

# Manual of Surveying Instructions

## For the Survey of the Public Lands of the United States



Prepared by the  
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case rectangularity will be ensured and corners placed appropriately.

(7) Intersecting lines and random and true lines normally form the boundaries of protracted blocks. Once the protracted corner is established by latitude and longitude from which the intersecting line is to be initiated, the line will be surveyed on the protracted bearing to an intersection with the existing surveyed line, random and true line, or water boundary. In a like manner, random and true lines will be surveyed from the established protracted corner to the existing corner designated on the amended protraction diagram. Where rectangular limits can be achieved in intersecting a corner on the boundary of the protraction block, the intersected corner will control the alinement of the intersecting line (section 3-34). Where there is a large misclosure in the exterior boundary of the protraction, it may be necessary to modify the plan of survey to avoid poorly shaped parcels.

(8) When surveyed, a protracted block will normally become a section containing the regular aliquot parts with the excess or deficiency against the previously surveyed boundary.

(9) When portions of the unsurveyed protracted areas are surveyed, it may not be necessary to create a new amended protraction diagram for the remaining unsurveyed areas. Since there will normally be no changes in the protracted latitude and longitude of other corners in the protraction, an appropriate notation to this effect on the amended protraction diagram is sufficient.

(10) In some cases, local or administrative surveys have been performed within the protracted area, prior to the official survey, to locate and mark lease boundaries, administrative boundaries, the extent of mineral interests, or to segregate meanderable water bodies for acreage chargeability. Positions established by these surveys have no official standing but, at the discretion of the appropriate BLM Chief Cadastral Surveyor, should be accepted as corner positions when they are in substantial conformity with the amended protraction diagram.

## Meandering

**3-158.** This discussion on meandering pertains to original surveys and new meanders. Meandering pertaining to resurveys and associated water boundaries are discussed in chapter VIII.

**3-159.** The traverse that approximates the margin of a permanent natural body of water, e.g., the bank of a stream, lake, or tidewater, is termed a meander line. Numerous decisions in the United States Supreme Court assert the principle that, in original surveys, meander lines are run, not as boundaries of the parcel, but (1) for the purposes of ascertaining the quantity of land remaining after segregation of the bed of the water body from the adjoining upland, (2) for defining the sinuosities of the water body for platting purposes, and (3) for closing the survey to allow for acreage calculations. The ordinary high water mark (OHWM), or line of mean high tide (line of MHT) of the stream, or other body of water, and not the meander line as actually run on the ground, is the actual boundary.

**3-160.** Properly executed meanders create certain riparian rights in the upland parcel. Chief among these rights is that ownership of the upland follows subsequent lateral change in location of the bed through slow and imperceptible processes, such as accretion, erosion, and reliction. When by action of water the bed of the body of water changes, the OHWM changes, and the ownership of adjoining land progresses with it (*Lane v. United States*, 274 F. 290 (5<sup>th</sup> Cir. 1921); *aff'd*. 260 U.S. 662 (1923)).

**3-161.** Meander lines will not be established at the segregation line between upland and swamp or overflowed land, but rather at the OHWM or line of MHT between the swamp or overflowed lands and the water body. Meanders between the swamp or overflowed lands and the upland are a common source of errors in older original surveys (section 3-211).

### Ordinary High Water Mark and Line of Mean High Tide

**3-162.** All lands beneath navigable waters and other important rivers and lakes are to be segregated from the upland. Meanders are run along the OHWM for inland waters, and along the line of MHT for tidewater.

The general rule is that when the Federal Government conveys title to a lot fronting on a navigable body of

water, it conveys title to the water's edge, meaning the OHWM or line of MHT. Such riparian boundaries are ambulatory, not fixed in position. When an exception to the general rule is shown, the consequence is that the meander line becomes fixed and can become a fixed and limiting property boundary. Meander lines may be held fixed because of (1) an avulsive change, (2) gross error or fraud, (3) substantial accretion after survey but before entry, or (4) where the facts and circumstances disclose an intention to limit a grant or conveyance to the actual traverse lines. But the mere fact that an irregular or sinuous line must be run, as in the case of a reservation boundary, does not entitle it to be called a meander line except where it closely follows the bank of a stream, lake or tidewater.

**3-163.** Practically all inland bodies of water pass through an annual cycle of changes and multiyear cycles of drought and wet years. The OHWM is found between these extremes. In regions of broken topography, especially when bodies of water are bounded by sharply sloping lands, the horizontal distance between the margins of the various water elevations is comparatively slight, and the surveyor does not experience much difficulty in determining the horizontal position of the OHWM. However, where the meanderable bodies of water are bordered by relatively flat lands, the horizontal distance between the successive levels can be significant and the proper line difficult to measure.

**3-164.** For inland waters, the OHWM normally used is the line below which the water impresses on the soil by covering it for sufficient periods to deprive it of terrestrial vegetation, and the soil loses its value for agriculture, including grazing of livestock. Terrestrial vegetation is to be distinguished from aquatic and wetland vegetation in that the same vegetation can be found at higher and drier sites. At this level a definite escarpment, and often a change in character in the soil, is generally traceable, at the top of which is the true position for the meander line. A pronounced escarpment, the result of the action of storm and flood waters is often found above the principal water level and is separated from the OHWM by the storm or flood beach.

**3-165.** Some areas of riverbank or lakeshore lack vegetation of any kind or escarpments that can be used to identify the OHWM for use in meandering. In those situations, an identifiable OHWM is identified between sites where vegetation capable of identification exists on either side of the barren area. Reliance on elevations to extend a continuous line projected on the bank that

is parallel in height to the water surface of the river or lake is a common method.

**3-166.** The ordinary low-water mark is the point to which nontidal waters recede, under ordinary conditions, at their lowest stage. It is usually identified by a shelf in the bank. The shore is the space between the margin of the water at the ordinary low water mark and the OHWM (*Alabama v. Georgia*, 64 U.S. 505 (1859)).

### *The Vegetation Examination*

**3-167.** The vegetation examination is conducted in the field to determine whether the grass, tree, shrub, or plant is aquatic or terrestrial vegetation.

Aquatic vegetation is any one of a variety of plants that must grow in water; they are obligated to grow with their roots in water. Many aquatic plants have hollow stems so as to stand upright in still water and others have floats in order to stay on the water surface. If a given plant is not found higher up on the bank, it is probably an aquatic species.

Transitional species, such as buttonwood, water oak, or cypress, are upland or terrestrial species that exist in very wet environments. There have been claims that cypress trees are aquatic plants. A number of court cases have used cypress as an upland indicator of the OHWM, however a mature cypress may no longer be a good indicator of OHWM.

Terrestrial vegetation is distinguished from aquatic vegetation by the location in which it grows. If vegetation type "A" is found along the water's edge—or even in the water—and type "B" is also found growing at sites situated more toward higher, drier ground (upland), then "A" is a terrestrial species. A good rule of thumb is to determine if the plant is part of a self-reproducing stand of woody vegetation and not a seasonal plant that can sprout and mature in the few months when the water is unseasonably low. Trees, shrubs, and other woody-stemmed plants are generally terrestrial.

A small pocket of an aquatic type plant growing in low places not in the riverbed is also not an indicator of the OHWM and does not indicate that the OHWM should be moved toward upland to include that pocket of aquatics. It is the most water-ward location of the terrestrial species that is determinative. A small pocket of terrestrial vegetation at a small area near the water's edge, for example, may be enough to identify that area as being a part of the upland.

Care must be taken with the evaluation of nonnative invasive species, because when introduced they can change or fix the previous natural indicators of the OHWM.

### *The Soils Examination*

**3-168.** The soils examination is the next complementary examination. The leading court opinions regarding OHWM with reference to soils did not rely on or intend the use of laboratory tests of soils for this purpose. Accordingly, when a court decision dated before the 1940s refers to the character of the soil, it usually refers to the presence and shape of banks on rivers, shelving along lake shores, presence of sandbars and gravel bars, and other physical forms or manifestations of soil.

Extended inspection along a river boundary will usually result in some sort of correlation between the types of vegetation and the presence of banks or natural levees. The tests for vegetation and the test for soils can thus become complementary.

It is sometimes difficult to find a defensible OHWM because of conflicting evidence. When that occurs it is necessary to go upstream or downstream to locate another bank or banks where the OHWM is clear and convincing using vegetation and soils and then correlate that height of the OHWM above the surface of the flowing water in the difficult location.

Also a chemical soil test could be used provided that it is definitive. Soils that have been submerged for a long period of time are chemically different from upland soils, so it is important to establish the time period when that soil's particular chemical properties developed. Flooding that created a particular soil formation centuries before the original survey and grant should have no bearing on a present-day OHWM determination.

### *The Litter Examination*

**3-169.** Litter is the rubbish, twigs, and other floatable material found in a rough alinement at the reach of the highest waves that wash up on the shore. Logs and stumps generally do not wash up along the litter line. They are usually stranded below and toward the water from the litter line.

The litter line along a river boundary is mostly parallel and higher in elevation than the OHWM determined by the vegetation and soils test. On a lake shore, particularly, the presence of litter may correlate with the other tests and be useful for OHWM determination. The

presence of litter does not indicate the OHWM directly. Instead, the height of the litter above the water surface may be useful in correlating the OHWMs along the bank or shoreline.

### *The Agricultural Test*

**3-170.** The agricultural test is another complementary test. The items to consider include cattle or sheep raising, mowing of wild hay or collection of wild rice, and the raising of typical crops of the region, including grains or tubers. In essence, the agriculture test is simply a vegetation test that is restricted to valuable crops.

**3-171.** For tidal waters, the shore, also called the tideland, is the space between the line of mean lower low tide and the line of MHT (section 3-204). For tidal water, in the interest of certainty, the line of MHT is the average elevation of all the high tides occurring over a period of 18.6 years. Because it is based on elevations, meanders along the tidelands are run either by reference to tide gages and their reported elevations or by observation of physical conditions abutting the shore. Special instructions will provide guidance in selecting the method to be used.

**3-172.** Individual States may develop their own rules for determination of their own boundaries as against private owners but such State laws cannot generally act to reduce Federally owned areas or otherwise alter the boundaries of Federal land.

See Chapter III Notes for case studies on placement of the OHWM.

### *Meanders*

**3-173.** A meander corner is established at every point where a standard, township, or section line or special survey boundary intersects the OHWM of a navigable stream or other meanderable body of water. For tidal waters, the meander corner is established at the intersection of the surveyed line with the line of MHT. Meander corners are a controlling monument on the surveyed line and shall be treated similarly to other regularly established monuments such as section or quarter-section corners and tract corners for dependent resurvey purposes.

**3-174.** A "special meander corner" (SMC) is established at the intersection of the OHWM or line of MHT with a run and marked subdivision-of-section line. "Auxiliary meander corners" (AMC) are used

where there is no intersection of a surveyed line with the OHWM or line of MHT, as in the case of a meanderable lake found completely within a section not requiring subdivision. Auxiliary meander corners are also established at the intersection of avulsed lands with riparian lands, at the intersection of omitted land parcels with riparian lands, at the intersection between fixed and limiting original meanders and the current meanders, on the meander line of a previously unsurveyed island not intersected by a surveyed line, and at other intersections of riparian boundaries where use of a special meander corner is not appropriate.

**3-175.** No monument should be placed in a position exposed to the beating of waves and the action of ice in severe weather. In such cases a witness corner should be established at a secure point near the true point for the meander corner. The distance across the body of water, from the true point, is ascertained and reported in the survey record.

**3-176.** It is not practicable in public land surveys to meander in such a way as to follow and reproduce all the minute windings of the ordinary high-water mark, even though technology allows for a much more precise location at the time of the survey. The United States Supreme Court has given the principles governing the use and purpose of meandering shores in its decision in a noted case as follows:

Meander lines are run in surveying fractional portions of the public lands bordering upon navigable rivers, not as boundaries of the tract, but for the purpose of defining the sinuosities of the banks of the stream, and as the means of ascertaining the quantity of land in the fraction subject to sale, and which is to be paid for by the purchaser.

In preparing the official plat from the field notes, the meander line is represented as the border line of the stream, and shows, to a demonstration, that the watercourse, and not the meander line, as actually run on the land, is the boundary (*Railroad Co. v. Schurmeier*, 74 U.S. 272 (1868)).

There is no requirement that the meander line very closely approximate the OHWM such that every small indentation and projection is depicted by angle (often called meander) points on the traverse. An excessive number of angle points are not necessary as the true riparian boundary constantly changes through the

processes of accretion and erosion. The intent is to show the general configuration of the water line. As a result, it is expected that when choosing the angle points, the meander courses may cross either water or land during the process to minimize the number of angle points. Effort should be made to balance the amount of water and land crossed to return accurate acreage.

Depending upon the terrain, meander courses may be as short as a chain or as long as twenty chains or longer. Meander lines may be surveyed by any reliable method of measurement that can determine bearing and distance or coordinates that may be mathematically converted to courses. The angle points along the traverse are not normally monumented.

**3-177.** Meanders are reported as a traverse from the beginning meander corner to the ending meander corner. The traverse is comprised of a series of meander courses running between angle points. These meander points are chosen at obvious breaks in the shoreline at the OHWM, line of MHT, or other required riparian line. Whether the angle points are measured by traditional traverse methods or by individual coordinate determination is immaterial.

The surveyor commences at one of the meander corners, follows the OHWM, and determines the length and true bearing of each course, from the beginning to the next meander corner. For tidal waters, the surveyor follows the line of MHT. All meander courses refer to the true meridian and are determined to the accuracy outlined in this Manual or, if more accuracy is necessary, as outlined in the special instructions.

**3-178.** The survey record of meanders shows the corner from which the meanders commenced, the true bearing and horizontal distance of each course, and the corner upon which the last course closed. The meanders may be reported in a separate section of the field notes segregated by section or tract. Meander line field notes may be placed on the plat.

**3-179.** The following items will be noted along the meander line in the field notes or on the plat: (1) all streams flowing into a river, lake, ocean, or meanderable bayou, with the width at their mouths and their course; (2) the position, size, and depth of springs, and whether the water is pure or mineral; (3) the heads and mouths of all bayous; (4) all islands, rapids, and bars, with intersections to the upper and lower ends; (5) the height of the banks of lakes, streams, and tidelands, the

height of falls and cascades, and the length and fall of rapids; and (6) artificial structures and other notables such as improvements in both land and water areas. Except for original survey meander lines, the above items may be noted when administratively necessary.

**3-180.** Where it is impossible or impracticable to measure the meander line along the required riparian line due to physical impossibility, safety or cost, the official survey record will state the true location, noting the offset from the line measured.

**3-181.** Whenever the Secretary surveys lands selected by an Alaska Native, an Alaska Native Corporation, or the State of Alaska pursuant to the ANCSA, the Alaska Statehood Act, or the Alaska National Interest Lands Conservation Act (ANILCA), lakes, rivers, and streams shall be meandered in accordance with the principles in the 1973 edition of the Manual (43 U.S.C. 1631(a)(1)). Navigability investigations in Alaska are described in section 8-56.

### Rivers and Tidewater

**3-182.** Facing downstream, the bank on the left hand is termed the left bank and that on the right hand the right bank. These terms will be universally used to distinguish the two banks of a river or stream.

Navigable rivers and bayous are meandered on both banks, at the ordinary high-water mark, by taking the general courses and distances of their sinuosities for that portion that is navigable. For rivers classed as nonnavigable, when duly authorized, the bed acreage is segregated where the average right-angle width is 3 chains and upwards. This width is chosen as a practical guideline to balance the cost of meandering all rivers against the value of the excluded acreage.

**3-183.** In selected lands in Alaska, by law, all non-navigable inland rivers where the average right-angle width is 3 chains and upwards are meandered on both banks, at the ordinary high-water mark (43 U.S.C. 1631).

**3-184.** Tidewater streams, inlets, and bayous are meandered at the line of MHT up to the point of tidal influence or where they still allow free travel by customary watercraft, whichever is farther downstream. Tidewater inlets and bayous are meandered, when duly authorized, where the average right-angle width is 3 chains and upwards, and they no longer allow free travel by customary watercraft. Oceans, gulfs, bays,

bayous, straits, and other tidally influenced waters are meandered at the line of MHT.

### Lakes

**3-185.** All navigable lakes are meandered. Nonnavigable lakes are not meandered except for lakes of the area of 50 acres and greater when duly authorized. However, in selected lands in Alaska, non-navigable lakes of the area of 50 acres and greater are meandered, but the area of such nonnavigable lakes is nonchargeable area (43 U.S.C. 1631).

**3-186.** Exceptions to the general size rule are shallow or poorly defined “lakes” that are actually pools that collect because of permafrost and lack of drainage or are seasonal. These “lakes” will not be meandered even when larger than 50 acres.

**3-187.** In the case of meanderable lakes that are located entirely within the boundaries of a section, a quarter-section line, if one crosses the lake, is run from opposite quarter-section corners. At intersection with the OHWM, one or more special meander corners are established, and the course and distances recorded.

If a meanderable lake is located entirely within a quarter-section, and if, during the subdivision of the quarter-section, a quarter-quarter section line crosses the lake at intersection(s) of the line with the OHWM, a special meander corner or corners are established and the course and distances recorded.

**3-188.** If a meanderable lake is found to be located entirely within the boundaries of a section and it is impracticable to run a subdivision-of-section line across the lake, an “auxiliary meander corner” is established at some suitable point on the OHWM and a connecting line is run from the monument to a regular corner on the section boundary. The course and length of the direct connecting line are shown on the plat of the survey.

**3-189.** The meander line of a lake lying within a section is initiated at the established special or auxiliary meander corner, as the case may be, and continued around the margin of the lake at its OHWM, to a closing at the point of beginning. All proceedings are fully entered in the official record. When the section is not monumented, a connecting line is run from the auxiliary meander corner to a suitable monumented point within the township. If there are numerous lakes within the township, and showing the connecting lines

will clutter the plat, the lines need not be shown on the plat.

**3-190.** Artificial lakes and reservoirs are not segregated from the Federal interest lands, unless specifically provided for in the special instructions, but the true position and extent of such bodies of water are determined in the field and shown on the plat.

### Islands and Sandbars

**3-191.** For official survey purposes, an island is defined as a body of upland that is completely surrounded by water when the water is at the OHWM for inland waters or at the line of MHT for tidal waters. In those States that recognize the low water mark as the boundary and where State law appropriately serves as the source of law for the question, the water at low water mark may be the height of water defining the body of upland.

**3-192.** A gravel bar or sandbar is a formation of soil on the bed of a lake or river that rise above the OHWM but consists of loose and unconsolidated material considered liable to be washed away during subsequent high water seasons and, most important, is devoid of woody vegetation.

Islands form in rivers by several different processes as follows:

- (1) By deposit of alluvial material onto the bed of the river during high flow events that consolidates and supports terrestrial vegetation;
- (2) By the river cutting across a vegetated point bar;
- (3) By an avulsive change where a new channel is washed out around an existing area of upland;
- (4) By marked scour of the river bed around a submerged area; and/or
- (5) By the result of human activity in the river.

**3-193.** Every island above the OHWM of any meanderable body of inland water or above the line of MHT of tidal water, except islands formed in navigable bodies of water after the date of the admission of a State into the Union, is locatable by survey and should be meandered and shown on the official plat.

**3-194.** All islands will be meandered if practicable. In passing islands not to be meandered, estimated ties to their upper and lower ends will be reported to establish their location. Such islands are to be exhibited on the plat as accurately as practicable.

**3-195.** Even though the United States has parted with its title to the adjoining mainland, an island in a meandered body of water, navigable or nonnavigable, in continuous existence since the date of admission of the State into the Union and omitted from the original survey, remains as unsurveyed public land of the United States. As such, the island is subject to survey. Such islands were not a part of the bed at the date of statehood, and therefore their title remained in the United States, subject to survey and disposal when identified. The right that attaches to the riparian parcels along the meander line of the mainland pertains only to the bed of the water body, to access to the water, and to such islands in nonnavigable water bodies formed within the bed subsequent to the disposal of the title (sections 8-158 through 8-165).

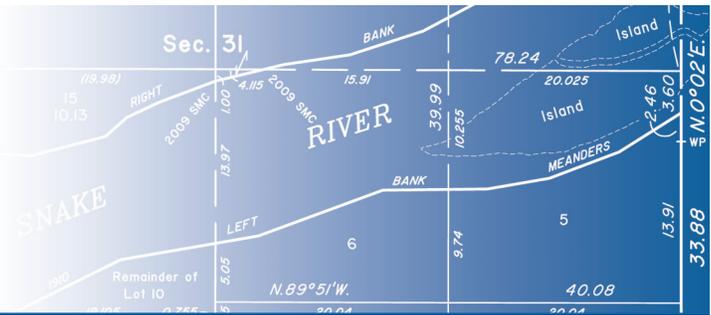
If the patent conveyed these lands to the State we are not concerned with their subsequent disposal, for that is a question of local law. But did the patent include them? This, of course, is a Federal question. *Francis Levee District*, 232 U.S. 186, 196 (1914); *United States v. Oregon*, No. 13, original, 295 U.S. 1, 27 (1935).

Whether an island in a meandered nonnavigable water body is subject to survey after the United States has parted with its title to the adjoining mainland has been subject to inquiry. The U.S. Supreme Court rulings on the subject, however, have consistently held that Federal law governs the intent and whether lands were conveyed or remain Federal, subject to survey.<sup>1</sup>

<sup>1</sup> The Supreme Court in *State of California, ex rel. State Lands Commission v. United States*, 457 U.S. 273 (1982), held that whenever the United States has a claim to unsurveyed lands then Federal law will apply. State law should only apply when the dispute is between private parties see *Oregon ex rel. State Land Board v. Corvallis Sand & Gravel Co.*, 429 U.S. 363 (1977). Without reference to the Supreme Court decision in *State of California, ex rel. State Lands Commission* supra, two circuit courts have reached two different conclusions, first in *Koch v. United States*, 47 F. 3d 1015 (10<sup>th</sup> Cir. 1995) the court held that unsurveyed islands in nonnavigable water passed to the littoral owner under State law as a portion of the bed of the nonnavigable water. In *Wolff v. United States*, 967 F. 2d 222 (6<sup>th</sup> Cir. 1992), the Court held that State law would determine what was intended to be conveyed by the Federal government and if the intent of the Federal grant is unclear then State law will control the title to unsurveyed islands regardless of the navigable character of the water. However, Article IV, Section III, Clause 2 of the United States Constitution provides that Congress will make the rules concerning disposition of Federal lands.

## Chapter VIII

# Resurveys and Water Boundaries



## Introduction

**8-1.** As a class, water boundaries represent some of the most challenging survey problems. In this chapter, water boundaries are divided into several subtopics in order that the elements of each type of problem can be brought out clearly. This chapter addresses the dependent resurvey of the original meanders, issues of navigability, bed ownership and division, accretion, erosion, reliction, avulsion, partition lines for the apportionment of accretions and relictions, accretion after survey but prior to entry, omitted lands, erroneously omitted lands, unsurveyed islands, and beds of nonnavigable rivers and lakes.

Dependent resurveys involving water boundaries usually involve two or more of these elements, requiring an overall analysis to find out which elements are involved. A study of the available historic maps and aerial photographs is made in all but the simplest cases.

## Meanders

**8-2.** Meandering and original surveys is discussed in detail in sections 3-158 through 3-207. In summary, the traverse that approximates the margin of waters is termed a meander line. The original survey of water boundaries described the conditions as they existed at the date of that survey. This process is presumed accurate at the date of the survey as future changes are expected. A meander line is not normally surveyed as a boundary but only as a representation of the actual boundary, which is the ordinary or usual upper limit of the water body. Normally, when the Federal Government conveys title fronting a navigable inland body of water, the intention is that the upland ownership extends to the ordinary high water mark (OHWM). For lands fronting a non-navigable inland body of water, the intention is that the upland ownership extends to the medial line. Finally, for lands fronting tidal water, the intention is that the ownership extends to the line of mean high tide (line of MHT). However, meander lines may become “fixed

and limiting boundaries” under special circumstances described in sections 8-94, 8-169, and 8-179.

**8-3.** The original survey of water boundaries described the conditions as they existed at the date of that survey. They reflect the original surveyor’s effort to follow the OHWM or line of MHT. Unlike upland boundaries, water boundaries are ambulatory. The water boundary is a concept that must be applied by observation of the river, lakeshore, or ocean beach and other tidal water bodies. The actual survey work merely approximates the infinite indentations of riverbanks, channels, or shorelines.

As the work progresses along the boundary under survey, the surveyor must continually assess the terrain and vegetation to compare the variations to the legal concept and establish survey positions that most adequately approximate the actual boundary. Surveys of water boundaries that involve Indian lands, besides enjoying the normal complexities of riparian principles, are highly variable in nature by virtue of the specific language used in the original Treaty, Executive orders, or congressional acts that describe the Indian interest. The surveyor must be cognizant of these differences and should consult appropriate legal counsel to assure the correctness of the survey prior to its completion.

**8-4.** Procedures for the dependent resurvey of water boundaries are separate from the original survey requirements. The resurvey must consider the historic procedures in place at the date of those original surveys. In particular, because of advances in technology plus the differences in value of riparian lands, the surveyor may find that there are substantial differences in the location of the current boundary from the original locations. These differences may exceed the differences that can be explained from normal changes due to accretions, erosion, reliction, and avulsions in the interim.

**8-5.** The concept of following the footsteps of the original surveyor is often not of prime importance in

the resurvey of water boundaries. The dependently resurveyed boundary is a concept established largely by common law that the surveyor shall apply to the conditions that are found along riverbanks, channels, or shorelines. In addition to any physical changes made by water action, State laws regarding water boundaries may be in conflict with the Federal rules and could influence the outcome, particularly where alienated lands are involved.

**8-6.** When important new subjects are encountered in this chapter, a brief definition of terms is provided in the text. If a more complete definition of a term is required, the reader should refer to the Manual supplement, *Glossaries of BLM Surveying and Mapping Terms*.

### Meanders and Meandering— Inland Waters

**8-7.** Inland waters are water bodies not influenced by the daily tides. Survey and resurvey procedures for lands along tidal waters are set out in sections 8-190 through 8-194.

**8-8.** Bodies of water that are meandered and reported on surveys are called meanderable waters and include the following:

A river is defined as a watercourse having banks to contain an ordinary flow of water; although, there may be no flow at various times of the year.

A lake is defined as a quiescent pool of water in a flowing river. A lake with no outlet is defined as a terminal lake, e.g., the Great Salt Lake in Utah.

**8-9.** Meanderable bodies of water include all navigable waters and also nonnavigable rivers that are 3 chains and upwards in average right angle width and nonnavigable lakes 50 acres and upwards in surface area. Nonnavigable rivers of importance, i.e., used as a boundary are meanderable even if less than 3 chains in width. The distinction between navigable and nonnavigable water bodies can be complex and is further detailed beginning in sections 8-21 and 8-32.

### Meandering Along Inland Waters

**8-10.** Meander corners are corners of the survey that are established where township exterior, section, or other

important survey lines intersect the margin of navigable waters or meanderable nonnavigable water. The purpose of meander corner monuments is to preserve the alignment of and the distance along the section line, and to provide a monumented beginning and ending point for the meanders. Where the meander corner location may be subject to erosion, bank caving, ice shoving, or wave action, reference monuments or a witness corner meander corner (WCMC) will be established as near as practicable.

**8-11.** Meander corner monuments are to consist of the regulation posts used for monumentation of the public lands surveys, described in more detail in chapter IV. Corner accessories to meander corners are to be established on the upland side of the meander lines running into or from the corner. Typical markings are found in chapter IV.

**8-12.** Meander corners are established and meander (sometimes called angle) points are located along the banks of meanderable rivers and lakes, and along the banks of islands that were formed in those water bodies before the date of statehood. Meander corners are also established along the banks of islands in meandered nonnavigable rivers and lakes that formed in those water bodies after the date of statehood but prior to alienation of the upland.

**8-13.** Meander lines are only run in front of public domain or other Federal interest lands. When it is necessary to show the sinuosities of a water body in front of alienated lands for platting purposes, medial line computations, establishing zero accretion points, or controlling proportionate corners, an informative traverse is run and may be included on the plat and field notes. An informative traverse is executed similarly to a meander line but neither establishes nor defines riparian rights of any kind in the adjacent upland. The informative traverse merely indicates the topography in front of the entered, claimed, or patented land. In addition, new areas are not returned. The result is represented on the plat as an informative traverse with different line weight or line style from shown meanders.

**8-14.** Remeandering is the process of establishing new meanders in front of previously meandered Federal interest lands. In the event of accretions to or relictions on such lands, the new meander line will be between the margin of the water and the former meander line.

**8-15.** Where it appears that upland was erroneously marked as lying below the original meander line and

thus omitted from survey (omitted lands), the original meander line becomes a fixed and limiting boundary. New meanders are returned and new acreage and lots shown on the plat for the formerly omitted areas.

**8-16.** When sections bordering meandered bodies of water are subsequently subdivided, it is common for the shore line to have materially changed during the intervening years between the date of the subdivision of the township and the date of the subdivisional or allotment survey, through the processes of accretion, erosion, or the recession of the water. If it is desirable to remeander the body of water in order to show the true conditions at the date of the section subdivision, the plat should show new lottings and/or areas for unpatented lands within the invaded sections (section 9-109 and figure 9-9).

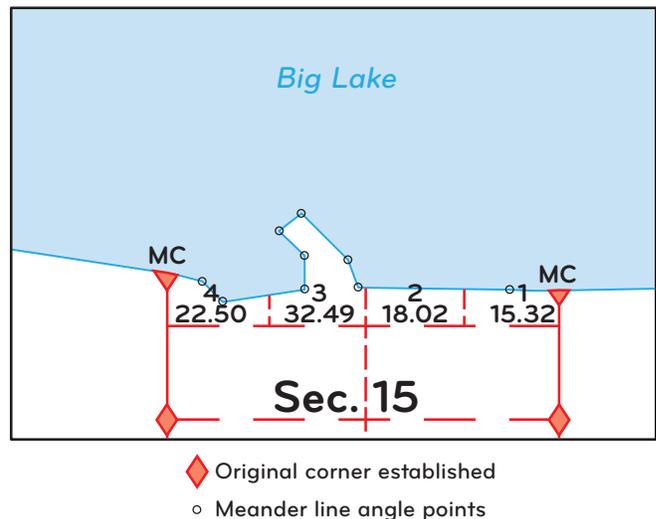
**Restoration of Meander Lines During Resurvey**

**8-17.** Following the perpetuation of obliterated meander corners or reestablishment of lost meander corners, it may be necessary to place the original meander line on the ground. This is done to assist in understanding the processes by which the changes occur, especially in identifying avulsions. Calls for bank heights, sloughs, vegetation, and other physical features in the previous record are compared with current conditions to understand why the changes occurred. The restoration of angle points along meander lines is made using the compass rule adjustment method described in section 7-53.

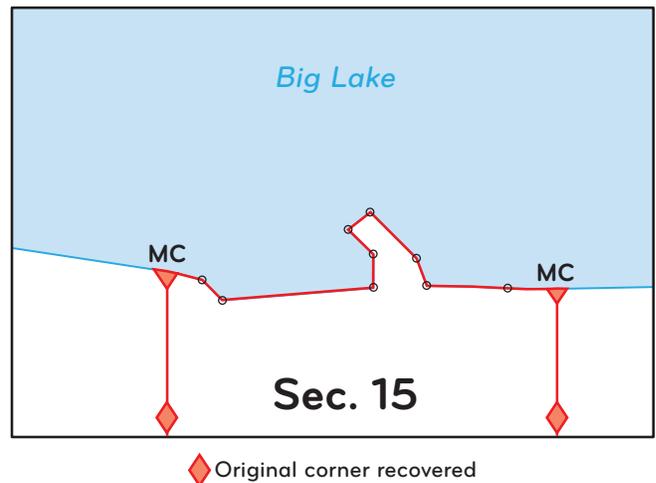
**8-18.** In situations where the record adjusted angle points fall in deep water or other impassible terrain, the restored angle points will be calculated based on the above field procedure and the coordinates of the restored angle points then established by a calculated traverse. A graphical layout of the entire traverse at a suitable scale is recommended for a check on the work.

**8-19.** The existence of a gross error or blunder in the original meander line record is sometimes apparent when a sharp topographic feature is reflected in the original record but is offset at a considerable distance from its restored location, hence the rationale for placing the original meanders on the ground (figures 8-1 through 8-3). Using the principle of placing the blunder where the blunder occurred, the record should be judiciously corrected so that the restored meander line adequately reflects the topography.

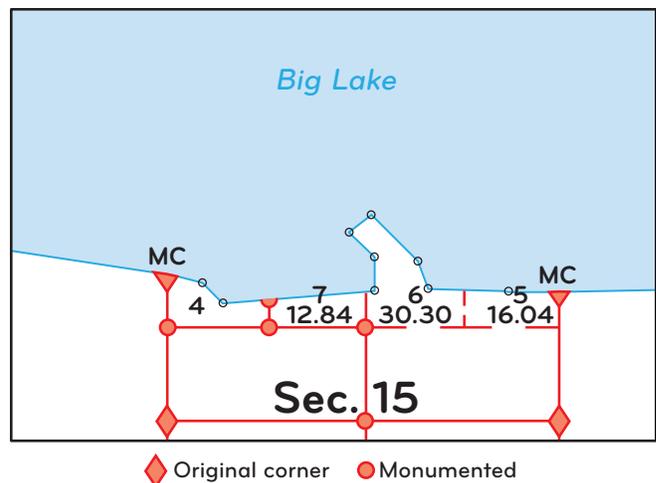
Past record errors have included reversed meander course order, an error in the inversed final course, the original surveyor erroneously following the banks of



**Figure 8-1.** A portion of the 1871 original survey plat showing a lake peninsula.



**Figure 8-2.** A portion of the 2009 retracement showing the same lake peninsula.



**Figure 8-3.** A portion of the 2009 resurvey and the subdivision of section 15.

another water body, e.g., meandering a stream entering the river intended to be meandered, meandering the top of vertical banks some distance back from the water's margin, meandering during flood stage rather than "ordinary high water" (not necessarily error but may explain an excessively wide river), or transcription errors.

**8-20.** Angle points of a restored adjusted record meander line are not ordinarily monumented except as necessary for administration or management purposes. These are monumented when the restored adjusted record meander line becomes a fixed and limiting boundary of Federal interest land or when accretions are lotted.

## Navigability

### Nonnavigable Waters

**8-21.** Nonnavigable bodies of water are rivers and lakes that have no history of use in navigation nor have the susceptibility of being used for commercial transportation in their ordinary condition at the date of statehood. They are the small natural ponds, rocky creeks, and even usually dry washes, and arroyos. They do not fit the description of streams or lakes that are legally navigable waters; navigable waters are more carefully defined below.

**8-22.** Nonnavigable watercourses, when crossed by lines of the regular survey and resurvey, are noted as items of topography. The field notes should reflect the distance along the line to the center of the watercourse, the direction of the flow, and average width. The shores of such small lakes will be noted as items of topography with the distance along the survey line and the bearing of the shoreline in the field notes.

**8-23.** Nonnavigable streams and lakes are meandered under certain conditions. Title to the beds remains in the United States until the shore lands have passed into private ownership (*United States v. Oregon*, 295 U.S. 1 (1935)). The Government's conveyance of title to a fractional subdivision fronting upon a nonnavigable body of water, unless specific reservations are indicated in the patent, carries ownership to the middle of the bed *in front of* the basic holding (*Oklahoma v. Texas*, 261 U.S. 345 (1923); see also 43 U.S.C. 931).

**8-24.** Well-defined nonnavigable watercourses more than 3 chains in average right angle width will be meandered on both banks between consecutive meander corners, unless otherwise directed by special instructions.

**8-25.** Nonnavigable lakes of 50 acres and upwards in extent will be meandered unless otherwise directed by special instructions. The survey procedure is the same as for a navigable lake.

**8-26.** It is necessary at times to survey the beds of nonnavigable streams and lakes, or the portions of the beds owned by the Government, in connection with the administration of the Federal interest lands, e.g., locating the medial line of the river which is the boundary of an Indian reservation. Where all the shore remains in public ownership, the survey is simply an extension of the regular rectangular system.

More commonly, it is desired to establish partition lines between alienated and Federal interest lands. In either case, if the area is covered by water, as in the case of the survey of the bed of a nonnavigable water body, the survey cannot be monumented in the regular manner, and many of the lines cannot be surveyed on the ground. The plat then represents a survey made largely by protraction. The procedure will be outlined in detail in the special instructions.

**8-27.** Where federally owned lots are dependently resurveyed along one bank of a meandered nonnavigable river and are opposed by entered, claimed, or patented lots along the opposite bank, generally the boundary line between the lots is located along the medial line of the river. The medial line is halfway between the opposite OHWMs of the river as of the time of the resurvey. See section 8-62 for more information about medial lines and exceptions to the general rule.

**8-28.** The field work usually consists of (1) a dependent resurvey of the lands bordering on the area to be surveyed; (2) the subdivision of the upland sections when necessary to determine the boundaries of Federal interest riparian subdivisions; (3) the monumentation of as many corners as practicable; (4) the protraction of section lines onto the bed to the extent needed for making computations; and (5) the establishment of medial and partition lines if this is to be done on the ground.

**8-29.** Nonnavigable rivers have been used as boundaries of reservations, borders between States, or other special purposes, e.g., the Yakima River in Washington State (a portion of the Yakama Indian Reservation boundary), the San Juan River (a portion of the Navajo Reservation boundary), or the Red River (a portion of the Texas and Oklahoma border). In some instances, the boundary of a special area follows one bank or the other rather than in the channel. It is important that the precise