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# PUBLIC LAND SURVEYS -- HISTORY AND ACCOMPLISHMENTS

I am pleased to have this opportunity to speak to you on the subject of the Rectangular System of public land surveys. As an employee of the Bureau of Land Management my work deals entirely with the survey of the public lands, and I am happy to discuss with you briefly the history and accomplishments of that field of activity in the United States. The scheme was not something that was just thought of on the spur of the moment, so to speak, but was the result of much thinking, and after the different colonies had tried out many systems. I will outline some of the events leading up, over the many years, to the formation of the final details of the system, and to its adoption by the Continental Congress, in the Land Ordinance of May 20, 1785.

It is safe to say that relatively few people realize and appreciate the importance of the rectangular system of public land surveys in the settlement and development of the vast public domain. Even less is known of the basic contribution it has made to our political and economical advancement. Like many of the advantages we enjoy, it has been accepted as an obious thing, whose benefits, if considered at all, now appear so self-evident that seemingly no other course could have been followed. But when this survey scheme was established by the Continental Congress, no other counterpart or pattern for it existed. The plan, as developed, was unique in three respects: First it introduced the new principle of "survey before settlement"; second, it introduced the concept of a mathematically designed and nationally integrated cadastral survey; and third, it created a standard land unit, the section, of uniform shape and area and with boundaries physically marked on the ground.

It might well be considered why this scheme was developed and where it was applied.

With the founding of the Republic, the colonies ceded their western lands to the central government in order that funds might be realized for payment of the cost of the Revolutionary War and to provide lands to reward the soldiers of the war. This nucleus of the public domain embraced the very large area north of the Ohio River, extending from the west boundary of Pennsylvania to the Mississippi River, and the lands from the west boundary of Georgia to that river. It was for the management of this area that the scheme of the rectangular system of public land surveys was conceived.

During the first 75 years of our national existence there were added to the public domain, areas in the Louisiana Purchase in 1803, the Florida Cession in 1819, the Annexation of Texas in 1845, the Oregon Territory in 1846, the Mexican Cession in 1848, and the Gadsden Purchase in 1853. At its greatest extent, the public domain embraced 1,441,346,560 acres, or more than 2,255,000 square miles, representing approximately 75 percent of the area of continental United States. This domain included the States of Florida, Alabama, Mississippi, and all States north and west of the Ohio and Mississippi Rivers except Texas. The acquisition of Alaska in 1867 added 365,481,600 acres to the public domain. It is this tremendous area, totalling more than 1 billion 800 million acres, which constitutes the field of application of the rectangular system of public land surveys.

As to the factors which prompted the development of an orderly scheme for the survey and disposal of the public domain, it may be pointed out that the American colonists coming from the Old World countries, were imbued with the concept of America as a New World. Here land was plentiful and easily obtainable. They were not inclined to forget the oppressive land tenure practices of the Old World feudal systems. From the earliest days there was an indicated intention for security of freehold titles in the individual. The dissatisfaction with the old order of indiscriminate and random division of lands was also manifest early in Colonial Times. One writer says of this phenomenon of attempting regularity of land partition in a world where such orderliness was unknown, "So early were the common lands thus laid out by men who had, up to that time, been familiar with the irregular method, that it seems as if the plan must have been one of the first products of the new American environment. Under the stimulus of unlimited area and an untouched soil, the newcomers at once improved the old system of dividing land".

The New England "Town Commons" were generally arranged in regular form and subsequent "pitches" or land claims in these organized areas tended to conform to the regular plan of the original layout. In the outlying areas also, an effort was made toward regular and uniform shapes of land disposals. As an example there may be cited a Maryland warrant of March 7, 1641 which directed the surveyor to "...lay out four thousand acres of land....and bound it with the most natural bounds as near you may to the form of a parallelogram".

The trend toward regularity and uniformity in land disposals was incorporated into the laws of some of the Colonies in the purchase regulations of the large Proprietors such as William Penn, Lord Baltimore, and the Earl of Shaftesbury of the Carolinas, and in the warrants for surveys of most Colonies. The early warrants of Penn instructed the surveyor to lay out the lands "according to methods of townships appointed by the Proprietors". Lord Baltimore directed the lands to be laid out in regular order.

Unfortunately these reasonable requirements were almost completely disregarded except in New England. There the grants tended with time to become more square and of a uniform size. Although directives existed in nearly all of the Colonies for the systematic layout of lands, the results were negligible except in New England. It seems that, while the virtues of land boundary regularity were recognized by our forefathers, they chose to exercise the most novel of their new freedoms--the right to pick and choose for themselves.

As attractive as this freedom of choice--free from all regulatory restraints--might appear to the settler, in time it created a situation of confusion, conflict, and controversy as to land boundaries and ownership.

In 1699 the House of Assembly of Maryland passed "an act ascertaining the bounds of land"; this was an early attempt to rectify the problem caused by unsatisfactory settlement practices. Boundary locations were a problem, but the greatest concern was the excess of land in the grants over the quantity called for in the warrants. Apparently there was seldom a deficiency. The surveyor was blamed for this and possibly rightly so, but you can readily visualize a claimant (who was also the employer) pointing out to the surveyor the bounds of the land he wanted surveyed. The surveyor had little alternative but to survey the lands in accordance with the selection of his employer.

An indication of the confusion which existed at that time may be gained from this act of the Maryland Assembly of 1699, which states in part, "Whereas, at the first taking up of lands in this Province, necessity constrained His Lordship to commissionate such persons to be surveyors as was but very meanly skillful in the art of surveying; ....and the said bounds are generally expressed in such uncertain terms, and being many times contradictions and inconsistent in themselves, whereby it comes to pass that at this time is very uncertain and many chargeable and tedious suits in law happen about such bounds, which are most times (as it were) by the favour and inclination of jurors arbitrarily determined differing ways in parallel cases". In 1715 a five-man commission was set up to hear and determine all differences and controversies in the matter of land boundaries. They had broad powers of subpoena and could hire surveyors who in cases of minor retracements "shall have only a quarter of a pound of tobacco per perch and no more".

Even earlier, in 1661-1662, the General Assembly of Virginia in connection with a bill providing for "processioning" said, "many contentious suits are dayly incited and stirred up about bounds of land for which noe remedy hath yet bin provided". By 1705 they were forced to come to grips with the problem and passed "an act concerning the granting, seating, and planting and for settling the titles and bounds of lands".

This gives an indication of conditions which created a basic

demand for the development of an orderly plan for survey and settlement of the public lands in the Western Territory.

In 1784 a Commission of the Continental Congress, of which Thomas Jefferson was chairman, reported an ordinance for the mode of locating and disposing of the lands in the Western Territory. This was considered and discussed at length. As amended and adopted by The Congress on May 20, 1785, it became the foundation on which was built the structure of the survey of the public lands.

This land ordinance provided for the survey of the Territory into townships, six miles square, by lines running due north and south and others crossing those at right angles. The ordinance further specified that "the lines shall be measured with a chain; shall be plainly marked by chaps on trees and exactly described on a plat; whereon shall be noted by the surveyor, at their proper distances, all mines, salt springs, salt licks, and mill seats that shall come to his knowledge; and all water courses, mountains and other remarkable and permanent things over and near which such lines shall pass; and also the quality of the lands". The ordinance also provided that "the plats of the townships, respectively, shall be marked by subdivisions into lots of one mile square, or 640 acres, in the same direction as the external lines, and numbered from 1 to 36". The surveys were directed to be made by a corps of surveyors, one from each State, to operate under the direction of the Geographer of the United States, a position held by Thomas Hutchins. The Geographer was directed to "personally attend to the running of the first east and west line and shall take the latitudes of the extremes of the first north and south lines and of the principal rivers".

The surveys under this act were known as "the seven ranges" in Ohio. The first township surveyed under this ordinance is in what is now Jefferson County in the vicinity of Steubenville, Ohio; the survey was executed in 1786 by Absalom Martin of New Jersey.

Late in 1785, Thomas Hutchins submitted to the President of the Continental Congress "a plan and remarks of that part of the Western Territory through which an east and west line has been run". The east and west line which he ran extended only four miles westward from the intersection of the Pennsylvania boundary with the Ohio River but his notes covered eight closely written pages in describing the slopes, soil, trees, and even medicinal herbs along the way. This established a pattern for reporting the character of the land, soil and timber which has been followed in the survey of the public lands from that time to the present, though probably the detail given in the Hutchins report has not since been equalled.

The administration of the public lands at that time was under the Treasury Department of the Federal Government. In 1790 Alexander Hamilton, Secretary of the Treasury, submitted a report to

Congress on the administration of the public lands. He proposed the establishment of a General Land Office in the Treasury Department and that a Surveyor General be in charge of the public land surveys, with a corps of deputy surveyors to execute the surveys. His recommendations were not acted upon immediately and, after much delay, only in installments.

Some of those recommendations were incorporated in the act of May 18, 1796, which provided "that a Surveyor General shall be appointed whose duty it shall be to engage a sufficient number of skillful surveyors as his deputies whom he shall cause, without delay, to survey and mark the unascertained outlines of the lands lying northwest of the River Ohio and above the mouth of the River Kentucky, in which the titles of the Indian tribes have been extinguished, and to divide the same in the manner hereinafter directed". This act went on to provide for the subdivision of the Territory into townships much the same as in the land ordinance of 1785. The act also required that "the corners of the townships shall be marked with progressive numbers from the beginning; each distance of a mile between said corners shall also be marked with marks different from those of the corners. Half of the said townships, taking them alternately, shall be subdivided into sections, containing as nearly as may be, 640 acres each, by running through the same each way parallel lines at the end of every two miles, and by marking a corner on each of said lines at the end of every mile." The act also provided that all of the lines were to be measured with chains containing two perches of 16½ feet each and for the marking of witness or bearing trees at each corner location.

This is the first reference to a section as the unit of subdivision of the township and is also the first statutory requirement for the physical establishment of corners on the boundaries of the townships and sections. Other early laws providing for the survey of the public lands were the acts of May 10, 1800; February 11, 1805; and April 25, 1812. However, the land ordinance of 1785 and the act of 1796 are considered to have established the basic principles in our surveys of the public lands; on these two acts hang all the laws and the prophets so far as public land surveys are concerned.

The act of May 10, 1800 provided for the running of section lines at intervals of one mile and the establishment of quarter-section corners. The finality of the surveys was guaranteed by the act of February 11, 1805, which provided that:

1. All of the corners marked in the surveys returned by the Surveyor General shall be established as the proper corners of the sections or subdivisions of sections which they were intended to designate.

2. The boundaries actually run and marked in the surveys returned by the Surveyor General shall be established as the proper boundary lines of the sections or subdivisions for which

they were intended, and the lengths of such lines as returned in the surveys shall be held as the true lengths thereof.

3. Each section or subdivision of section shall be held and considered to contain the exact quantity of land returned in the survey.

Rufus Putnam was the first Surveyor General under the act of 1796. He served from 1797 to 1803, followed by Jared Mansfield, Josiah Meigs, and Edward Tiffin. That part of the Northwest Territory which became the State of Ohio was the experimental ground for the development of the rectangular survey system. Here the plans and methods were tested in a practical way and notable revisions in the rules and practices, based on the earlier experiences, were made applicable as the surveys progressed westward until the plan became perfected. Much credit must be given to the work of the early Surveyors General in developing and perfecting the plan of surveys. During their incumbency in office, the surveys in Ohio were largely completed and the work had been extended into Indiana and southern Michigan.

The adoption of the rectangular system marked the transition from the surveying practice prevailing in the greater part of the colonial states where land grants were defined by irregular metes and bounds, each depending more or less on the description of an adjoining tract, which was known by name or number, and mostly without common geographic location other than a possible reference to some well-known natural object.

The general plan of the rectangular system of public land surveys is well known, particularly in the portions of the United States over which it has been extended. Its importance in our history is such that many high school textbooks describe its features and advantages. No attempt will be made here to describe this sytem in detail. Suffice it to say that the basic unit of survey is the township, six miles square. The next lower unit is the section, one mile square. Since the townships are arranged in a checkerboard pattern, oriented north-south and east-west, which is a coordinate system of construction, each township can be described as so many townships north or south of the base line and so many ranges east or west of the governing principal meridian. The sections are laid out within the township in a systematic manner, beginning with No. 1 in the northeast section and proceeding west and east alternately through the township with progressive numbers to No. 36 in the southeast section. Operational errors are prevented from accumulating and geodetic factors compensated for by the establishment of standard parallels (or correction lines) and guide meridians at stated intervals.

It must be realized that from its inception in 1785 until about the turn of the 20th century, the public land surveys were carried forward

in virgin territory--unexplored and unmapped--in advance of settlement. The records of those surveys, consisting of the official plats and descriptive field notes, afforded substantially the only information as to the character of the land and its resources. The field notes, for example, contain the surveyor's estimate of the quality of the soil for each mile surveyed, remarks on the lay of the land and description of vegetation, as well as information on streams, lakes, and ponds. The plats show the lengths and directions of lines and the legal areas of sections and their subdivisions as well as planemetric data such as the streams and lakes and the extent of prairie or swamp land.

Looking back over the history of the westward expansion of this Nation, we must realize that the information afforded by these basic survey records was essential to that expansion and was relied upon by those who purchased the lands in the early days, those who sought agricultural lands under the Homestead Act of 1862, and those in search of timber or other resources of the land.

The rectangular system of public land surveys was extended before settlement. Thus, with every surge of their drive to the frontier, the settlers found that the Government surveyors had been there before them and had neatly blocked out the agricultural land into mile squares, with the boundaries definitely established and marked on the ground.

The history of the development of this country can be traced largely by the timing of the public land surveys. The annual reports of the Commissioner of the General Land Office were for many years accompanied by a map showing the extent of the public land surveys executed to the date of the report. It is fascinating to follow the progress of those surveys and to picture the development of the country which followed.

By the 1860's, the surveys had been extended across the Mississippi and embraced practically all of Louisiana, Arkansas, Missouri, Iowa, and southern Minnesota; you will also find that large areas in California and Oregon had been surveyed to accommodate the settlement following the gold rush of 1849 and the migration to the Oregon Territory. The map accompanying the report of 1865 shows surveys in eastern Kansas and Nebraska and along the old Santa Fe Trail in New Mexico in advance of settlement in that area, and in a very small portion of Colorado to accommodate the settlement after the discovery of gold and silver in the Cripple Creek area. That map also shows limited surveys in Utah to accommodate the influx of the Mormons. Vast areas comprising the Dakotas, Montana, Idaho, Wyoming, Nevada, much of Kansas, Nebraska, Colorado, Utah, New Mexico, and all of Oklahoma (then Indian Territory) and Arizona were entirely unsurveyed at that time.

Prior to 1910, the public land surveys were executed by a corps of deputy surveyors who operated under negotiated contracts at a price from about $2 to $8 a mile.

By act of Congress the contract system of surveys was abolished in 1910 and since that time the work has been carried on by a corps of cadastral surveyors on the Federal payroll. The reason for the change from the contract system to the direct employment system was largely the fact that the remaining unsurveyed public lands were relatively scattered and in small blocks in difficult terrain. Difficulty was experienced in contracting for the work at the rates allowed by law. Coupled with this there was the necessity for re-surveys occasioned by the disappearance of the corner monuments due to the lapse of time and ravages of the elements which involved the protection of the vested rights of those who had acquired title to lands through operation of the public land laws. This created conditions beyond the capabilities of the average contract surveyor and necessitated the development and training of a corps of specialized surveyors to handle the problems.

By the time of the conversion of the contract to the direct system, much of the arable land area and the areas for which need could be foreseen, had been surveyed. As might be expected from a program of this magnitude, which extended over a period of more than 120 years and stretched from the Appalachian Mountains to the Pacific Ocean and from Canada to the Gulf of Mexico, some irregularities had crept in. Undoubtedly, some of the reported surveys in the rougher and more remote regions were more or less fraudulent. However, surveys of that character are but an infinitissimal portion of the total and cannot be permitted to influence the judgment as to the accuracy and integrity of those men who braved the wilderness in the early days of the history of this country for the purpose of creating land boundaries to enhance and speed the development of the Nation.

Under the contract system, the corner position monumentation was by the most durable native material available. This could have been marked stones, stakes, living trees, or other material thought to be adequate for the purpose. Such monuments are subject to deterioration and disappearance through natural causes. In many cases the surveys were made years and years in advance of settlement or before the land became economically desirable for other purposes. During that lapse, much could and did happen in the way of destruction of the corner monuments. I am convinced that in many cases the charge of fraudulent survey has been incorrectly made whereas, in reality, the absence of identifiable corners is due to the lapse of time since the survey was executed.

Since 1910 the survey corners have been monumented with wrought iron galvanized posts having a brass cap on which the corner marks are stamped. It is the expectation that, with the exception of areas of the most adverse soil conditions, this type of corner monumentation will last for 100 years or more. I may say, however, that we have not abandoned thought of an even more permanent corner marker and are continuing our search for suitable material.

An important economic advantage of the rectangular scheme of surveys is that the lands are ordinarily disposed of in square units or legal subdivisions of 40 acres each. The land record in the counties of the public land States can thus be entered easily and maintained on printed and uniform size diagrams of township plats. The title records are much more complicated and involved in the older areas where the records must be compiled from innumerable irregular and uncoordinated survey records.

From the standpoint of land economics, the disposal of land in blocks, which entailed the taking of the bad with the good, has resulted in the highest land use of the whole. This was a bitterly-opposed feature of the original land ordinance and the wisdom of the course was slow to be appreciated. Naturally the settler wanted all of his holdings to be good land and objected to having what he considered as worthless hills, swamps, or poor land included in his settlement. However, experience has proven that, once it was his, he has made every effort to utilize it all to the best advantage--the hills have become woodlands and pasture; the swamps and sloughs have been drained or filled, where possible; and the rocky or poorer land may have been used as home or barn sites. With the settlement of the country and increasing value of the land, new uses and new demands have been made for even the scattered and isolated tracts of unattractive land in the areas of the earliest settlement. As a result, much land that once had only marginal economic value has been transferred to private ownership in units of manageable size and character, thus eliminating the endless administrative problems incident to Federal management of those scattered tracts.

You will recall that the 1805 act established the finality of the corners and lines of the public land surveys. As a result, in spite of the intense development of much of the area covered by those surveys, the lines and corners are still preserved as corners and boundaries of the privately owned land. This is demonstrated emphatically in air travel over the agricultural areas of the Midwest where the fields still conform to the lines of the early surveys. Even in such metropolitan areas as Chicago, the townsite subdivision is controlled by the section lines of the original public land surveys--streets are laid out along those lines and the public land survey corners have been perpetuated and buried beneath the pavements.

As to accomplishments, I have indicated that the rectangular public land surveys have been extended over the public lands from the Appalachian Mountains to the Pacific coast and from the Canadian border to the Gulf of Mexico. Statistically, approximately 1 billion 330 million acres in the continental United States have been surveyed. Only a very small portion of Alaska has been surveyed but the surveys in that Territory are being extended as rapidly as necessary to anticipate the needs of settlement and industry.

The present corps of cadastral surveyors in the Bureau of Land

Management is engaged principally in the execution of three classes of surveys in the continental United States:

1. The execution of original surveys in regions so fantastically rough and broken that until the discovery of uranium and petroleum in relatively recent years, it was not believed that there would ever be a need for their survey. In some of these areas it is necessary to transport survey crews by helicopter in order to accomplish the required surveys.

2. The resurvey of early surveys and identification of the boundaries of remaining public lands for the proper administration of those lands which have become increasingly valuable with the settlement and development of the country.

3. The resurvey and remonumentation of the boundaries of areas subject to intensive development—such as reclamation projects.

There are large areas of unsurveyed public lands included in permanent reservations, such as National Forests and National Parks, in which the extension of the public land surveys probably never will be required. However, there are some 175 million acres of public lands still under the jurisdiction of the Bureau of Land Management. It is estimated that much of this area will require resurvey to permit effectual management of the land and resources. There are very extensive areas where, due to deterioration of corner monuments, there is uncertainty as to position of boundaries between Federal and privately owned lands, wherein the services of our surveying organization are urgently needed to settle matters of trespass. While it is improbable that all of Alaska will require survey, there are very extensive areas suitable for settlement and development in that Territory which must be surveyed to develop their full potentialities. All of these mount up to a very considerable program of survey and resurvey of the public lands which will require many years for completion.

Looking back over the years, one who has been closely connected with the public land survey system cannot help but admire those who conceived the plan and put it into operation. The names of many, such as Hutchins, Mansfield, Meigs, Tiffin, Freeman, Ellicott, William Burt and his four sons, come to mind as those who have contributed so largely to the successful inauguration and prosecution of this system. Designed originally to mark on the ground the boundaries of tracts of land for purposes of settlement and development of the wilderness, the public land survey system of the United States has been and is a marked success.