of that decision by the Department of the Interior as you can read in the case. There was a particular reason why they had to – this isn't normally done unless there are some resource issues or something going on. It was the Oregon legislature that had caused some of this to occur.

So we see that the Oregon statutes claimed that any lake that had been meandered was navigable. Now that is not a correct or true definition of navigability for any reason. So the Government actually sued in 1935 the State of Oregon over this issue and won the case. Now we want to remember then, which the State of Oregon should have known, is that meandering is not done

just because of it is navigable. Meandering was done on lakes that exceeded 50 acres. It was done on rivers that exceeded a certain width. It was not about navigability. So you notice on the last bullet there, the Oklahoma v. Texas case, that was a 1923 U.S. Supreme Court case, which heard this same argument that meandering of the river between Texas and Oklahoma proved that it was navigable. The Supreme Court came back and very clearly and said (I love the way they said it), those officers (referring to the surveyors at the GLO), those officers were not clothed with that authority. Meaning they don't have any authority over jurisdiction to be able to say whether something is navigable or not. The fact that they meandered it doesn't make it navigable. So that is an important lesson and might be a surprise to a lot of surveyors, and state boards and other organizations in the United States that still don't understand meandering, and still don't understand navigability, and so don't understand what we just talked about.

Now here is an example of Oregon doing what a number of states have attempted to do and that is claim just about anything. It was stopped and in particular it was stopped with Oregon with a lawsuit against them in particular and so that is why that 1948 investigations said Flagstaff Lake is not navigable and that is why they informed the State of Oregon to make sure they recognized that it was part of the results of that investigation, was part of that lawsuit.

So let's take a quick look at the original plats of these different surveys that we just saw listed. Portions of these are shown in the *Casebook* as well so I won't spend a lot of time on them. As you can see, the township to the northeast, there where they meandered and surveyed that township into sections and dealt with the lake up there. And then here we had the township to the south, where again the same scenario transpired and meandering the lake.

And then we look at this plat which is the one to north and west. And it is also showing the lake and they didn't meander; there is no lotting up against it, it is kind of strange what they did there and so they came out later with another plat which showed the details of that lake there which is important because we do have some patenting in that area. So townships are offset you know, it is about as complicated as it can get from other surveying points of view. We are just primarily focusing on the reliction of the lake itself.

So here are again those lands that are patented and I circled them this time. Lot 4 of that section 30 was patented and then section 36 of 34 south, 24 east was a school section and that is vested in the State of Oregon so that is alienated land, it is not Federal land, it is not private per se but there were no other patents. Those are the two we have to deal with directly to protect their bona fide rights and the Federal courts have upheld doing things that are "in front of" the upland holdings as we will see on the next two slides.

Johnston versus Jones was a significant case from 1862 U.S. Supreme Court and it is the one that said accretions (and again we treat relictions like accretion from a surveying point of view) should be equitably distributed between the upland holdings and that is discussed at 8-62 in the *Manual* and that is one of those underlying principles that we attempt to follow. You know the Supreme Court as usual didn't say this is how you do it, or use this method of proportionate, or whatever, no they said it should be "in front of".

So we have another Supreme Court case which is the one I referenced a couple of slides back. With the Oklahoma versus Texas and that was also the “in front of” issue came up in that. And although it is not part of the supreme court case decision, there is statute about this “in front of” requirement there at 43 U.S.C. 931. So we have some really strong legal background for the “in front of” requirement and that is just one of those underlying principles that with few exceptions, we really want to pay attention to.

So the reason this survey was done by BLM was that 1948 investigation and the lawsuit that had predated it (which we had already talked about), it was decided this lake was nonnavigable so it did not belong to the state. There were a couple of adjoiners with private land whose bona fide rights needed to be protected, but it also meant that whatever didn't need protected, that was not part of the bona fide rights of those landowners that were in there, the adjoiners, whatever was not in there, that was related to private lands was still Federal land and it was still actually unsurveyed, Federal land, unsurveyed public domain.

And so the BLM can survey Federal land in anyway it wants to and as we see in this case, they came in and did a completion survey, so to speak. They just extended the rectangular system out over the bed of the lake with the exception of the two parcels that needed to be used to protect the private rights that were in there.

So we come here to a statement of the issues and they are basically this; the lake bed whether it is wet or not is nonnavigable; therefore it's bed belongs to the upland adjoiners and the rights of the upland patents have to be protected. The survey of the remaining Federal lands can be done however they want for management or available for entry by others. It is interesting that they went out and did some cross-sectioning of the lake, they wanted to make sure there wasn't a definitive channel in the lake. That was because if a definitive channel had been there it might have been a dividing line so that everyone had access to the water. But there was no channel. It was a flatbed so they proceeded to simply look at what they had and the five different methods that are available to us as we are about to discuss.

So then here is the order of the resurvey process. Retrace existing lines, restore lost corners by the correct methods, run the record meanders, adjust those because they will not close, using what is commonly called the compass rule. We are going to have to compute a medial line and try the five methods that are outlined in this course and the *Casebook* and select the one that is best. And then after protecting those private rights the original survey will be extended out into that lake for all of the remaining Federal lands. That is basically the order in which this was done.

The Five Methods

So let's now begin our look at the five methods that are available to deal with and apportion out land within a relicted lake. Notice at the bottom of this slide it mentions where access to the water is of primary importance, they might look at something else. As I mentioned they cross sectioned the lake just to be sure there was no channel through there where a stream continued to flow. That might have been a better dividing line than just some equitable medial line. But there wasn't, but this gives you some advice. In most cases the land itself is the most important consideration, so we try to choose a method that will equitably divide that up. So you see the five methods listed and now we are going to look at each one of those in particular.

Method 1 – Round Lake (Pie Method)

The first method here is what is called the round lake method or also called the pie method. The bottom line is if the lake is round or close to it, then this is something you can do where everything will be "in front of". If you look at this diagram, you can see it is "in front of". The two patents that we are having to deal with here and protect, they are highlighted in blue what they would get under this method. So the bottom line is you figure out the graphic center of the lake which is quite easy with today's COGO tools. If you put the meanders of the lake in and adjust them for misclosure, just do a center or gravity command in AutoCAD and it comes up. Then they connect the lines from there up to the meander corners or special meander corners on the shore. So that is a pretty clean method. Again if the lake is round or close to round and in particular in this case the lake is round but most of the lake was not private so they can continue to look at some other possibilities.

Method 2 – Long Lake Method

One of those other possibilities being this one, the long lake method. Now this is where a lake is longer and this is probably most lakes that you deal with. What you do is compute a medial line down the center of that lake and we will talk a little about that, and then in this method you go at normal to the medial line. So you come off the medial line at ninety degrees to hit those meander corners or special meander corners that are on the ancient shore that are on the adjusted or original meander line.

And it certainly meets the requirement of the "in front of". Notice usually when you have a long lake method, you end up with a pie method, partial pie method on each end to be more equitable, so that is what they did here. You can see that they picked some radius points on each end for those two or three parcels there, then did the long lake method for the rest of it. So that is running a medial line and then running normals off that medial line out to your meanders corners or special meander corners as the case may be.

Method 3 – Apportionment along a Medial Line Method

Now method three here is going to use that same medial line but it is not going to run it at normals. It is going to run based on proportioning along that medial line. And as you can see kind of, its different along the south side than the north side, but what you are doing is

proportioning the amount of frontage that the upland lot had on the original meander; then you are prorating that so that they get their same share out there on the medial line. So that is a little bit different, it looks about the same doesn't it, notice we have the pie method on either end again. So what is really different here is we are proportioning along that medial line not running it at normals. So that is a little bit different take.

Method 4 – Colonial Method

Method 4 is the colonial method and that is usually combined with one of the other methods. As you can see here it was done also with the pie method on each end just like we have been talking about, the pie method was utilized. But then see like in section 36 the relictions to section 36 are established by turning ninety degrees to a line connecting the two meander corners on the section line. So this is different than normals to the meander line, this is running from the two meander corners or SMCs depending on what you are dealing with on the shore and turning 90 degrees off of those. So it is sort of a cord if you will also of a curve of the lake itself, not perfectly, just an analogy. Then you run out at ninety degrees to that to hit the medial line. So that is a very different approach and it's called the colonial method because that is what the colonial states traditionally have done with relictions.

Method 5 – Extension of Upland Line Method

Finally we come to the fifth method which is the extension of the upland lines. So if we put these red dashed lines in here you can see what that does. You just kind of extend the rectangular end out into it. Now that seems simple and in some places that is what people do, but if I was one of those owners there in section 36 which is the state in this case, but if I owned that lot, I think I would be saying hey I didn't get very much equitable of all that land that was relicted out there. Nor am I really "in front of". What they gave me there is not "in front of", so as you will see when as we go through the pros and cons that is the problem with these. These guys have a right that goes up to some kind of medial line or something else and the extension of the line just doesn't do that.

Computation of a medial line

So we have been talking about medial lines, median lines that sort of thing and I want to give you a little information about that subject. Several of those methods we just described rely on a median line or a medial line. They are actually two different things as we will see in a moment. In 8-62 through 8-69 of the *Manual* will give you some guidance. There's a number of ways to do this and I will mention a couple of them for you. But we need to remember that no matter where you and I determine the ordinary high water mark or even the retracements of what had been done before; if its partially relicted where we say it is or different issues, where we run the medial line, what we pick as salient points; however you do it, we are all going to be different from one another.

There is almost infinite (well I shouldn't say that), there is quite a large number of possibilities and we need to be very flexible and recognize that what other surveyors have done before us, unless they are really out of whack, they should probably be accepted. This is true with anything

that involves estimating new high water marks or medial lines and how you compute it and how you may adjust it and that sort of thing. So that is kind of a heads up with that. Now let's look at these two terms and understand what the difference is.

Median Line vs. Medial Line

While these terms are often used synonymously they are not exactly the same thing. Even I may slip up with the tongue here and there and call it the wrong thing. But let's understand that a median line is actually (as it says here), a continuous line made up of tangents and curves and everywhere on it is at midpoint to every location. How you think about that with the sinuosity of a lake or even a river for that matter, there could literally be thousands or tens of thousands of courses along that line, little curves or little things. So that gets very very complicated and it is. The median line is usually derived from the record meander lines. That is a good way to do it unless they had significant error or problems with them. You can use them to help you determine that, but still to be at midpoint at everywhere that is the important thing to remember.

Now a medial line is a little bit different. It is a smoothed out line from the median line. Frankly it is a far better thing and easier to compute. It splits distances especially at salient points or prominent features, it doesn't have near as many courses and that is exactly what the BLM did in our case in D5. It doesn't have thousands of little courses in there. So often a median line is computed but then converted to a medial line. They talk about that in the *Casebook* but frankly using the modern software that we have now, and AutoCAD and other things, we can actually create the medial line quite well right from the start.

So let's think about this, if you compute a median line, you are going to spend quite a bit of time at it. A medial line is easier as I said. I will show you here in just a second. As I mentioned and this is probably the most important thing of this. Whether you are doing a median line or medial line, no two surveyors are going to come up with the exact same solution. So we need to have an open mind about that. Sometimes, some surveyors kind of have an attitude that no one can survey as good as me, so it's my way or nothing, that is a foolish thing to do. It is usually best to consider what had been done before you unless it just violates laws or is totally out of whack somehow, it probably ought to be accepted. So have an open mind.

The use of AutoCAD, Terramodel, Microstation and whatever else that is out there provides simpler faster ways to compute medial lines. Use of midpoint features, center of gravity of various points that you pick can provide for that. Here is just a simple drawing. Just say the salient points along each side, and I just connect them with a line and pick midpoint and then draw a line between them, the red dashed line. To me, that is a medial line and if you don't like the sharp curve (excuse me the sharp angles) at some of those, well you can put in a small curve there if you want but again we are talking about really a protracted line that you have created out there in the water in some cases or what may be under water and you are basing it off of salient points you have picked (either new ones or old ones) depending on your circumstances.

There is a lot of plus or minus there, so I am not one of those who ever gets worried about a few feet here or there. There are differences with someone else as long as what they have done is practical. So think about how you can use your software and do that. If you want to create

additional points just pick places along your adjusted meander lines on either side and draw a line across there and midpoint it to come up with an additional point if you want more courses, or if you want a little more detail in how you are going to determine that medial line.

Interim Review

So, at this point we are going to take just five questions here, an interim review. I am going to leave them up there for you a few seconds to look at then we will answer those. So go ahead and take a look at the questions and jot down your answers.

1. If the lake is navigable, how will partially relicted lands be apportioned?
2. T/F: A medial line in a lake is along the lowest channel.
3. Which method of apportionment requires a geographic center be computed?
4. Which method uses normal from the medial line to divide the reliction?
5. The point where a centerline of a section intersects an adjusted record meander line is called what?

Okay then let's take a look at the answers we got here.

1. If the lake is navigable and it is partially relicted; will the ordinary high water mark is the boundary so the upland owners own down to that ordinary high water mark and the state owns what's left; still underwater unless they have disposed of it somehow.
2. T/F: A medial line in a lake is along the lowest channel. That is false. The medial line is a mathematical creation. That doesn't mean you will always use the medial line, but that is an example of that.
3. Which method of apportionment requires a geographic center to be computed? That is the round lake method, which is often called the pie method.
4. Question 4, which method uses normals from the medial line to divide the reliction? That's the long lake method, which if you remember may have pie method, partial pie methods on either end usually it does.
5. And the last question 5, the point where a centerline of a section, your subdividing a section, intersects an adjusted record meander line is called what? Will that is an SMC, or a special meander corner.

So with that brief interim review, let's go one and start comparing now these different methods that we have looked at.

Considerations in Selecting a Method

So we have these five methods or mixtures of methods and we want to talk about considering which method would be best. And that is not as complicated as it may sound. Here's a few thoughts.

Does it protect riparian rights in an equitable manner? Is it fair, in how it; that is really how the Supreme Court came up with the "in front of" language which is point number two here. Does it satisfy the "in front of". Does it result in useful shapes of land or is it totally useless little slivers that can't be managed or used in anyway. That is something to think about. Can the method that you use and chose, can it be logically derived and reproduced? It is not so darn complicated, or that you provided enough information on your plat or in your notes that someone can retrace it and figure it out if they had to do some additional work down on the other end of the lake, say.

Make sure that you don't cut off people's riparian rights. Remember riparian we talk about water boundaries and we use the word riparian and that has a lot of different meanings, But in this case, riparian – the word "*ripa*" in Latin means edge. So it is talking about the right to be at the edge of the water. So that is a good question to ask.

If the lake is only partially relicted, does the method that you chose to do—does it still offer some access to the water if that is an important issue for all of the owners. Again that is why BLM cross-sectioned Flagstaff Lake and determined that there really wasn't a channel so they just went with the normal methods, which is what we are doing here.

Final Solution used by BLM

So with those things in mind, let's understand what the BLM did here. And then we will figure out how that all fit in here. As shown, the BLM chose to use the Colonial method for the relicted lands in section 36, they thought that was the most fair. But, they used the long lake method with a pie at the end of it for lot 4 of section 30 due to its shape. So they mixed the methods here in order to come up with something that was equitable for both parties; that they were "in front of"; that they got reasonable pieces of land that could be managed and used; and it was basically equitable.

Now again, the rest of the lake bed was Federal because the Federal Government, public domain, was the remainder of that frontage, all the other uplands, and as we see when we get to the final plat, they just went in and continued the rectangular system out into the bed. But what they chose to do here was, mix and match the methods in order to come up with the best solution for those adjoiners so that they would have an equitable "in front of" solution.

So here then are the plats, the final solutions that they used. Of course there are three of them because we are in three townships, or parts of three townships, but you can look at these more closely in the *Casebook* and see better detail than you see on this slide. But this, was to the west, west side there. This was on the south end and again you can see how they pushed the rectangular system. They protracted actually out into the lake bed except for the places where

they were protecting the frontage, the “in front of”, what we call the riparian rights. It is sort of an odd looking thing when you look at it you see that one piece sticking out and another one as a triangle there down out of section 4 to the north there. But and then it is all rectangular, the rest of it. But that was exactly what was done.

They protected the private bona fide rights and then just surveyed the remaining Federal lands so that it is open to disposal, or management or whatever uses the Government had for it. Here, I have just blown up of that area so you can see what I am talking about as far as how that looks in their solution.

COGO Exercise Introduction

So it's time for us to introduce the really last major part of this course and that is the COGO exercise. There are files called, as it says here, reliction.rtf or there are ones in TXT and PTS formats. And you should load those into whatever kind of COGO program you have and then you will be able to use some of the data. And the instructions for this are also included in your handouts for this course.

But here is the original plat of Deer Lake which is the lake we are going to deal with and do a small project on just to practice what we have learned here to take a look at medial line, as well as division lines or partition lines that we use to create our protection of bona rights that individuals may have out there. And so again this data is there for you in a handout format. Let's look at the record meanders of Deer Lake.

<u>Section 28</u>		<u>Section 26</u>	
N63°W	7.00	S76°E	8.00
N30°E	12.48	S12°E	2.10
<u>Section 27 (North)</u>		<u>Section 35</u>	
East	15.00	S53°E	8.00
S73°E	28.50	S50°W	10.00
S80°E	23.00	S73°W	7.76
S68°E	11.00		
S66°E	5.81		

Record Meanders of Deer Lake

Section 34

S64°30W	3.50
N63°0W	8.00
S38°0W	6.00
S69°0W	7.00
N45°0W	8.00
S86°30W	18.50
S55°0W	12.50
N33°30W	17.50
N49°0W	10.09

Section 27 (South)

N29°0W	15.42
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And you don't have to be jotting all this down, this information is printed for you in the instructions file. Just showing you that there were quite a few meanders and the way it sits there it actually has meanders in section 27 in two different places so I have just identified those as north and south. So those are all the record meanders that we will be dealing with. Again that stuff is in your files.

Let's see what other information we have for this project. So here is kind of the extent of this exercise, what you get to do. You are going to have to adjust the record meanders. We have already subdivided section 34 for you, so lot 2 is the parcel we are going after. We are going to; you will set SMCs on the adjusted record meander lines. Then we want you to try all five of the methods. Now I provided you a simple medial line in the file, if you want to try your own medial line to see how close you get that is fine. That might be good practice. Of course I can't ahead of time know how you are going to do it so I am using the medial line that I have provided in there and the answer sheet will of course be tied to that. But that is the process and it gives you a chance to look at the medial line as well as look at all five of those methods.

So that is the extent of this and we recommend that you stop the course now and you take a look at that COGO exercise. If you really do spend some time on that it could take an hour or so to do different things but it is a good opportunity to really put to work the things we have been talking about.

COGO Exercise #2

A file is included in this course called “Reliction COGO Record”. It is in three formats: txt, rtf, and pts. You should load this file into your personal COGO software. It contains the record data for the meanders, section subdivision, and a medial line we have computed for you. To complete this exercise, you should:

1. Adjust the record meanders to the portion of Deer Lake in section 34. We used the unadjusted record meanders for the rest of the lake to create a medial line.
2. Establish the SMCs where lot 2 intersects your adjusted meander line.
3. Determine the points along the medial line for the methods shown in the course:
 - a. Normal to the shoreline
 - b. Normal to the medial line
 - c. Proportionate shoreline
 - d. Extended upland lines
4. You might want to set a radius point for the whole lake just to compare a pie method to the long lake method we ended up using.
5. Our medial line is established as we showed in the course. While the medial line could have been extended one or two more points to the west, you will see such a solution would have created very odd-shaped areas added to the section 27 lots. The medial line we provided you assumes the east and west ends of it would be the radii for pie methods on the ends of the lake.
6. In a file called “Reliction COGO Answers”, with the same file formats, is also included which will allow you to compare your solutions to ours.
7. We have also included a dxf file (if you are able to import it) to see the line work and layers we used to solve this exercise.
8. After seeing these solutions, decide which you would prefer. We chose the proportionate shoreline method as it seemed most equitable and is safest legally. But this exercise shows how close some of these solutions can be to each other in this real world example.

Deer Lake CAD

Well hopefully you have worked with that COGO exercise and played around with it a little bit because it is good practice. Here is just a simple CAD reproduction of the lake as I had done it. I want you to notice what I ended up using, I didn't adjust the meanders on the north side of the lake. It doesn't really matter where you are plus or minus anything anyway, but I did adjust the meanders on the south side on the section we are working with.

I want you to notice that medial line where I decided to end it on the east end and west end. Obviously if this is a long lake method well then those will be the radius points on the pie part. Notice, here if I extended that out further look what it would do to some of those properties. They would be oddly shaped out there, so I didn't go any further I decided that was a good place for the radius point of the pie method that would be on the end and it would protect the properties better.

Now the next thing you had to do was to adjust that meander line which I did and I think it had about thirty feet of error in it. So once you adjust that, then you can set the special meander corner where the north-south mid-section line intersect, of course that is a fractional section, so you had to run that on the weighted mean and then you can set the other SMC where the longitudinal line of the northeast quarter intersects the adjusted meander line, so there are our two SMCs.

And then you know the next thing that I did, I set a radius point. I just said; well, what if, I did the whole lake made by the pie method and obviously if you consider where that is you would have some really long narrow useless triangles of land so that this is much better in the long lake method. The next thing I did, you see these yellow lines where the arrows are pointing is where we ran the normals to the shoreline. That is not the most logical solution at all times and especially when you have that jagged of a shoreline.

And so we came off ninety degrees, on the west side it was kind of normal there on the midsection line but on the other line it didn't make any sense. Then, the next thing I tried was going proportionate shoreline and that is where those two fall, those blue lines. And that made a lot more sense. It is not quite as much of "in front of" but it certainly is more equitable than those other solutions gave the person more land. Of course with these you always want to consider what happens with the entire lake, not just the one parcel you are doing.

And the next solution I looked at was where these green pointers are, and I just said; well what if we extend the upland property lines. Run the mid-section line and the sixteenth line straight out. Of course that makes it look real normal but then that won't work for some of the other parcels on the other extremes. Of course that is what you can do in your COGO program, just play with that, see all those, and see that it won't make sense. In fact it cuts some of the people off from any rights.

So finally, I looked at the normals to the medial line. And this is where we just run ninety degrees off the medial line to where we hit the SMC and those really look (well I hate to use the word normal) but they looked really good and as you consider some of the other possibilities,

that normal to the medial line seems like a pretty good solution, so there that is just seeing it in a DWG format.

Course Review

So this brings us to the end of the course. On this slide you can see on the left the two objectives that we set you know to talk about; how to apportion; To see that there are five methods and then some general ideas about how to evaluate what might be best under certain circumstances. So there is a lot more complexity to this subject as you can imagine, we said there are things we were not covering. If there was an ordinary low water line or and partial reliction or various other issues.

But we covered enough here and introduced terms and concepts that I think it helps us to figure out the solution to most of these when they come along. So there is a final exercise that you will take depending on the format of the course you are taking. But it will give you an opportunity to display what you have learned and how you have learned to apply it.

Once again some of the most important things in here is to remember that we have basic principles of law, we have extreme grey areas when it comes to how we decide like a medial line, and we have sometimes two, three, four, five different choices as to how to divvy up or apportion (the better word), the area that has been relicted. And so there is a lot of professional judgment here and I would again encourage you (like I did a few slides ago) to be open minded with what has already been done by others. Your way is just your way and it might even be a little better, but if someone else has already been there and has already done it and it is within reason, and it doesn't really violate the principles and that sort of thing, then I strongly suggest you go with that; so, and that is true with a lot of different things in surveying, frankly. But hopefully we have met your expectations, your needs with this course to give you some ideas and to look closely at case number D5.

So that completes our course, hopefully it's been of use to you. We want to thank you, on behalf of the CFedS Program and the Public Land Survey System Foundation. Hope that you got a lot out of this. We have other courses available too so enjoy that. Now you got a good foundation to learn even more to look at other resources and to learn more things about the fascinating subject of water boundaries. So we wish you all the best in all that you do. This is Dennis Mouland saying take care.