

U.S. RECTANGULAR SURVEY STATES

# CHAPTER 5

## U.S. RECTANGULAR SURVEY SYSTEM



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## Introduction

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The system of rectangular townships, six miles square, and consisting of thirty-six one square mile sections, is technically called *the system of rectangular surveys*. It is also referred to as the *surveys of the public lands of the U.S.*, or *Government Land Office surveys*.

The state standard cadastral map system is referenced to the system of rectangular surveys. The map areas, numbers, tax lot numbers and scales are directly tied to the rectangular survey. The tie is essential because the rectangular survey is the reference base for nearly all deeds, surveys, plats, and assessment records.

When preparing, installing or maintaining a cadastral map system, hardly a day will go by that the cartographer isn't working with some element of the rectangular survey system. It is, therefore, essential that each cartographer be well versed in the principles of that system.

This chapter is devoted to the key principles, laws and problems related to the system. The methods of survey not related to cartography have been purposely omitted; however, if you wish to pursue the technical survey requirements, we recommend reading the 1973 BLM *Manual of Instructions on the Survey of the Public Lands of the U.S.*<sup>1</sup>

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## Brief History

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In the Colonial States and other New England and Atlantic Coast States (except Florida), and later West Virginia, Kentucky, Tennessee and Texas, the only system used to describe properties was the *metes and bounds* method.

As the country began to expand, it became necessary to develop a more uniform system of surveying and describing government lands being conveyed to citizens.

In 1784 the U.S. experimented with several rectangular survey systems, such as the ten-mile square township system recommended by Thomas Jefferson. In April of 1785 Congress approved a seven-mile square rectangular survey system, and in May of 1785 the law was amended and the six-mile square township rectangular survey system was adopted.

In 1812 the General Land Office (G.L.O.) was created to take charge of "all acts and things touching or re-

specting the public lands of the U.S.;" which included the surveying of the public lands. In 1946 the G.L.O. was abolished and absorbed into the newly created Bureau of Land Management.

The rules and regulations were established in 1785 and have been continuously revised to the present. Detailed regulations were printed in the Manuals of 1855, 1881, 1890, 1894, 1902, 1930, 1947, and 1973.

After admission of the States into the Union, the U.S. continued to hold title and administer the laws to unappropriated lands. Various enabling acts provided that the title to unappropriated lands within each State shall remain in the U.S. Congress alone has the power, derived from article IV, section 3, of the U.S. Constitution, of disposing of the public domain. It is a well-settled principle of law that the U.S., through the Department of Interior, has the authority and duty to extend surveys to include lands erroneously omitted from earlier surveys.

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## Navigable Waters

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The beds of navigable waters are *not public domain* and are *not subject to survey and disposal* by the U.S.; the sovereignty is in the individual States. Under U.S. law the navigable waters have always been, and shall always be a *common highway*. This includes all tide-water streams whose natural and normal condition, at the date of admission of the State into the Union, was such as to classify the same as navigable water. (See *navigable river*, *navigable stream*, *navigable in fact*, *navigable waters of the U.S.* and *test of navigability* in the glossary.)

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## Swamp and Overflowed Lands

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In the Act of March 12, 1860, (12 U.S. Stat. 3) swamp and overflowed lands were granted to the State of Oregon.

The provisions of the grant apply to the elevations situated below the uplands; wherein the lands are of such character that without the construction of levees or drainage canals the areas would be wet and unfit for agriculture. The grants apply to all swamp and overflowed lands that were unappropriated at the dates of the granting acts, and whose character *at that time* would bring them within the provisions of the grant.

# System of Rectangular Surveys

## General Scheme

According to the laws of the U.S.: (1) the public lands of the United States shall be divided by lines intersecting true north and south lines at right angles so as to form townships six miles square; (2) the townships shall be marked with progressive numbers from the beginning; (3) the townships shall be subdivided into 36 sections, each one mile square and containing 640 acres as nearly as may be; and (4) the 36 sections shall be numbered, respectively, beginning with the number 1 in the northeast section, and proceeding west and east alternately through the township with progressive numbers to and including 36. (R.S. 2395; 43 U.S.C. 751)

In accordance with the foregoing legal requirements, the public lands are surveyed under the method called *the system of rectangular surveys*, which embraces the following procedures:

“(1) The establishment of independent *initial points*, each to serve as an origin for surveys to be extended in separated localities.”

The initial point for Oregon is at geodetic coordinates:

latitude 45°31’11”  
longitude 122°44’34”

“(2) The survey of principal meridians and base lines, originating at the initial point.”

The principal meridian for Oregon and Washington is the *Willamette Meridian* adopted in 1851.

“(3) The establishment of *guide meridians* initiated at base lines, and of *standard parallels* initiated at the principal meridians, at intervals short enough to maintain a workable adherence to the legal definition of the primary unit, the township six miles square.”

“(4) The survey of township exteriors within the framework so established. Townships are numbered to the north or south commencing with number 1 at the base line, and with range numbers to the east or west beginning with number 1 at the principal meridian.”

“(5) The subdivision of the townships into 36 sections by running parallel lines through the township from south to north and from east to west at a distance of one mile. The sections are numbered commencing with number 1 in the northeast section of the township, proceeding thence west to section 6, thence south to section 7, thence east to section 12, and so

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Figure 5-1

on, alternately, to number 36 in the southeast section.” See figure 5-1.

The law also prescribes that (1) the corners marked in public land surveys shall be established as the proper corners of sections, or of the subdivision of sections, which they were intended to designate, and (2) the boundary lines actually run and marked shall be and remain the proper boundary lines of the sections or subdivisions for which they were intended, and the lengths of these lines as returned shall be held as the true length thereof. (R.S. 2396; 43 U.S.C. 752.)

The original corners *must stand as the true corners* they were intended to represent, *even though not exactly where professional care might have placed them in the first instances.*

When compared to subsection (2) above, the last statement sounds contradictory; however, the statement is based on a long established principle of law that *the corner as placed in the ground by the original surveyor is the corner in fact, regardless of where original survey dimensions and bearings might have placed them.*

## Principal Meridian

The principal meridian, or Willamette Meridian, is to conform to the geodetic (true) meridian, extending north and south from the initial point. Regular section and section corners are established at intervals of 40 chains, and regular township corners at intervals of 480 chains. Corners designated as meander corners are established at the intersection of the line with meanderable bodies of water.

## Base Line

The base line is extended east and west from the initial point on a true parallel of latitude. Standard quarter corners and section corners are established alternately at intervals of 40 chains and standard township corners at intervals of 480 chains. Meander corners are established where the line intersects meanderable bodies of water. (See Chapter on riparian rights)

## Standard Parallels

Standard parallels, also called *correction lines*, are extended east and west from the Willamette Meridian.

The parallels were to be run at intervals of 24 miles north and south of the base line; however, some have been placed at intervals of 30 and 36 miles. When placed at 30 and 36 miles, intermediate correction lines are to be established, to which names, such as *Fifth Auxiliary Standard Parallel North*, may be given. These lines are, in all respects, like regular standard parallels.

## Guide Meridians

Guide meridians are extended north from the base line, or standard parallels, at intervals of 24 miles east and west from the Willamette Meridian. The guide meridians are terminated at the points of their intersections with the standard parallels. The guide meridians are to be projected on a geodetic meridian, and the fractional measurement is placed in the last half mile. Figure 5-2 shows four quadrangles embrac-

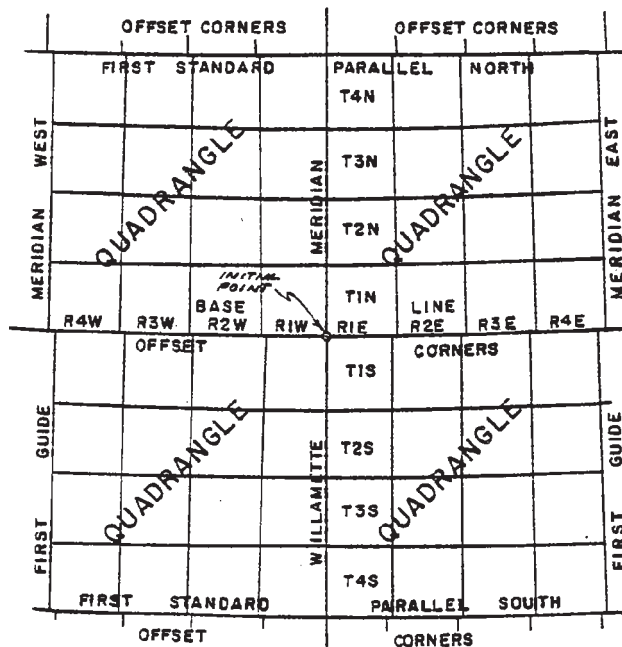


Figure 5-2

ing 16 townships bounded by standard lines, showing the coordinate system of numbering townships.

Some guide meridians were placed at intervals exceeding 24 miles. In this case new governing lines are established, and these new guide meridians have names such as *Grass Valley Guide Meridian*.

## Township Exteriors

The *south* and the *east* boundaries of a township are normally the governing lines of the subdivisional surveys. Many previously established exteriors were defective in one way or another. Errors of former surveys, however, are not to be incorporated into surveys of abutting townships. Where the defective township exterior cannot be used, other controlling lines known as sectional correction lines and sectional guide meridians are employed.

## Meridional Boundaries

Whenever practical, township exteriors are surveyed successively through a quadrangle in ranges of townships beginning with the townships on the south (figure 5-2).

The meridian township boundaries have precedence in the order of survey and are run from south to north on true meridians. Excesses and deficiencies are placed in the north half-mile.

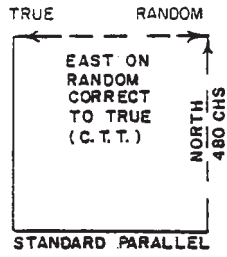
## Latitudinal Boundaries

The latitudinal township boundary is run first as a random line, setting temporary corners, on a cardinal course, from the old toward the new meridian boundary, and is corrected back on a true line if conditions are ideal. Where both meridian boundaries are new lines or where both have been established previously, the random, latitudinal boundary is run from east to west. In either case, if the defective conditions are not met with, the random line is corrected back on true line. Fractional measurements are placed at the last half-mile.

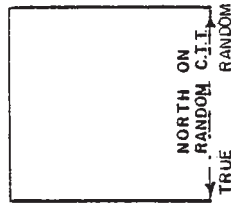
Figure 5-3 illustrates the regular order of completing township exteriors. The solid lines represent previously surveyed lines, and the dash lines represent new lines surveyed. The arrows represent the direction of the survey, and double arrows indicate a random line to be corrected to true (abbrev. C.T.T.).

Remember, exterior township lines are run first; and exterior section and quarter section corners are run before the interior is subdivided into sections.

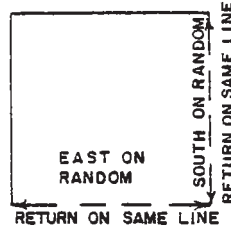
The regular order of completing exteriors is often departed from. The departure from the regular order



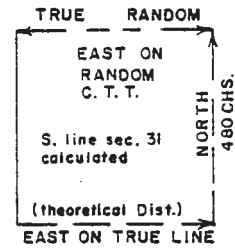
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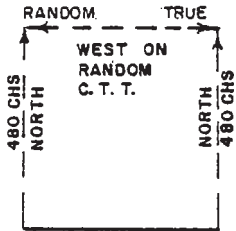
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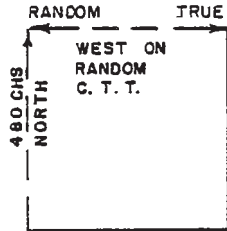
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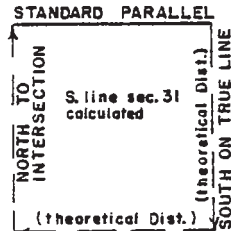
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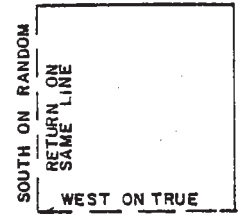
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D



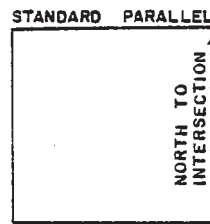
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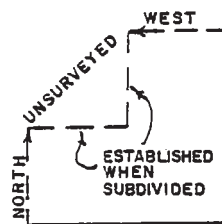
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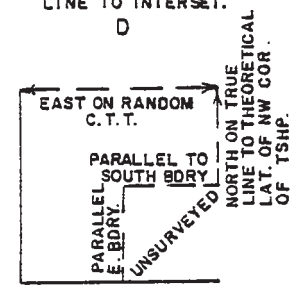
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E



F

Figure 5-3

Figure 5-4

is always based on the principle of accomplishing the same relationship of one township boundary to another as would result from regular establishment under ideal conditions. Figure 5-4 illustrates some of the departures to the regular order of completing exterior boundaries. The solid lines represent previously surveyed lines, and the dash lines represent new lines surveyed. An arrow indicates direction of the survey, and double arrows indicate a random line to be corrected to true.

The township interior (the sections) are to be subdivided after the exterior boundaries are run.

A random line, run upon the cardinal course, is made the true line where the falling would otherwise require a correction exceeding 14' of arc. Where the random latitudinal boundary closes on a new meridional exterior the temporary township corner is adjusted to the latitude of the opposite township corner. But where both meridional boundaries have been previously surveyed, a closing township corner is established at the point of intersection of the random latitudinal line with the meridional boundary, or its projection to the north or south as the case may be.

A random meridian boundary is made the true line if the falling plus the correction for parallelism of the meridian subdivision lines result in calculated bearings (in the northernmost miles of the latter lines in excess of 14' (fourteen minutes) from cardinal).

The 14' limit for exteriors applies only to the establishment of new boundaries. If a boundary is accurate within 21' of cardinal, it is not considered defective.

### Partially Surveyed Exteriors

Where the end portions of a township exterior have been previously surveyed and fixed in position by use, the fractional unsurveyed middle part is completed by random and true line without offset, regardless of the deviation from the cardinal direction. As a general rule, the fractional measurements are placed in the north or west half miles.

Figure 5-5 (from the BLM Manual) illustrates representative cases of incomplete township exteriors, showing methods for completion.

## Rectangular Limits

"The normal township includes 36 sections, only 25 of which are returned as containing 640 acres each. Sections against the north and west boundaries, except section 6, contain regular aliquot parts totaling 480 acres with four additional fractional lots in each section. Section 6 contains regular aliquot parts totaling 360 acres with seven additional fractional lots." (BLM 1973 Manual)

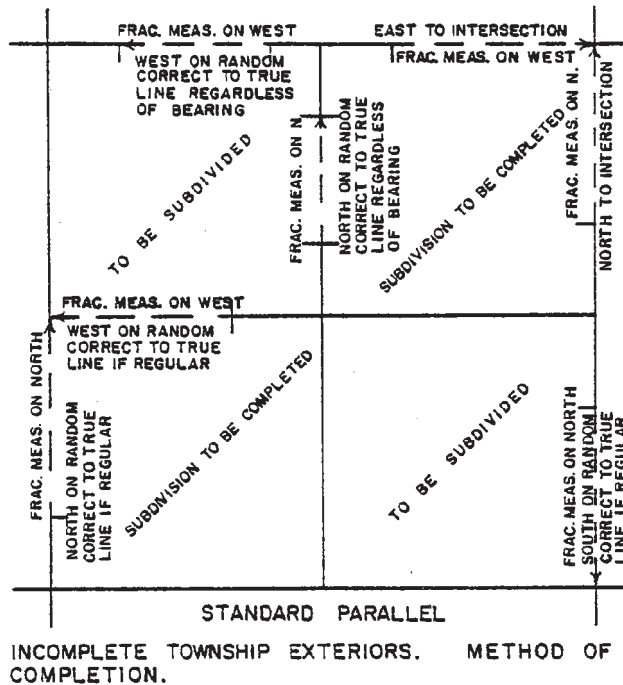


Figure 5-5

The ideal section is allowed to give way to one that is termed *regular*. The amounts of variance from regular are still considered regular and are referred to as *rectangular limits*.

- (1) Alignment. Section boundaries must not exceed 21' from cardinal, in any part, nor may the opposite (regular) vary more than 21' (21 minutes).
- (2) Measurement. The distance between regular corners are allowed adjustments not to exceed 25 links

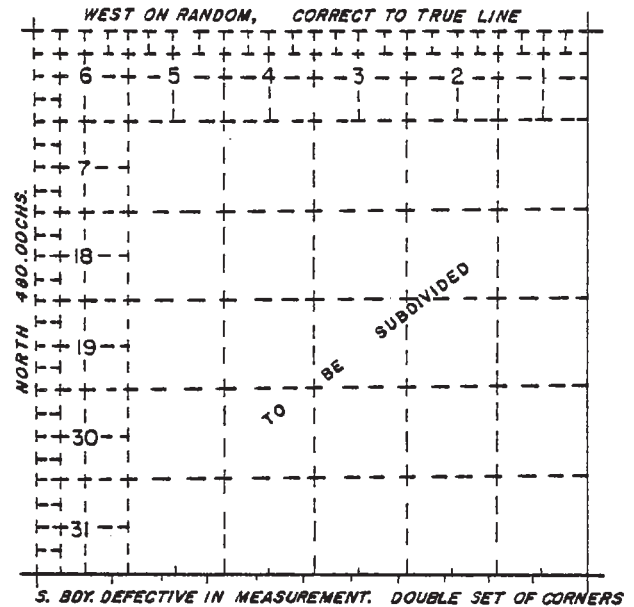


Figure 5-7<sup>2</sup>

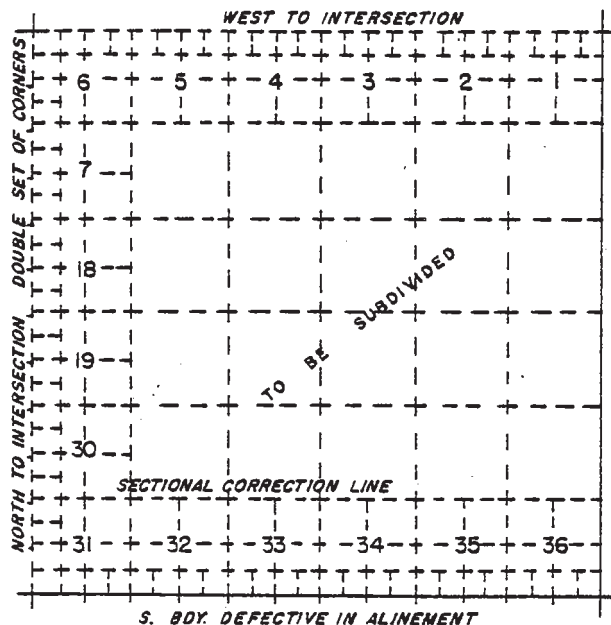


Figure 5-6<sup>2</sup>

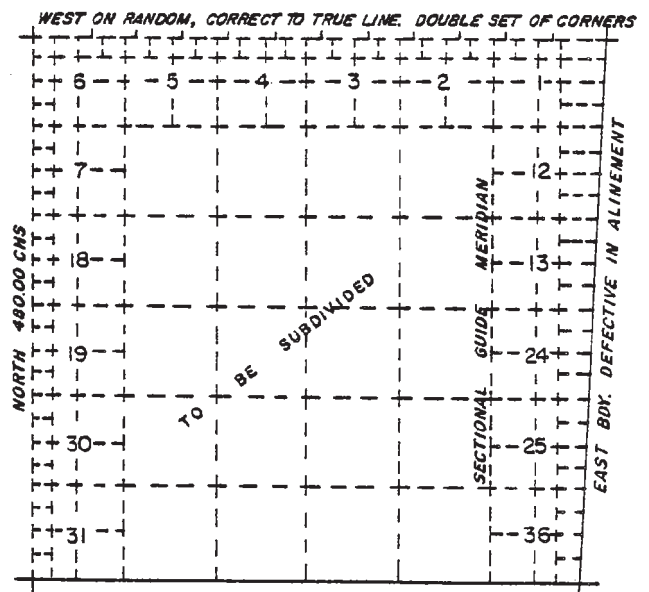


Figure 5-8<sup>2</sup>

in 40 chains. Township exteriors, or portions of exteriors, are defective when not within above limits.

- (3) Position. The corresponding section corners upon opposite boundaries are to be so located that they may be connected by true lines deviating no more than 21' from cardinal.

NOTE: The above *limits* are not the same as *allowable error of closure*.

## Defective Township Exteriors

Township boundaries already established may be defective in alignment, measurement or position.

The position of the new exteriors, or of corners set on defective township boundaries in the new survey, must be established by an actual rerunning of the lines. Data acquired in surveying subdivisional lines closing upon a defective exterior is not acceptable in lieu of retracement or resurvey.

The south boundary of a township is regularly the governing latitudinal boundary. If the south boundary is defective, a sectional correction line is required.

The east boundary of a township is regularly the governing meridian boundary. If defective, a sectional guide meridian is required.

New east and south boundaries of a township became the closing meridian and latitudinal boundaries of the townships to the east and south respectively.

Where the previously established north or west boundaries are defective in measurement or position and subdivisional surveys have been initiated from them, the original corners are changed only to refer to sections to the north or west.

Closing section corners are established when subdividing. New  $\frac{1}{4}$  corners are placed on the *old line* at mean distances between section corners, or at 40 chains from one direction, depending on the plan of the subdivision of the section. Where the previously established north or west boundaries are defective in alignment, but not in measurement or position, no changes are required.

Figures 5-6 through 5-8 illustrate the guiding principles involved in establishing new governing boundaries where previous exteriors are defective. Each diagram illustrates a simple condition affecting one boundary only, and examples are taken only from regular orders of procedure. The same procedures hold true under irregular order.

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# Subdivision of Townships

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The boundaries of a township are within satisfactory governing limits for control of the subdivisional survey when the lines may be theoretically projected from the boundaries without closely approaching the rectangular limits. The danger zone has already been placed at theoretical bearings exceeding 14' from cardinal, and the corresponding zone in respect to lengths of lines may be placed at theoretical adjustments exceeding 33 links per mile.

## Meridional Section Lines

These lines have precedence in the order of survey. They are initiated at the section corners on the south township boundary and are run north parallel to the governing east boundary. Meridian lines are numbered counting from the east and are surveyed successively in the same order. Regular  $\frac{1}{4}$  section and section corners are established at intervals of 40 and 80 chains as far as the northernmost interior corner.<sup>3</sup>

The last mile of a meridional line is continued as a random line, each successive random line being parallel to the true east boundary on a section to which it belongs "... the random line is then corrected to a true line ... and permanently establishing the quarter-section corner on the true line at a distance of 40 chains from the south, placing the fractional measurement in the north half mile."

Where the north boundary of the township is a base line or standard parallel, the last miles of the meridional section lines are continued as true lines parallel to the east boundary of the township. At 40 chains from the south  $\frac{1}{4}$  corners are established, closing corners are established at the points of intersection with the north boundary. New  $\frac{1}{4}$  section corners are established at mean distances between closing corners, or at 40 chains from one direction, depending on the plan of the subdivision of the section.

## Latitudinal Section Lines

The latitudinal section lines, except in the west range of sections, are normally run on random lines from west to east, parallel to the south boundaries of the respective sections.

In the west range of sections, the random latitudinal section lines are run from east to west, parallel to the south boundaries of the respective sections. Permanent  $\frac{1}{4}$  section corners are established on the *true lines* at 40 chains from the east, placing the fractional measurements in the west half miles.

## Accumulated Error

Error in the alignment of the meridional section lines is taken up in part in the measurement of latitudinal lines, which must be within 50 links of 80 chains in length, except in the *west range* of sections where the convergency of the meridional lines is provided for. The accumulated error in alignment for the five miles of true meridional line is taken up in the sixth mile, which is run random and true. Here the true line must be within 21' of cardinal. Accumulated error in measurement in running north is placed in the last half fractional mile. Here the meridional distance is checked by a calculated closing around the last section, and the latitudinal error must not exceed 25 links to come within limits of closure. Limit of rectangularity will be exceeded if the accumulated error is greater than  $3\frac{1}{2}'$  in alignment or  $8\frac{1}{3}$  links per mile in measurement.

Figure 5-8 shows sectional guide meridians to be used when the east exterior is defective.

Figure 5-9 shows the proper sequence of numbers on section line when the normal order of subdividing is adhered to.

## Summary

The object of the BLM rules is to secure the maximum number of normal sections. The sections adjoining the east boundary are regular if they conform with the usual rectangular limits. In this case,  $\frac{1}{4}$  corners are placed on latitudinal section lines at midpoint.


Figure 5-9

The sections adjoining the south boundary of the township are not regular unless the meridional lines are established at 80 chains in length, and the sections are otherwise in conformity with the usual rectangular limits.

## Closing Section Lines

Guide meridians are closed against standard parallels. Township and section lines are closed on standard parallels. Both township and section lines may be made closing lines to maintain rectangularity. A different type of closing line occurs where the lines cross or close on boundaries of reservations, grants, State boundaries, or the lines of various kinds of claims.

Closing corners are normally established at intersections with a surveyed reservation, grant or State boundary.

Quarter-section corners are established between closing corners for sections closing on reservation or grant boundary.

The BLM normally does not locate quarter-section corners on state lines since they do not have the authority to survey state boundaries.

Closing corners are not set at the intersection with the line of a surveyed mineral claim, forest homestead claim, small holding claim, or the like; unless required to provide an interval of monumentation of one-half mile or less.

Where a section line or township line crosses a surveyed claim, the bearing of the intersected claim line and the distance to the nearest corner are determined and noted (on the plat).

Remember, the accuracy of lotting in the section is dependent on the accuracy of the claim location. All bearings, distances and ties should be used by the cartographer to obtain accurate claim-section relationships.

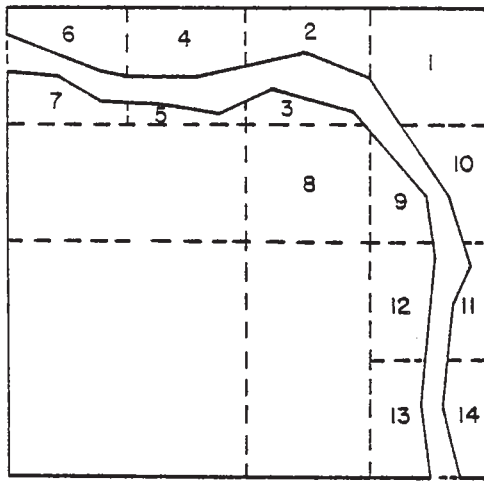
## Subdivision of Sections

Revised statutes, secs. 2396, 2397 (43 U.S.C. 752 and 753), contain fundamental provisions for the subdivision of sections into  $\frac{1}{4}$  and  $\frac{1}{4} \frac{1}{4}$  sections. The sections are not subdivided by G.L.O. or B.L.M. unless provision is made in special instructions; however, certain subdivision-of-section lines are always protracted upon the official plat.

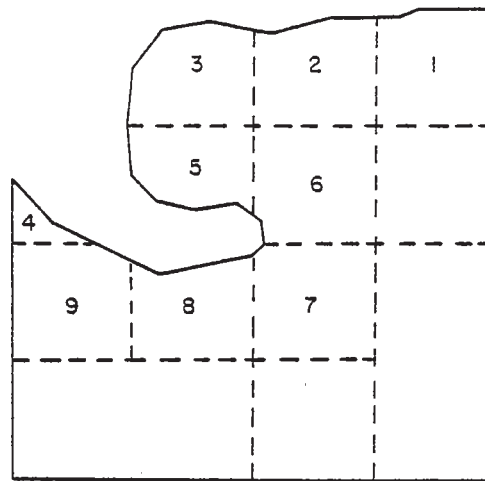
Under the general land laws, the *unit of administration* is the  $\frac{1}{4} \frac{1}{4}$  section of 40 acres.

Lands, by rectangular survey, are identified on the ground by fixed monuments (not to be moved, altered, destroyed) established in the survey. *A U.S. patent con-*

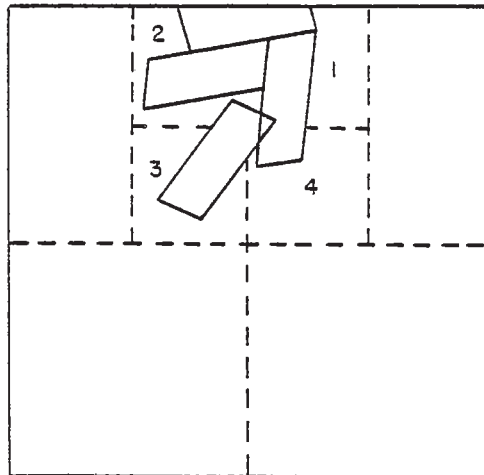




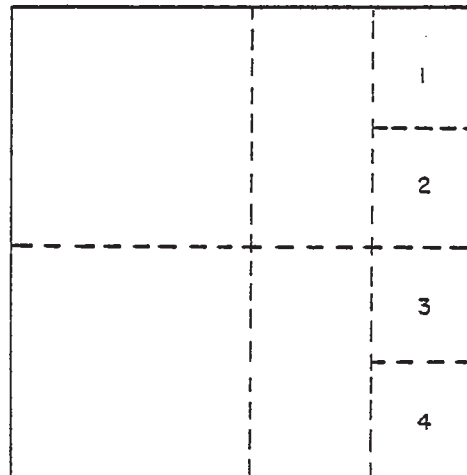
MEANDERABLE RIVER  
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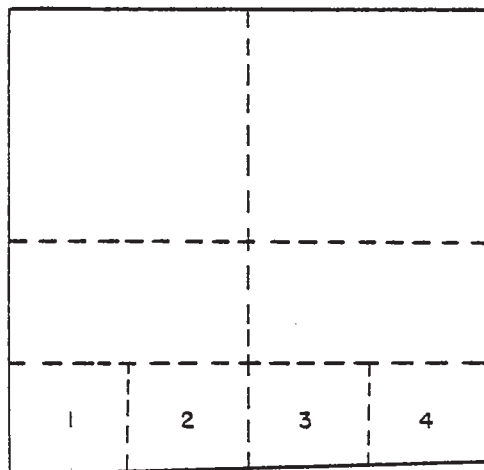
MEANDERABLE LAKE  
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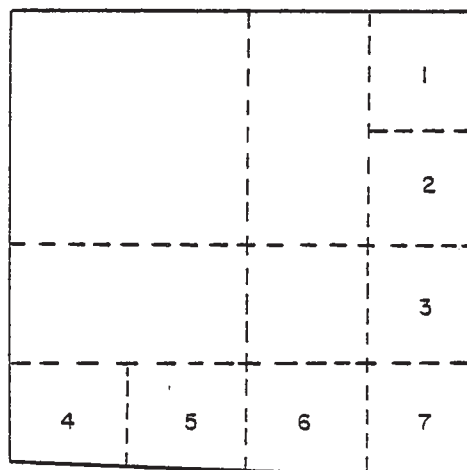
MINERAL CLAIMS  
C



E. BDY. DEFECTIVE IN ALINEMENT  
D



S. BDY. DEFECTIVE IN ALINEMENT  
E



E. & S. BDRS. DEFECTIVE IN ALINEMENT  
F

Figure 5-13

In modern practice, sections in excess of 120 chains are avoided by creation of half-townships or half-ranges. This cannot, however, be done with interior sections.

### Subdivision of Sections into 1/4 Sections

To subdivide a section into 1/4 sections, run straight lines from the established 1/4 section corners in a straight line to the opposite 1/4 section corners. The point of intersection of these *centerlines* or 1/4 lines will be the *corner common to the several 1/4 sections*, or the *legal center* of the section.

### Subdivision of Fractional Sections

The law provides that where opposite corresponding 1/4 section corners have not been or cannot be fixed, the subdivision-of-section lines shall be ascertained by running from the established corners north, south, east or west, as the case may be, to the water course, reservation line, or other boundary of the fractional section, as represented upon the official plat.

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 geodetic; or to run parallel to the east, south, west or north boundary of the section, as conditions may require.

### Subdivision of Quarter Sections

Preliminary to the subdivision of 1/4 sections, the 1/4 1/4 (1/16 section) corners will be established midway (half-way) between the section and 1/4 section corners and between the 1/4 section corners and the center of section, except on the last half mile of the lines closing on township boundaries, where they should be placed at 20 chains, proportionate measure, counting from the regular 1/4 section corner.

The 1/4 1/4 (1/16 section) corners having been established as directed above, the center lines of the 1/4 section will be run straight between opposite corresponding 1/4 1/4 corners on the 1/4 section boundaries. The intersection of the lines thus run will determine the legal center of a 1/4 section.

### Subdivision of Fractional Sections

The subdivision of fractional 1/4 sections will be run from properly established 1/4 1/4 corners, with courses governed by the conditions represented upon the official plat, to the lake, water course, reservation

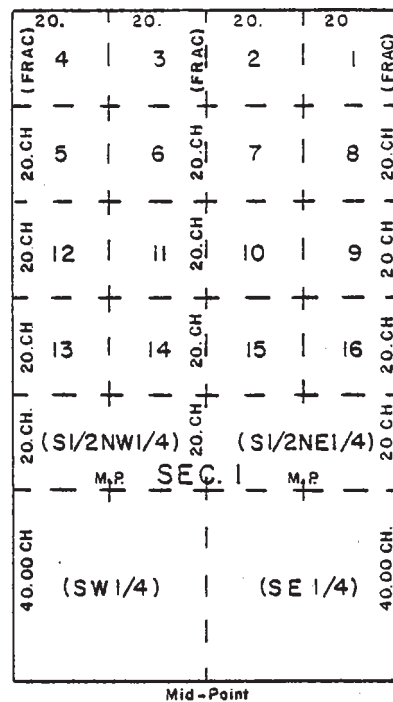


Figure 5-14

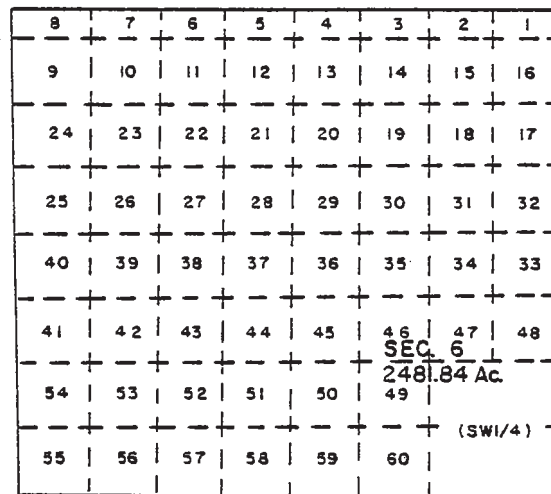
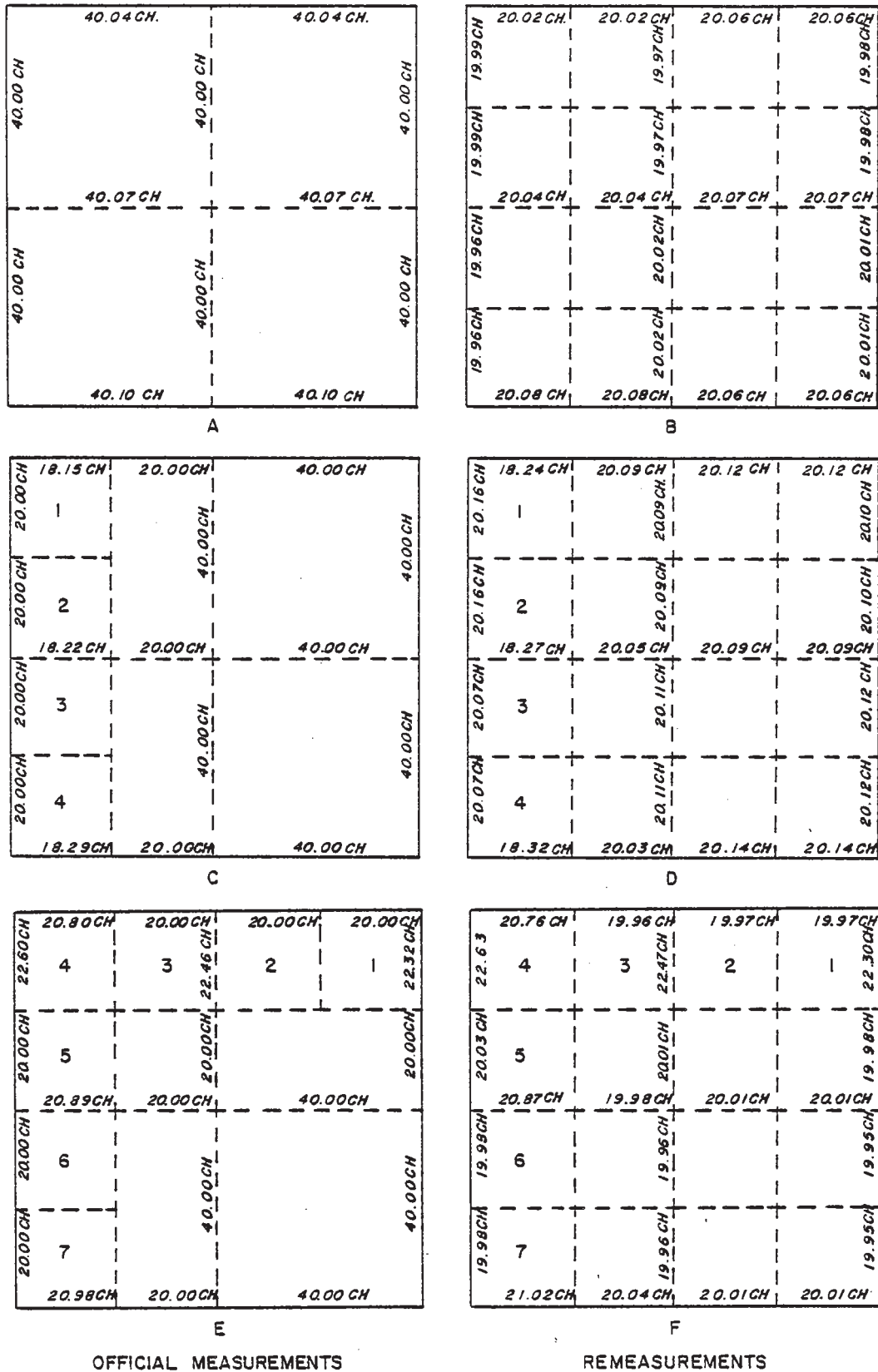


Figure 5-15

or other irregular boundary which renders such sections fractional.

Reasonable discrepancies between former and new measurements may generally be expected when retracing the section boundaries. The shortage or surplus is distributed by proportion in establishing a 1/16 corner, or 1/4 1/4 corner. In this manner the discrepancies between original and new measurements are equitably distributed. See figure 5-13.



OFFICIAL MEASUREMENTS

REMEASUREMENTS

Figure 5-16

Example of subdivision by survey showing relation of official measurements and calculated distances to remeasurements, and indicating proportional distribution of differences.

(BLM Manual)

## Summary

It is emphasized that when entrymen<sup>4</sup> have acquired title to certain legal subdivisions, they have become owners of the identical ground area represented by the corners established on the ground, which should conform to the official plat.

A private survey made for the purpose of marking on the ground a theoretical line, platted but not run by the U.S., where executed within allowable departure from geodetic course, and relied upon by owner under title passed by the U.S. in the placing of improvements on the patented land, will not be disturbed, but it will be adopted by the U.S. as a boundary for closure of the survey of the adjoining public land. (*Algoma Lbr. Co. v. Kruger*, 50 L.D. 402 (1923))

## Meandering

The traverse of the margin of a permanent natural body is termed a meander line. All navigable bodies of water and other important rivers and lakes are segregated from the public lands at mean-water elevation (see glossary). In the original surveys, *meander lines are run for the purpose of ascertaining the quantity of land remaining after the segregation of water areas.*

Numerous decisions in the U.S. Supreme Court assert the principle that *meander lines are not boundaries defining the area of ownership of lands adjacent to the water.* The general rule is that *meander lines are run not as boundaries, but to define the sinuosities of the banks of a stream or other body of water, and as a means of ascertaining the quantity of land embraced in the survey; the stream, or other body of water, and not the meander line, is the boundary.* (See Chapter 10)

Meander lines will not be established at the segregation line between upland and swamp or overflowed land, but at the ordinary high-water mark of the actual margin of the lake or river.

## Rivers

Facing *downstream*, the bank on the left hand is termed the *left bank* and that on the right hand is termed the *right bank*.

Navigable rivers and bayous, as well as non-navigable rivers which have a right angle width of 3 chains and upwards, are meandered on both banks, at the *ordinary mean high-water mark*.

Shallow streams and intermittent streams without well-defined channel or banks are not meandered, even when more than 3 chains wide. Tidewater streams are meandered at *ordinary mean high tide* as far as navigable even when less than 3 chains wide. Tidewater inlets and bayous are recorded and are

meandered if more than 3 chains in width, but when non-navigable are not meandered when less than 3 chains wide.

## Lakes

All lakes of the area of 50 acres and upward are meandered.

## Islands

Every island above the mean high water elevation of *any* meanderable body of water, except islands formed in navigable bodies of water *after the date of admission of Oregon into the Union*, is meandered and shown on the plat.

Even though the U.S. has parted with its title to the adjoining mainland, an island in a meandered body of water, navigable or non-navigable, in continuous existence since the date of the admission of Oregon to the Union, and omitted from the original survey, remains *public land of the U.S.*

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## Resurveys in Brief

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A *resurvey* is a reconstruction of land boundaries and subdivisions accomplished by re-running and re-marking the lines represented in the original field notes and plat.

Government resurveys involve considerations of a different character from those relating to *original* surveys. The object is two-fold: First, the adequate protection of *existing rights* acquired under the original survey; and second, the proper marking of boundaries on remaining public lands.

## Dependent Resurveys

A *dependent resurvey* is a retracement and re-establishment of the lines of the original survey in their true original positions according to the best available evidence of the positions of the original corners.

By law, and in fact, lands contained in a certain section of the original survey, and lands contained in the corresponding section of a *dependent resurvey* are identical.

## Independent Resurvey

An *independent resurvey* is the establishment of new section lines and often new township lines, *independent* of and without reference to the corners of the original survey.

In the independent resurvey boundaries of patented lands which are not identical with those of the resurvey must be preserved.

## Retracement

A *retracement* is a survey that is made to ascertain the direction and length of lines and to identify monuments and marks of an established prior survey.

## Jurisdiction

The Act of March 3, 1909 (35 Stat. 845), as amended June 25, 1910 (36 Stat. 885); 43 U.S.C. 772 authorized the Secretary of the Interior to make resurveys.

The Act of September 21, 1918 (40 Stat. 965 43 U.S.C. 773), provided authority for resurvey of townships in which disposals exceed 50% of the total area.

The Act of July 14, 1960 (43 U.S.C. 1364), authorized the Secretary of Interior to accept contributions for cadastral surveys performed on federally controlled or intermingled lands.

The B.L.M. has *exclusive jurisdiction* over all matters pertaining to surveys and resurveys affecting public lands. As between owners of patented lands, final determination in the matter of fixing the position of disputed land boundaries rests with local courts of competent jurisdiction.

## Bona Fide Rights of Claimants

The Act of March 3, 1909 (35 Stat. 845), as amended June 25, 1910 (36 Stat. 884; 43 U.S.C. 772) reads in part as:

*“That no such resurvey or retracement shall be so executed as to impair the bona fide rights of claimants, entrymen, or owners or land affected by such resurvey or retracement.”*

The rights of claimants are to be similarly protected under the provisions of the Act of September 21, 1918 (40 Stat. 965; 43 U.S.C. 773).

*Bona fide rights* are those acquired in good faith under the law.

When a resurvey plat does not show *new lot acreages* the original lot acreages must be used. This normally occurs on private lands, and the acres are not changed because of the principle of the protection of *bona fide rights*; because the original acreage is the *patented acreage*; and possibly because the original acreage is within tolerable limits.

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# Special Surveys of the U.S.

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*Special Surveys* are surveys that involve unusual applications of, or departures from, the rectangular survey system. They often carry provisions of a special legislative act. Special surveys include surveys of tracts or lots, special subdivision of sections, metes and bounds surveys, and townsite surveys.

## Tract or Lot Surveys

Special surveys may involve areas of land that are not aliquot parts of sections but are designated as *tracts* or *lots*. In common usage the term *tract* is applied to an expanse of land of no, particular size, often irregular in form. As regards the *rectangular survey* a tract usually ties in one or more sections and cannot be identified with any particular section, such as *donation land claims*. Tracts within a township are numbered beginning with 37 or the next highest unused numerical designation to avoid confusion with section numbers.

## Subdivision of Sections—Special

Special surveys of subdivisions of sections include Indian allotment surveys, subdivisions within reclamation projects, the determination of boundaries between intermingled public and patented lands within a section, the subdivision of sections into small tracts, and various fragmentary surveys.

If a section is subdivided, the center  $\frac{1}{4}$  section corner is established and monumented. If a  $\frac{1}{4}$  section is subdivided, all  $\frac{1}{16}$  corners are established and monumented.

## Metes and Bounds Surveys

Metes and bounds surveys are required to define the boundaries of irregular areas of land, which are not conformable to legal subdivisions. This type of survey may involve mineral claims, small-holding claims, private land grants, forest-entry claims, national parks and monuments, Indian reservations, lighthouse reservations, trade and manufacturing sites, homestead claims in Alaska, or the like.

Metes and bounds surveys located upon surveyed lands are usually connected to rectangular survey corners.

## Townsite Surveys

U.S.R.S. 2380 and 2381 (43 U.S.C. 711, 712) and numerous special acts make provisions for the executive withdrawal of public lands for townsite purposes.

A townsite survey, in public-land surveying practice, is a survey made within one or more regular units of the township subdivision by which the land is divided into blocks, streets and alleys as a basis for the disposal of title in village or town lots.

Townsite surveys fall into two general classes: those with few or no prior improvements and those where villages or towns already exist.

"In the typical U.S. surveyed townsite, the block dimensions are usually between 300 and 400 feet. The principal streets are usually made 80 feet in width, though frequently as much as 100 feet where greater width is called for. Less important intersecting streets, though narrower, are seldom given a width of less than 60 feet." (1973 BLM. Manual of Surveying Instructions 7-20, p. 162.)

"The normal frontage of lots is 50 feet. Unless conditions require a special plan, the whole system is laid out on cardinal." (BLM Manual.)

### Small Tract Surveys

The Act of June 1, 1938 (52 Stat. 609), as amended by the Act of June 8, 1954 (68 Stat. 239; 43 U.S.C. 682a), provides for the sale or lease of small tracts not exceeding five acres.

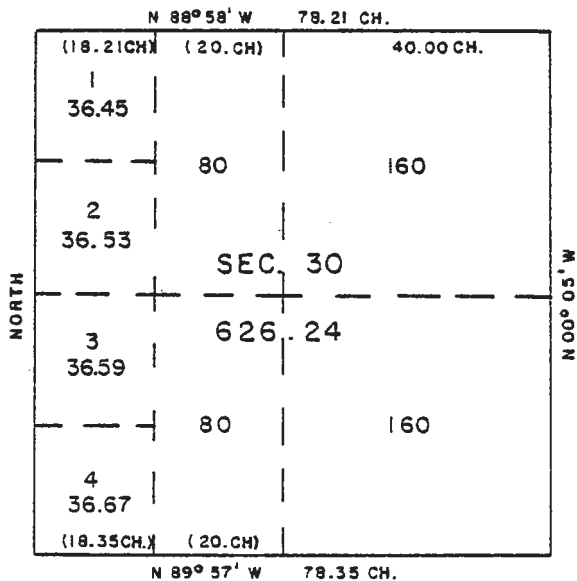


Figure 5-17

## Mineral Segregation Surveys

A mineral segregation survey is metes and bounds survey made to define the limits of non-mineral public land adjoining one or more mining claims and to supply data for lotting the non-mineral land against the claim.

### Mine Surveys

This class of survey is important in connection with the leasing of mineral lands, particularly coal lands. The field work usually consists of a dependent resurvey and partial subdivision of the section or sections involved, a traverse of the main entries to the mine with ties to the portals and improvements, and the marking of the section and subdivision of section lines within the mine which divide private and public ownership.

## B.L.M. Policy on Area Computation

According to subsection 9-24 (p. 195) of the U.S. B.L.M. Manual of Surveying Instructions, "The deficiency in area which results from the convergence of meridians is placed normally in the fractional lots adjoining the west boundary of the township. Sections 7, 18, 19, 30 and 31 each usually contains 1 to 4, inclusive, whose meridional dimensions are all even

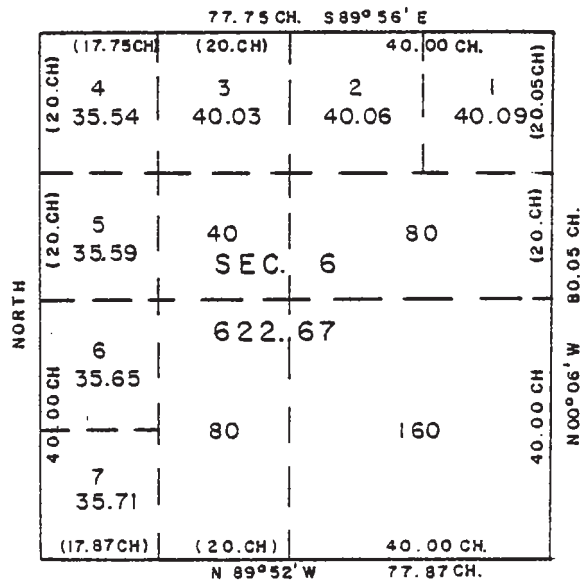


Figure 5-18

20.00 chains; the dimensions of the latitudinal boundaries of these lots are computed proportionally from the fractional measurements ascertained on the section lines. The area, in acres of each government lot is then found simply by adding the lengths, in chains, of its north and south boundaries."

For example, taking section 30 (figure 5-17) the dimensions of latitudinal boundaries and the areas are found as follows:

	Lot 1	Lot 2
N. Dim.	18.21 chs.	18.245 chs.
S. Dim.	<u>18.245 chs.</u>	<u>18.28 chs.</u>
	36.455	36.525
	36.45(+) acres	36.53(-) acres
	Lot 3	Lot 4
N. Dim.	18.28 chs.	18.315 chs.
S. Dim.	<u>18.315 chs.</u>	<u>18.35 chs.</u>
	36.595	36.665
	36.59(+) acres	36.67(-) acres

The areas of lots 5, 6 and 7, section 6, are ascertained similarly, making due allowance, when calculating the length of the north boundary of lot 5, for any material variation from 20.00 chains in the meridional dimension. (figure 5-18.)

The surplus, or deficiency in area, which results from the discrepancy in the meridional measurements between the exterior boundaries and the subdivisional lines is placed normally in the fractional lots adjoining the north boundary of the township. Sections 1 through 5 each usually contains lots 1 through 4, whose dimensions on their latitudinal boundaries are all treated as an even 20.00 chains; the meridional dimensions of these lots and their areas are computed on the plan for computing fractional lots adjoining the west boundary of the township.

The areas of lots 1, 2 and 3, section 6 (figure 5-18), are ascertained similarly, making due allowance when calculating the length of the west boundary of lot 3, for the departure across lot 4, where more or less than 20.00 chains. The area of lot 4, section 6, in acres equals the product of its mean dimensions in chains, divided by 10.

The following is an example of ascertaining the areas of the fractional lots in section 6 (figure 5-18):

	Lot 1	Lot 2
E. Dim.	20.05 chs.	20.037 chs.
W. Dim.	<u>20.037 chs.</u>	<u>20.024 chs.</u>
	40.087	40.061
	40.09 acres	40.06 acres

	Lot 3
E. Dim.	20.024 chs.
W. Dim.	<u>20.011 chs.</u>
	40.035
	40.03(+) acres

	Lot 4
E. Dim.	20.011 chs.
W. Dim.	<u>20.000 chs.</u>
	20.005 mean

N. Dim.	17.75 chs.
S. Dim.	<u>17.78 chs.</u>
	17.765 mean
$2.0005 \times 17.765 = 35.539$ acres	
	35.54 acres

	Lot 5	Lot 6
N. Dim.	17.78 chs.	17.81 chs.
S. Dim.	<u>17.81 chs.</u>	<u>17.84 chs.</u>
	35.59 acres	35.65 acres

	Lot 7
N. Dim.	17.84 chs.
S. Dim.	<u>17.87 chs.</u>
	35.71 chs.

"In irregular sections and in sections which are invaded by meanderable bodies of water, or by lines of segregation, the center lines of the section and the center lines of each quarter section in turn are given calculated values based upon the balanced field closing sheets. Points of intersection of the center lines with the meander lines or other lines of segregation are then computed in order to complete the boundaries of each fractional lot. With the results of these computations at hand the area of each fractional lot

may be most readily computed by the method of *double meridian distances*.<sup>15</sup>

For example, to compute the area of Diamond Rock (lot 4) in Section 18 (figure 5-19) use the following procedures:

1. To compute an area by double meridian distance, the closing error of the figure is eliminated, or the traverse of its boundary is balanced, by the most applicable rule (see Chapter 9).
2. The double meridian distances (D.M.D.'s) of the several courses are computed by:
  - a. The D.M.D. of the first course equals the departure, or the increment in easting or westing, of the course itself.
  - b. The D.M.D. of the second course, and each succeeding course in turn, is ascertained by taking, the D.M.D. of the preceding course, plus the departure of the preceding course, plus the departure of the course itself.
  - c. The D.M.D. of the last course is numerically equal to its departure, but with opposite sign, thus verifying the value of each preceding D.M.D.

3. For convenience in making the computations, the differences in

$\left. \begin{matrix} \text{latitude} \\ \text{departure} \end{matrix} \right\}$  to the  $\left. \begin{matrix} \text{north} \\ \text{east} \end{matrix} \right\}$  are treated as of positive sign;
   
 to the  $\left. \begin{matrix} \text{south} \\ \text{west} \end{matrix} \right\}$  as of negative sign.

4. The point of beginning is taken at the westernmost salient of the figure and the direction of the traverse is run counterclockwise. On this plan each D.M.D. and the algebraic sign of the final results are positive.
5. Multiply the latitude of each course by the D.M.D. of the course. The positive products are arranged in a column for "north areas"; the negative products in a column for "south areas."
6. The sum of the negative products is subtracted from the sum of the positive products.
7. The area, corresponding to the unit of measurement that is employed, is ascertained by taking one-half the last result.
8. Where the unit of measurement is the chain (as in the example of figure 5-19, and the computations of figure 5-20), the area in square chains is divided by 10 to give the area in acres.

The computation of lot 4 of section 18, in figure 5-19, is shown in figure 5-20.

Knowing *how* the U.S. acreages were computed will be helpful when confronted with illegible acreage figures on photocopies of the U.S. survey plats. If the preceding computations are followed, the acreage of any lot can be confirmed.

On standard lots (uninterrupted by special survey lines such as meanders, mineral survey, townsite surveys, etc.) the U.S. acreage is official. For example, the U.S. patented acreage (36.53) of lot 2 in sec. 30 (figure 5-17) is official. If the land is in private ownership, even a government survey cannot change the lot acreage. The only way the lot acreage can be changed (assuming it is in U.S. ownership and not private) would be by a resurvey.

The same is true of the areas of sections designated as 20.00 acres, 40.00 acres, 80.00 acres, 160.00 acres, 640.00 acres, etc. If the lands are in private ownership, the patent acreage stands. B.L.M. attorneys advise against changing the patent acres; unless, of course,

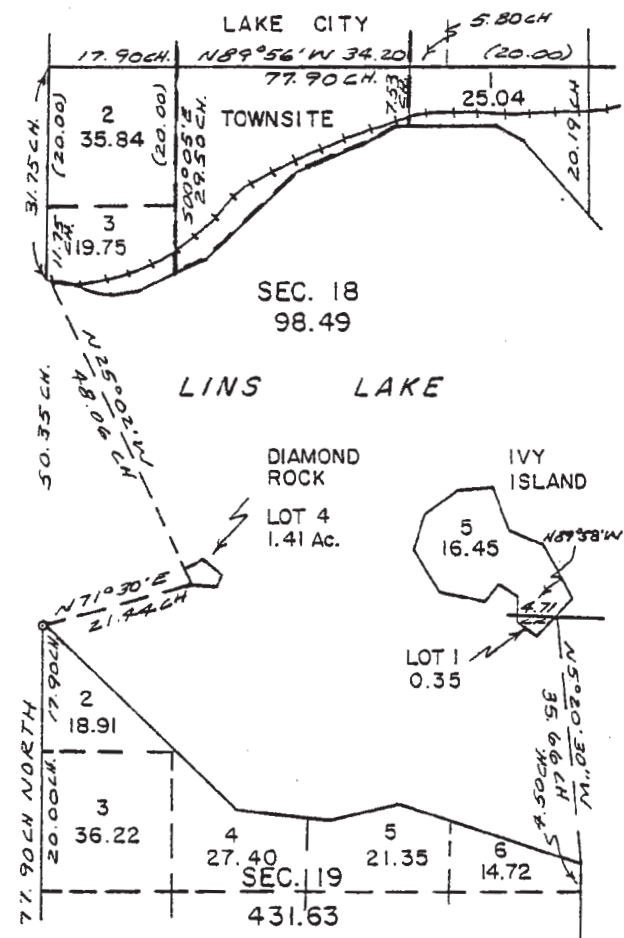


Figure 5-19

Fig. 5-20  
COMPUTATION OF AREA OF LOT 4

No.	Course	Distance	Latitudes		Departures		D. M. D.'s	N. areas	S. areas	Totals	
			North	South	East	West				Lat. N.	Dep. E.
Tie	N. 71°30' E.	21.44	6.80		20.33					6.80	20.33
					+ .005						
5	S. 86° 46' E.	3.19		0.18	3.185		4.73	0.85		6.62	23.52
4	N. 33° 00' E.	2.20	1.845		1.20		9.12	16.83		8.465	24.72
3	N. 48° 30' W.	3.50	2.32			2.62	7.70	17.86		10.785	22.10
2	S. 61° 15' W.	2.90		1.395		2.54	2.54		3.54	9.39	19.56
1	S. 16° 30' E.	2.70		2.59	.77		.77		1.99	6.80	20.33
			4.165	4.165	5.155	5.16		34.69	6.38		
					.005			6.38			
			14.49	4.165	4.165	5.16	5.16	28.31	Double area.		

Begin total lots, and depts. at M. C. or W. bdy. sec. 19, for purposes of platting.  Numbering of courses as taken from field notes, order reversed to counterclockwise	D. M. D.'s (1) 0.77 9.12 (4) +.77 +1.20 +3.19 -2.62 <hr/> (5) 4.73 7.70 (3) +3.19 -2.62 +1.20 -2.54 <hr/> (4) 9.12 2.54 (2)	14.15 Square chains 1.41 Acres ← RESULT  Begin D. M. D.'s at angle point of meanders farthest west, end of course No. 2 running SW., or end of course No. 1 running NW.
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the area in question is occupied by many parcels (i.e., urban lands, small rural parcels, suburban parcels, etc.). The Department of Revenue, however, recommends changing the area of a section if:

1. The owner requests the change;<sup>6</sup> and
2. he supplies a *registered survey* (that is - one executed by a registered Oregon Land Surveyor or Registered Engineer; stamped with the official seal of the surveyor or engineer; and, signed by the surveyor or engineer);
3. and, the acreage of the registered survey is correct.

NEVER CHANGE A PATENT ACREAGE TO CORRESPOND WITH ACREAGE DERIVED DIRECTLY FROM AERIAL PHOTOS. Such areas would seldom be accepted by the courts.

The lots bordering meanders are not as sacred as those we have just discussed. Although the acreage of the lots should not be changed, the assessable acreage of the lot owner will seldom be identical to the lot acreage. This policy is based on two principles:

**PRINCIPLE:** *Meander lines are not run as boundaries, but to define the sinuosities of the banks of a stream of other body of water, and as a means of ascertaining the quantity of land embraced in the survey; THE STREAM, OR OTHER BODY OF WATER, AND NOT THE MEANDER LINE, IS THE BOUNDARY.*<sup>7</sup>

In other words—the meander line does not mark or limit the ownership boundary; therefore,

**PRINCIPLE:** *The acreages of meandered lots are the quantities of land remaining after the US. Survey segregation of water areas. They are not ownership acreages and, therefore, are not the assessable acreages. The assessable acreages are ascertained by computing acreages to the mean high water mark (navigable rivers); to the center of non-navigable streams; or other legal riparian boundaries. (See Chapter 10 on Riparian Rights.)*

### Areas of Lots on Resurvey Plats

Where lots have been alienated (by the U.S.) subsequent to the former subdivision of the U.S. survey, the lotting will not be changed by the resurvey. In such cases, the G.L.O. (or B.L.M.) plat will carry a notation that refers to the lottings of the previous plat:

U.S. plat represents a dependent resurvey of the original township boundary and subdivisional lines designed to restore the corners in their true original locations according to the best available evidence.

Except as indicated hereon, the lottings and areas are as shown on the plat (or plats) approved (date or dates of former survey plat or plats).

The reference to modified lottings or areas is omitted when there are no exceptions.

On plats of dependent resurveys the areas of the subdivisions are shown only in those exceptional cases where the differences between the actual quantity of the vacant subdivisions, as found by resurvey, and the former area, as returned on the original approved plat, are so great as to warrant revision. According to the U.S. regulations "in that case the question of a revision rests upon the element of *quantity* rather than upon that of *distortion*. For practical purposes a variation of 2.00 acres to the quarter-quarter section has been found advisable before making a change."<sup>8</sup> A new lot number and area are assigned to each vacant subdivision (not alienated) which is to be revised.

Remember the acreages of alienated lots cannot be revised in the resurvey. If alienated lot acreage is revised, U.S. records should be checked to see if a patent was issued. In most cases where it appeared as though alienated lot acreages were being changed, research revealed the lots to actually be in U.S. ownership—not private ownership.

An exception is sometimes made to the 2-acre minimum where it is shown that more exact acreage is needed for proper management of U.S. lands.

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## Mineral Surveys

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Mineral surveys are made to mark the legal boundaries of mineral deposits or ore-bearing formations on the public domain, where the boundaries are determined by lines other than the normal subdivision of the public lands.

Each survey is given but one number. A location under the mining laws can legally be made only of a tract or piece of land embraced within one set of boundary lines.

The position of the official survey upon the ground is fixed by ties to corners of the public survey or mineral location monument (M.M.). In either case, the corner must be within two miles of the claim.

Mineral location monuments are usually located at a point, visible in every direction, where the permanency of the monument will not be endangered. Mineral

monuments usually are tied to geodetic coordinates and can therefore be tied to state plane coordinates.

When plotting large groups of claims, the best procedure is to locate the mineral monuments and the claim and section corners to those monuments. The plats of claims usually show ties to corners of overlapping or adjacent claims; these ties should be closely adhered to in cadastral mapping.

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## Annotations

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Navajo Co. v. Apache Co., 26 Ariz. 74, 721 Pac. 837:

*If all the corners marked in the surveys, returned by the surveyor general, are established as proper corners of sections, or subdivisions of sections, which they were intended to designate, the corners of half and quarter sections, not marked on the surveys, are placed as nearly as possible equi-distant from two corners which stand on the same line.*

Poleske v. Jones, 192 Iowa 1015, 185 N.W. 917:

*Centers of sections cannot be ascertained by running a line, (on a cardinal) directly south from the ¼ section corner on the north line, and marking off 160 rods on such line. The lines must be run from ¼ section corner to ¼ section corner, and the legal center of the section is placed at the intersection of these lines.*

Barringer v. Davis, 141 Iowa 419, 120 N.W. 65:

*A government survey, even though incorrect, is conclusive where there is a controversy between persons asserting conflicting claims under grants or patents based on such survey.*

Greer v. Squire, 9 Wash. 359, 37 Pac. 545:

*Corners shown to have been originally set by U.S. surveyors are conclusive and must be accepted as the true corners, no matter how inaccurately they may have been originally established.*

Hubbard v. Dusy, 80 Cal. 281, 22 Pac. 214:

*Where it is doubtful which of two lines or monuments is the true government line, that one is to be so considered which more nearly conforms to the U.S. field notes (or plat).*

The following ruling is very important to cadastral cartography.

Goodman v. Myrick, 5 Ore. 65; Van Dusen v. Shively, 22 Ore. 64, 29 Pac. 76:

*Where there is a discrepancy in a government survey, between the monument and the distances given in the field notes (or on the plat), the monuments will control...*

In Hall v. Tanner, 4 Pa. 244, 45 Am. Dec. 686, it was said:

*"It has ever been held that the marks on the ground constitute the survey. The courses and distances are only evidence of the survey."*

Henrie v. Hyer, 92 Utah 530, 70 Pac. (2d) 154:

*Official government surveys are not open to attack between private parties in boundary disputes.*

Vaught v. McClymond, 116 Mont. 542, 155 Pac. (2d) 612:

*Errors in U.S. surveys cannot be corrected by the courts since such surveys create boundaries and do not merely ascertain them.*

Wing v. Wallace, 42 Idaho 430, 246 Pac. 8:

*A resurvey does not affect the rights previously vested. Its purpose is to ascertain the lines of the original survey without regard to their correctness.*

Fegtly, Historical Development of Land Surveys, 38 111. L. Rev. 220:

*Lines established by official surveys control over those made by private parties.*

Goff v. Avent, 122 Miss. 86, 84 So. 134:

*If a deed description is by rectangular survey section numbers, the land conveyed is such as it physically exists on the ground, the original government corners and lines being such sections' true and only boundaries.*

R.L.C. (1939) Subsection 1022. Single and double proportionate measurement, post, subsection 384, 385.

*"A proportionate measurement is one that gives concordant relation between all parts of the line . . ." and new distances are to be of the same relation to the original record length...*

Dept. of Justice Opinion, Oregon, 150-01-813-72; 1620:

*"Surveys made by the authority of the United States or the State of Oregon may be considered as evidence in any court in this State, and unlike private surveys, need not be arrested."* ORS 41.540.

*The same is true of Bureau of Land Management field notes.* ORS 209.090.

*"The statutes reflect the generally accepted rule that a resurvey is evidence, although not conclusive evidence, of the location of the original line, and the question of whether the resurvey accurately retraces the original survey, is a question of fact. United States v. Hudspeth. 384 F2d 683. 1967."*

*"Although some practical problems may arise, I see no legal reason why the assessor may not employ the resurveys in preparation and maintenance of his maps, as the resurveys represent the best information available."*

*" . . . I would suggest assessors remain aloof from controversies involving title and boundaries until such time as the conflict is resolved between the parties in interest."*

ORS 307.080 MINING CLAIMS

*"Except for the improvements, machinery and buildings thereon, mining claims are exempt from taxation prior to obtaining a patent therefor from the United States.*

Lee Wilson & Co. v. United States, 245 U.S. 24:

*"First. Where, in a survey of the public domain a body of water or lake is found to exist and is meandered, the result of such meander is to exclude the area from the survey and to cause it as thus separated to become subject to the riparian rights of the respective owners abutting on the meander line in accordance with the laws of the several states. Hardin v. Jordan, 140 US. 371; Kean v. Calumet Canal Co., 190 U.S. 452, 459; Hardin Y. Shedd, 190 U.S. 508, 519."*

*"Second. But where upon the assumption of the existence of a body of water or lake, a meander line is through fraud or error mistakenly run because there is no such body of water, riparian rights do not attach because in the nature of things the condition upon which they depend does not exist and upon discovery of the mistake it is within the power of the Land Department of the United States to deal with the area which was excluded from the survey, to cause it to be surveyed and to lawfully dispose of it. Miles v. Cedar Point Club, 175 U.S. 300; French-Glenn Livestock Co. v. Springer, 185 U.S. 47; Security Land & Exploration Co. v. Burns, 193 U.S. 167; Chapman & Dewey Lbr. Co. v. St. Francis Levee District, 232 US. 186."*

*"If in the making of the survey of public lands, an area is through fraud or mistake meandered as a body of water or lake where no such body of water exists, riparian rights do not accrue to the surrounding lands, and the Land Department, upon discovering the error, has power to deal with the meandered area, to cause it to be surveyed, and lawfully dispose of it."*

*"The fact that its administrative officers, before discovery of the error, have treated such a meandered tract as subjected to the riparian rights of abutting owners, under the State laws, and consequently as not subject to disposal under the laws of the United States, cannot stop the U.S. from asserting its title in a controversy with an abutting owner; and even as against such an owner, who acquired his property before the mistake was discovered and in reliance upon action and representations of Federal Officers carrying assurance that such riparian rights existed, the U.S. may equitably correct the mistake and protect its title to the meandered land. The equities of the abutting owners, if any, in such circumstances are not cognizable judicially, but should be addressed to the legislative department of the Government." (Moon Lake Case )*

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## Endnotes

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1. The B.L.M. Manual, now out of print, is the authority for most of the material in this chapter.
2. From the 1973 Manual of Instructions for survey of public lands of U.S.
3. Ibid.
4. One who makes an entry of land under the public land laws of the U.S.
5. U.S. B.L.M. Instructions
6. Such requests should always be in writing.
7. *Minto v. Delaney*, 7 Ore. 337; *Weiss v. Oregon Iron & Steel Co.*, 13 Ore. 496, 11 Pac. 255.
8. U.S. B.L.M. regulations.