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REMONUMENTATION IN MINNESOTA

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PREFACE

The purpose of this paper is to provide legislators and others with background information on remonumentation. The escalation of land values in recent years has created a need for the precise delineation of property boundaries. In Minnesota property boundaries are defined by monuments of the United States Public Land Survey. The loss of many monuments over the years has made the relocation of these markers a concern for public policy. Remonumentation programs attempt to address this concern. The paper includes a description of the problems created by lost monuments and the efforts of the present system to deal with this problem. Primary emphasis is placed on outlining alternative approaches to remonumentation. No attempt is made to specify the "best" alternative. This evaluation is left to the reader.

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INTRODUCTORY NOTE

It is recommended that readers who are unfamiliar with remonumentation consult Appendix A: "A Brief History of the Public Land Survey and Monumentation." It provides a needed perspective on the issue.

Mention should also be made at the outset about information sources. Very little has been written on the subject of remonumentation; most of the paper is based upon personal interviews. Appendix B lists the various groups contacted during the course of this study. A brief summary of the perceptions of each group as to the need for remonumentation is also presented.

I. THE PROBLEM

Presently, many of Minnesota's Public Land Survey (PLS) monuments are either lost or non-existent. A 1975 survey of county officials revealed that only 23% of the state's PLS monument positions are known to have a permanent monument. About 27% of the monument positions have some records of unknown value, with 50% of the positions unknown with no records. The differences between counties are tremendous. Hennepin County is completely monumented but 55 of Minnesota's 87 counties have fewer than 25% of the monuments and seven counties have no monuments at all (Appendix C).

There are numerous reasons why the monuments were lost. Since the original PLS monuments were made from natural materials (wood and dirt), many positions that were never relocated have been lost through the processes of time and decay. Since the initial survey, developmental pressures such as deforestation, prairie cultivation, road construction, and urban expansion also destroyed monuments throughout Minnesota.

While these pressures were at work state and county officials tended to neglect the task of replacing and perpetuating the monuments. The number of county surveyors declined drastically around the turn of the century when many became county engineers with county road programs. During both world wars and the Depression little effort was made to relocate monuments. It is only in the post-World War II period that some counties have renewed an interest in remonumentation.

Monuments continue to be lost today in many parts of the state. Farm consolidation and the advent of large scale irrigation systems have destroyed fence lines and monuments, while urban sprawl and related developments in suburban areas pose the threat of further losses. The passing of time will make the relocation of many monuments even more difficult. A generation of Minnesota's older citizens, whose parents initially settled the land, can supply important testimony which provides a way to re-establish a monument. As this group of witnesses passes away their evidence will be lost forever. All these factors imply that the problem of missing monuments will be exacerbated over time.

There is no doubt that many PLS monuments are missing; the consequences of missing monuments are less evident. However, it is very difficult for either the government or the surveying community to quantify the extent and impact of all these problems.

Perhaps the most significant problem associated with missing monuments is economic. Since surveyors usually need the PLS monuments for reference points before a piece of land can be surveyed, missing monuments must be relocated first. Survey costs increased on the average by a factor of three in poorly monumented sections compared to completely monumented sections. A private surveying firm in Hopkins estimated in 1969 an average cost of \$800 for a boundary survey of a forty-acre parcel in a completely monumented section compared to an average cost of \$2400 for the same survey in a poorly monumented section. These costs are much higher today.

Increased survey costs affect both private parties and public agencies. All land subdivisions made by a private party require a

survey. Practicing surveyors can cite cases where survey costs in poorly monumented sections were prohibitive for a private citizen. This is because surveys are often necessary before a parcel of land is transferred. There is no way of quantifying how many private citizens cannot afford land surveys because of lost monuments.

The two state agencies that are most affected by lost monuments are the Minnesota Department of Natural Resources (DNR) because of land acquisition activities and the Minnesota Department of Transportation (DOT) because of road construction work. The DNR's Surveys and Maps Division estimates that 70 to 75% of their time is spent on locating and re-establishing monuments. The DNR spent about \$400,000 on monumentation in 1976. Remonumentation would surely lessen this element of DNR's work.

Unfortunately, it is nearly impossible to document the scope of increased survey costs caused by lost monuments. A former President of the Minnesota Land Surveyors Association (MLSA) estimates that private surveyors gross about \$20 million a year statewide. It is impossible to say how much of this figure reflects work in poorly monumented sections. Lost monuments increase survey costs in general terms, but there is no way to quantify this specifically.

Another major problem resulting from missing monuments is property boundary litigation. The incidence of court cases involving boundary disputes is increasing as land values escalate according to the MLSA. However, this trend cannot be quantified. These disputes

are often brought to court because monuments are lost. Different surveyors may base their work on the wrong position and legal action results. The number of cases involving boundary disputes is also impossible to measure.

Boundary litigation would initially increase if Minnesota were to be remonumented. Once disputes arising from the new monuments were settled one could anticipate a significant decrease in these types of cases.

The problems described above vary across the state. The areas which need monuments most are those where land prices are escalating and where land transfers and subdivisions are most frequent; urban fringes and lakeshore properties, therefore, have the greatest need for remonumentation.

II. PRESENT REMONUMENTATION EFFORTS IN MINNESOTA

In Minnesota the counties are responsible for the maintenance and perpetuation of the Public Land Survey (Minnesota Statutes 381.12). The type and extent of county remonumentation programs vary significantly in different parts of the state (Appendix C). Some counties have a full-time county surveyor, an annual budget, and a systematic program to replace all corners in the county. Others have a part-time surveyor, a limited budget, and a partial remonumentation program based upon requests. Many counties are still without a county surveyor and thus lack any type of remonumentation program. Under these circumstances, a landowner must hire a private surveyor for monument relocation.

Since every county approaches remonumentation differently, there is a total lack of uniformity statewide. Methods, records, and even the type of monuments used varies from county to county. In Minnesota, the statewide effort at remonumentation is unsystematic at best.

The success of a county remonumentation program depends upon two factors -- interest and financial resources. In many counties, neither the residents nor the county commissioners show much concern about lost monuments. Some counties which have an interest in the problem are strapped financially. State law (M.S. 381.12) allows the counties to levy a tax for remonumentation, but this is not a special levy and thus comes under the general levy limits. Many counties with large land areas and sparse populations are unwilling to spend any significant part of their limited budgets on monumentation. However, at least two (Cook and Koochiching) of the nine northern counties eligible for matching funds from the Iron Range Resources and Rehabilitation Commission have been able to work on remonumentation with these funds. Nevertheless, it is clear that the counties vary too widely in their resources and commitment to undertake a state-wide monumentation project.

Not all counties in the state have the same need for remonumentation. Generally, the counties with the most land activity (as reflected in deed transfer tax revenues) are the counties that are also most heavily engaged in remonumentation programs. These counties have the population and financial resources to pay for their programs with county revenues (Appendix D).

In sum, those counties in need of remonumentation presently do so according to their interest and limits on resources. This

makes the statewide effort disjointed. In aggregate the counties have been unable to perpetuate Public Land Survey monuments.

III. REMONUMENTATION PROGRAMS IN OTHER JURISDICTIONS

One may now examine how remonumentation programs have worked in other jurisdictions. Representative examples are presented to show three different approaches to the problem. It is not intended to be a complete list of every jurisdiction outside of Minnesota with a remonumentation program.

A. County Based

Both Indiana and Wisconsin attempted to remonument their PLS corners. In each state a statute was passed requiring the counties to relocate at least 5% of their monuments each year. It was hoped that these states would be remonumented within twenty years.

Indiana and Wisconsin both found this approach to be ineffective. In Wisconsin, the clout implicit in the law was removed when a later amendment changed the language "shall" monument to "may" monument. No means of state funding or state enforcement was provided by either state. Wisconsin tried unsuccessfully to enact legislation to use the deed tax at the state level to finance remonumentation. Overall, since these systems are dependent upon the counties, there have been varying degrees of compliance.

The one region where remonumentation succeeded in these two states was due to the efforts of Wisconsin's Southeastern Regional Planning Commission. This seven-county area, using the Wisconsin State Plane Coordinate System, was able to re-establish the PLS corners. Racine County is completely remonumented.

The Indiana and Wisconsin experience indicates that county remonumentation programs will be successful only if the counties take an active interest, including a financial one, in the problem. For the county approach to be successful statewide requires state funding and enforcement.

B. State Based

Three states -- Missouri, Arkansas and Florida -- have remonumentation programs administered at the state level.

Missouri has a State Survey Authority which was initially autonomous and is now a part of the state's Department of Natural Resources. Their three-fold program includes: 1) serving as a repository for all statewide survey records and documents; 2) remonumenting PLS corners; and 3) providing geodetic control extension. Remonumentation is done by contracting with private surveyors and about 300 monuments are relocated per year. Missouri collects a \$1 fee on all land related documents, generating about \$280,000 per year which goes into the general revenue fund. Now that the survey authority is in the DNR it is subject to regular appropriations and received a \$53,000 cut in its last budget.

Florida's remonumentation program is also part of the state's Department of Natural Resources and is called the Bureau of Coastal and Land Boundaries. Their activities include: 1) a mandatory recording program for all remonumented corners; 2) an incentive program for private surveyors to remonument corners (\$75 per monument); 3) an active state program to systematically restore all corners in whole townships; 4) a limited data bank system; and 5) some work with geodetic control. The bill which established this

program was passed in 1977 but without any funding. The 1978 appropriation was \$150,000. Together with other DNR funds the current budget for the program is about \$500,000. A user tax system patterned after the Missouri system is under consideration for the future.

Arkansas has a state-based program that is also similar to the Missouri system. They have both a State Surveyor and a Land Surveyors Advisory Board. The State Surveyor started out in the State Land Office, then went to the State Department of Commerce, and is now attached to the Geological Commission. His office is involved with: 1) restoring corners; 2) serving as a statewide repository for survey information; 3) establishing the state plane coordinate system; and 4) improving the qualifications of surveyors. In two years they have re-established 1052 PLS corners. The budget comes directly from legislative appropriations and has grown annually from \$30,000 to \$135,000 over five years.

The state-based programs of Missouri, Florida, and Arkansas seem to be effective in providing coordination and control of remonumentation efforts. However, the program budgets are small in all three states. Because of this not many corners have been remonumented. Under these circumstances, complete remonumentation will be a slow process.

C. Land Data Systems

A modern and sophisticated land data or cadastral system is based upon coordinate survey control monuments. From this base many benefits can follow including mapping, land data banks and computerized property registration. Many European countries have developed these

kinds of systems. In the United States, a number of small jurisdictions have modernized land data systems. Forsyth County (Winston-Salem), North Carolina has digitized by computer its land registration system.

Probably the most modern, extensive and comprehensive cadastre in North America is being developed in the Maritime Provinces of Canada. The Maritime Provinces (New Brunswick, Nova Scotia and Prince Edward Island) founded the Land Registration and Information Service in 1973 to improve their knowledge on land location, land ownership, and land characteristics. The program has four phases: 1) a monumented coordinate survey control network; 2) maps of resources, urban areas, and property; 3) redefined land titles and an improved land tenure system; and 4) a land data bank. Millions of dollars have already been put into the program. Progress has been good thus far and the program has been deemed as a success.

The potential for a modernized land data system is here today. Remonumented PLS corners could serve as a base for developing such a system. The task is expensive but it provides numerous benefits. This is the future direction of all land description systems.

IV. COST OF REMONUMENTATION

Re monumenting all the PLS corners in Minnesota would be an expensive proposition. Precise estimates are difficult to determine because of the cost variance between individual monuments, the scope of the remonumentation program, inflation, and the hidden costs of further delay.

The price tag of re-establishing a single monument varies greatly; it depends on the type of survey notes, the availability of witness testimony, and the amount of development on the landscape.

Private and county surveyors suggest a range averaging anywhere from \$200 to \$2,000 for replacing a single monument. Estimates from state officials are in the lower end of this scale with average Department of Natural Resources costs at \$100 to \$500 and average Department of Transportation costs at \$325 to \$600. The DNR has documented one project where the cost of monumenting one section of land was \$9,000. Variations also exist between different regions of the state. Many of the less developed areas in the northern part of the state have physical evidence of the monuments remaining, making replacement less expensive.

The cost of a statewide remonumentation program is dependent upon the scope of the program. The Minnesota Land Surveyors Association puts a rough estimate of \$150-\$200 million on their proposal to remonument the entire state. This would be carried out over a 20 to 30 year period with annual costs of \$8 to \$10 million. The addition of geodetic control or a land data system would boost costs even higher.

Another cost consideration is inflation. Any price estimate given in today's dollars will surely escalate over time. The cost of surveying equipment has been subject to extreme inflationary pressures over recent years.

Additional hidden costs of a noninflationary nature would be caused by further delays in implementing remonumentation. Continued neglect of monuments over the next few years will result in higher costs of relocation. The loss of established monuments and sources of evidence is bound to continue. Like inflation, these hidden costs are hard to predict.

An even more difficult cost consideration is whether or not remonumentation is worthwhile. It is difficult to say if the benefits of replacing all the PLS monuments are worth \$150-\$200 million. In terms of immediate returns it may not be, but over a long period of time perpetuated PLS corners would provide more benefits than the cost of maintenance. Other potential benefits would result from using the PLS corners as the basis of a modern land registration and data information system.

Benefit evaluation also implies that a value judgment be made on the importance of remonumentation vis-a-vis other state needs.

There have been a few cost/benefit studies of remonumentation conducted in other jurisdictions. A study of geodetic control monumentation in Monroe County (Rochester), New York found the system to be cost effective.¹ The Land Registration and Information System of the Canadian Maritime Provinces was also found to be cost-effective in many ways.² Neither of these studies will be summarized here due to space limitations. They are of limited value when compared to proposed plans for Minnesota because of different conditions in the respective geographic areas as well as major program differences. In summary, there is a lack of information on either precise costs or benefits with which to measure the cost effectiveness of a PLS remonumentation program for Minnesota.

¹Phillip C. Johnson, "A Measure of the Economic Impact of Urban Horizontal Geodetic Control Surveys," U.S. Department of Commerce, National Geodetic Survey, 1976 reprint.

²P.S. Ross and Partners, Final Report and Executive Summary, "Benefit-Cost Study of the Land Registration and Information Service Program," March, 1977.

V. ALTERNATIVE APPROACHES TO REMONUMENTATION

The Minnesota Legislature can deal with the problem of lost Public Land Survey monuments in a number of ways. Six alternative approaches to remonumentation will be discussed in this section. Three important issues must be addressed, however, before considering any of these alternatives.

The question of who is responsible for remonumenting the U.S. Public Land Survey is complicated. Since the responsibility for the PLS monuments was originally with the federal government, then the state, and finally the counties, the monuments themselves are public property and it is illegal for private parties to tamper with them. In legal and tax matters property is defined in terms of the markers. The public sector is responsible for the original placement and the continued use of the monuments.

An argument can also be made, however, that the private sector has some responsibility for the monuments. It is the private landowner in need of a survey on his land who most directly benefits from re-established monuments. Should he have to pay for their replacement?

Because one purpose of this paper is to set forth public policy options, the rest of this section will be based on the assumption that remonumentation is in the jurisdiction of the public sector.

A second issue to consider is whether remonumentation is a local or a statewide concern. How this question is answered determines which approach to remonumentation is most appropriate. It has an impact on county versus state control and on voluntary versus mandatory programs.

A final concern is the question of perpetuating the monuments if they are re-established. The current condition of the PLS monuments was caused by neglect. Unless allowances are made for maintenance, a remonumented PLS could fall into a similar state of disrepair in the future.

All of these questions must be evaluated in light of each alternative.

A. Retain Status Quo

This do-nothing approach would keep the state of Minnesota out of the monument restoration business and allow the present system to continue in operation. Recent trends indicate that more and more counties are becoming involved with remonumenting the PLS corners. This is indicated by the growing number of county surveyors and the increasing size of county survey budgets. If these trends continue, many counties will be remonumented through their own efforts. Since the counties with the most land activity are the same counties that are remonumenting the present system is working in the areas with the most immediate needs.

If the state does not become involved with remonumentation a necessary caution is that further delays will result in more lost monuments and higher relocation costs. Compared to many other states the condition of Minnesota's PLS corners is relatively good. It is difficult to assess the impact of further neglect of remonumentation. If the legislature feels that remonumentation is a worthy program, it would be opportune to act quickly.

B. Partial Remonumentation

A partial remonumentation program would provide financial relief to the counties and private citizens for their immediate

monumentation needs without placing an undue financial burden upon the state. Under this scheme, only those monuments that are actually needed for survey work would be replaced. State funds would be utilized when there were user demands from private parties and would replace moneys currently spent on remonumentation by private citizens and by counties employing a user demand system. An even more limited program could provide state financial support for remonumentation only when it is shown that costs are prohibitive to the private citizen.

A partial program of limited scope should be administered by the county commissioners. They would be in the best position to gauge county interests and the areas of greatest need. Using state remonumentation funds, they could direct their own county surveyors to conduct the necessary work.

This approach would not have any impact on perpetuating the system or on preventing the further loss of monuments. To this extent it is similar to a do-nothing approach. Many of the needed monuments that would be replaced at state expense under this option are probably already being replaced by county surveyors. This implies that the number of restored PLS corners would not increase dramatically; those that are restored will be covered at the state's expense instead of the county's.

C. Complete Remonumentation - County Supervision

A more comprehensive approach to the problem would be the total remonumentation of the state's PLS corners. A complete remonumentation program could be administered by either the counties or by the state.

In either case this slow process might resemble a partial remonumentation program in its initial stages. The progress of a total replacement program would depend upon annual funding and the available number of surveyors. Presently Minnesota has approximately 300 registered land surveyors, about 100 of whom operate private firms. The balance is made up of part-time, retired, and government-employed surveyors. Allowances for how fast surveyors would be able to work must be made if time constraints are placed on the program. Remonumentation could conceivably go on for decades without deadlines.

A complete restoration of the PLS monuments could proceed in one of two ways. A systematic approach would proceed section by section and township by township. A more productive approach would be to remonument the areas of greatest need first, such as the expanding land developments around metropolitan areas, and then proceed to areas with less immediate needs.

Under a statewide remonumentation program controlled at the county level the county commissioners would be the administrators, the county surveyors would restore the lost PLS corners, and the state would provide the funding. If one operates from the premise that remonumenting the PLS is the only goal of the program (i.e., with no intentions of setting up geodetic controls, land data systems, etc.) then county administration with state financial assistance seems to be a reasonable approach. However, if there are additional plans for utilizing the PLS monuments, county administration would create 87 different systems, each having its own standards. A state land data system would be difficult to establish without reliable and consistent statewide standards among all the counties.

Another consideration that influences the success of county supervision would be whether the program was voluntary or mandatory. Any type of a voluntary program, dependent upon either county commissioner initiatives or county matching funds, is bound to fail on a statewide basis. The counties that would participate in such a program would probably be the same counties that are presently remonumenting. There is no reason to suspect that counties which have not shown an interest in remonumentation in the past would do so under a system that did not require participation. Any legislative determination for statewide remonumentation under county supervision would require mandatory legislation and state resources. Given county financial constraints a mandatory statewide program would be successful only if adequate state funding were available.

It is appropriate at this time to comment upon H.F. 965, the remonumentation bill presented to the Minnesota House of Representatives during the 1977-78 Session. The bill called for county administration and state financing through the deed tax with each county receiving the same amount of money as it collected. This bill acknowledges the need for monumentation and provides the counties with state funds by using an equitable allocation formula. However, most of the money would go to the counties that least need it. Those counties that are in great need of monumentation would not receive enough funds to conduct an adequate program. If this bill were law, there would be very little difference between it and the present system as to which counties were or were not replacing monuments. If one wanted to replace all the PLS monuments across the entire state, each county would have to be provided an adequate amount of funding.

D. Complete Remonumentation - State Supervision

An alternative to county supervision would be state supervision. Administration and finance would be important components of such a program.

1. Administration

Statewide administration would be suited for a remonumentation program that included geodetic control or a land data system. This supervision could come from one of two sources.

One source of state supervision could be an existing agency -- either the Department of Natural Resources or the Department of Transportation. Both departments already have survey sections. The DNR has eighteen surveyors in the field while the DOT employs twenty-two surveyors. The DOT is also working with geodetic control and photogrammetry. Either department, if required to administer a statewide program, could provide uniform statewide standards with reliable centralized control. The actual relocation of PLS corners would be conducted by contracting private and county surveyors.

Another source of state control could come through the establishment of a state survey board or a state surveyor general. This kind of administration was proposed to the Minnesota Senate during the 1977-1978 Session in S.F. 820. A central authority of this order would provide the same kind of supervision as DNR or DOT. In addition, a state survey board would serve as a central location for all survey and monument records. It would also direct all surveying and mapping activities in the state to prevent overlapping and duplicative work. These activities would save the state and other parties a great deal of time and money.

It should be noted that statewide supervision would be costly. This cost must be measured against the gains in quality control and the elimination of duplicative effort. In addition, state supervision might be met by opposition from local governments.

2. Financing

Regardless of the state's administrative role, some sort of finance mechanism must be established for a public sector remonumentation program. A land oriented tax would have the closest relationship to remonumentation. Five methods of funding are outlined below.

Until about 1967 Minnesota had a state property tax. Reinstatement of such a tax on a smaller scale could be used for remonumentation, although it might be unpopular considering the public mood on taxes.

Another tax that could be used for remonumentation is the state deed transfer tax. This tax is imposed on the transfer of all land and other realty in the state. Proceeds are credited to the state's general fund. In fiscal year 1978, \$10.5 million was collected (Appendix D). Since the deed tax is based on land value its revenues increase as land values rise. Current proceeds would provide more than enough money for the annual funding of a remonumentation scheme. If the present deed tax rate were maintained and designated for remonumentation the moneys would be taken at the expense of the general fund. To retain the present level of the general revenue fund would require an increase in the deed tax rate with the additional moneys going into a special remonumentation fund.

A third type of tax that could be utilized is the state mortgage registry tax. This tax is imposed on principal debt that is secured

by any mortgage of real property in the state. The proceeds are split between the state general fund (95%) and each county's general revenue fund (5%). In fiscal year 1978, \$8.8 million was collected (Appendix D). The mortgage registry tax could be applied to remonumentation in the same manner as the deed tax.

An allocation problem arises when using either the deed or mortgage registry tax for remonumentation. The counties that generate the most revenue through these two taxes are generally the counties already remonumenting, whereas many poorly monumented counties receive small amounts from these taxes. If equity were preserved and moneys given back to the counties according to origin, remonumentation would not become a reality statewide. There is a need for some kind of formula which takes into account land area and the status of monumentation in each county. S.F. 820 contains a formula of this type that allocates deed transfer tax revenues. The inequities of such a formula could be justified by the fact that the counties with the most land have the most work to do and often have a small population and tax base. Some sort of financial consideration might also be made for those counties which had the foresight to use county funds for remonumentation prior to the start of a state program.

A fourth kind of financial mechanism would be to tax land-related documents. This idea, conceived in Missouri, places a surcharge on the filing of every land-related document. One drawback of this method is that it generates limited amounts of money; Missouri collects a \$1 fee on every document and only raises about \$280,000 per year for remonumentation.

A final method of financing would be to work through regular appropriations and the state general fund. This would give the legislature much more control over the amounts designated for monumentation than it would have over a special fund that used the ever expanding proceeds of the deed tax.

One must consider what, if any, role the counties should play in financing remonumentation. The obvious way to cut back the state's financial obligation would be to require the counties to match state funds at some specified ratio. The drawback is that it makes remonumentation permissive, so that many counties might not become involved.

E. Geodetic Control

A complete remonumentation program would probably save the state money and prevent future monument losses after implementation if the PLS markers were perpetuated. This would require the establishment of the Minnesota State Plane Coordinate System. This system would contain a set of geodetic control monuments, each of which would be defined by latitude and longitude. From the geodetic monuments each PLS corner would be assigned a coordinate value in the system. A destroyed PLS monument could be replaced with ease by using the coordinate values. The DOT is currently using geodetic control monuments in all of its highway work. If this system were expanded statewide, re-established PLS corners would never be lost again. Without geodetic control, re-established PLS monuments could within a century be in a state of disrepair similar to today's situation.

A geodetic control net is a sophisticated addition to the Public Land Survey monuments. It is also an expensive proposition. The cost could be justified in two ways. First, geodetic control would perpetuate the PLS monuments and prevent the future loss of monument positions. Second, geodetic monuments can be used for topographic and cadastral surveying and mapping.

F. Modernized Land Data System

The development of a modernized land data system would be the ultimate and most advanced by-product of remonumenting the Public Land Survey. Only after the PLS corners are re-established with geodetic control can the system be utilized for other purposes. These spin-offs include precision mapping, photogrammetry, computerized land registration systems, digitized land data information banks, and much more. All of these programs would be referenced to a network of coordinated and perpetuated PLS corners.

Such programs would be expensive, but would also have the greatest potential for beneficial returns. The cost-benefit ratio of a modern land data registration and information system would greatly exceed the benefits stemming from just re-establishing the PLS corners and doing nothing further. These additional tasks would not have to be completed right away, nor would they have to be included in a PLS remonumentation program. They are best described as potential by-products made possible by remonumentation.

Perhaps all of the activities described above sound extravagant. However, a former head of the National Geodetic Survey maintains that a statewide PLS remonumentation program in itself is a waste of time and money without the prospect of doing something more than

placing stones in the ground. Modernized land data systems are already coming into use. Future trends in land description are undoubtedly pointed in this direction. It is in this area that the greatest benefits from re-established PLS corner monuments can be derived.

Conclusion

This paper has outlined the problem of lost Public Land Survey monuments and has presented alternatives for re-establishing these positions. No final conclusions will be presented here because some extremely important questions have yet to be answered.

There is no quantification as to the monetary losses that result directly from missing monuments. The precise cost of a complete remonumentation program is unknown. Therefore, it is difficult to say if remonumentation is a worthwhile project for the state of Minnesota. A cost/benefit analysis of remonumentation would prove to be instructive. More could also be learned as to the potential uses and benefits of a land data information system based upon PLS monuments.

Given these unknowns, the Minnesota Legislature should consider further study of the alternatives. Some type of a pilot project would provide useful information on the costs and merits of remonumentation. Appropriate groups to involve in such a study would include the University of Minnesota's Department of Civil Engineering and the Minnesota Land Surveyors Association. A study that asked the right questions would provide the answers necessary for an objective evaluation of remonumentation.

APPENDIX A

"A Brief History of the Public Land
Survey and Monumentation"¹

The United States Public Land Survey was utilized to divide and distribute all the land that makes up present day Minnesota. The physical evidence of this survey consists of marked positions on the land called monuments. They define every piece of property in the state and serve as reference points for all survey work. Many of these monuments are no longer in place. A discussion of the need for remonumentation programs requires an understanding of how and why the monuments were originally set.

The federal government became interested in surveying undeveloped lands west of the Appalachian Crest after the Revolutionary War. Thomas Jefferson headed a committee to propose legislation on this subject in 1784. Their ideas were revised in 1785 by a new committee headed by William Grayson of Virginia. This committee's work was passed into law as the Land Ordinance of 1785. The Ordinance outlined a rectangular system of surveying which became the basis of the Public Land Survey (PLS). The PLS, first applied to the territory northwest of the Ohio River, eventually covered the western two-thirds of the country, including Minnesota.

The Public Land Survey was unique in providing an organized and definable system of land description. It laid out rows of townships

¹See William D. Pattison, Beginnings of the American Rectangular Land Survey System, 1784-1800, (Chicago, 1957), for an early history of the PLS. For a discussion of the implementation of the survey and its cultural influence upon the Upper Midwest, see Hildegard Binder Johnson, Order Upon the Land, (New York, 1976).

and ranges oriented along north-south and east-west lines. Each township was six miles square and contained thirty-six sections of one mile square. Surveyors marked off positions on the land by placing eight monuments around each section -- one on each corner (section corners) and one on the mid-points of the four outside lines (quarter corners). This made it easy to locate any given parcel of land.

The original survey was monumented with local materials. In Minnesota wooden stakes were used in the timbered areas and earthen mounds were placed on the prairies. Re-established monuments today use more permanent materials such as casted metals, concrete posts, and iron pipes.

The Public Land surveys were conducted before an area was opened for settlement and land sales; they were, therefore, done as quickly as possible. Measured by today's standards, it was a low accuracy survey. However, since a government survey rule stated that the placement of a monument represented the correct position for the corner, despite its errors, the system succeeded in minimizing boundary disputes. That is why these monuments are still important today. All property boundaries are based upon the physical location of a monument.

The original survey was made by the federal government at its own expense. In Minnesota, the PLS was completed during a 60-year period (1847-1907) and left behind over 310,000 monuments. Upon its completion all the records and archives related to the Minnesota survey were transferred from the U.S. General Land Office to the Minnesota Secretary of State (M.S. 5.03). After that the perpetuation

of the monuments became a state responsibility. The state in turn passed the responsibility of preserving and re-establishing these monuments to the counties (M.S. 381.12). This same provision allowed the counties to levy a tax to finance remonumentation. Time has shown, however, that both interest and ability to remonument the PLS varies greatly from county to county. Today the condition of PLS monuments in Minnesota differs widely among counties.

Despite the loss of many monuments, the impact of the Public Land Survey remains with us today. It is an historical legacy that helped shape the pattern of settlement and the look of the landscape of rural America. Rural roads were placed along section lines. Many towns were laid out in rectangular grid patterns oriented to the survey. Farmers still measure their landholdings by "quarters" or "quarter-quarters". An airplane flight over the Midwest reveals rectangular fields, a reflection of the influence of the Public Land Survey.

APPENDIX B

"Interest Group Perceptions
on the Need for Remonumentation"

The following list includes the names of all the agencies, organizations, and interest groups that were contacted in person or by phone in the course of this research. A short statement of the group's view on the need for remonumenting Public Land Survey corners is also given. Organizations contacted included representatives of the surveying community; national, state and county groups; and private parties.

I. Surveyors

American Congress on Surveying and Mapping

Minnesota Land Surveyors Association (Various members were contacted including many county surveyors.)

Surveyors from other states (Arkansas, Florida, Indiana, Missouri, and Wisconsin)

Every surveyor I contacted was in favor of remonumentation.

II. National

National Conference of State Legislatures

NCSL has not addressed the problem of lost monuments. The people contacted did not recollect ever receiving any request on the subject.

National Geodetic Survey, National Oceanic and Atmospheric Administration, U.S. Department of Commerce

NGS strongly supports remonumentation of the PLS, establishment of geodetic control monuments, and modernization of land data systems.

Soil Conservation Service, U.S. Department of Agriculture

Remonumentation would prove useful in SCS fieldwork.

III. Minnesota

Department of Natural Resources

The DNR supports remonumentation. It would help DNR's land acquisition and forestry division activities.

Department of Transportation

The DOT also supports remonumentation. This would assist the Department with its road construction work. DOT favors geodetic control, too.

Minnesota Historical Society

The MHS does not utilize PLS markers in its fieldwork activities.

State Planning Agency

The SPA is involved with CURA in the Minnesota Land Management Information System. This land data bank is based on 40 acre PLS parcels, but does not require the precise data that a remonumented PLS system would provide.

University of Minnesota, Center for Urban and Regional Affairs

CURA's work with land base information systems does not require the precise detail of PLS monumentation.

University of Minnesota, Professor Jesse Fant, Department of Civil Engineering and consultant to Mn/DOT

Professor Fant stresses the need for remonumenting the PLS with strict standards utilizing the state plane coordinate system and geodetic control. He is also interested in setting up a land data bank system. Fant would like to study the potential advantages of such a system.

IV. County

Association of Minnesota Counties

The Association passed a resolution supporting a remonumentation program funded by the state deed tax (November, 1978). Support was not unanimous and most counties opposed any type of supervision from the DOT.

County Commissioners

The MLSA has resolutions supporting remonumentation from about 25 counties.

Minnesota Association of County Officers

The Association has not taken a stand on remonumentation. They are concerned, however, about the fairness of a system using the deed tax.

V. Private

Dayton-Hudson Properties

This company was contacted to represent the views of a major land developer. They favored remonumentation and geodetic control monuments.

Minnesota Farm Bureau Federation

Delegates to the 1977 Farm Bureau meeting passed a resolution supporting county remonumentation financed by fees assessed for recording deeds.

Minnesota Association of Realtors

This association has not taken a position on remonumentation. They are opposed, however, to doubling the rate of the state deed tax.

Minnesota Bar Association

The State Bar was unable to quantify the amount of boundary litigation conducted in Minnesota.

APPENDIX C

"Condition of PLS Monuments, Remonumentation Programs,
and County Surveyors in Minnesota by County"

County	Total Gov't Corners ¹	Existing Monuments ¹	Monument Positions With Some Records ¹	Monument Positions With No Records ¹	Status of Remonumentation 1970 ²	Status of County Surveyor 1975 ³	1975 Surveying Budget ⁴
Aitkin	6,000	200	800	5,000	None	P-R	?
Anoka	1,585	1,426	159	0	Act.S	F-R	?
Becker	8,000	80	1,920	6,000	None ⁵	P-R	\$ 4,000
Beltrami	25,544	819	23,725	1,000	None ⁵	P-R	32,300
Benton	1,308	65	130	1,113	None	P-R	0
Big Stone	1,619	100	100	1,419	None	0	0
Blue Earth	2,433	730	100	1,603	None	0	0
Brown	1,990	60	1,309	621	Act.T	P-R	13,185
Carlton	8,000	390	1,710	900	Act.T	P-R	18,500
Carver	1,367	793	82	492	Act.S	P-R	61,000
Cass	6,750	1,687	2,700	2,363	None	0	0
Chippewa	2,600	600	500	1,500	None	P-R	?
Chisago	1,500	600	0	900	Act.T	P-R	20,000
Clay	3,292	987	500	1,805	None ⁵	P-R	Fee Basis
Clearwater	3,294	200	1,300	1,794	None	0	0
Cook	6,431	1,800	431	4,200	None	P-R	0
Cottonwood	2,053	1,480	420	153	None	0	0
Crow Wing	4,200	800	1,900	1,500	None	P-R	?
Dakota	2,200	990	660	550	Act.S	F-R	145,000
Dodge	1,381	138	690	553	None	P-R	?
Douglas	2,330	466	932	932	Act.S	P-R	7,000
Faribault	2,270	681	681	908	None	P-R	0
Fillmore	2,713	217	1,004	1,492	None ⁵	F-R	64,500
Freeborn	2,269	567	794	908	None	0	0
Goodhue	2,300	345	230	1,725	Act.T	P-R	0
Grant	1,874	69	987	818	None	0	0
Hennepin	2,500	2,500	0	0	Act.S	F-R	520,000
Houston	1,775	0	0	1,775	None	0	0
Hubbard	5,550	220	1,155	4,125	None	P-R	?
Isanti	1,461	460	551	450	Act.T	P-R	10,500
Itasca	13,000	10,000	2,500	500	Act.S	F-R	60,000
Jackson	2,269	1,450	600	219	None	0	0

County	Total Gov't Corners ¹	Existing Monuments ¹	Monument Positions With Some Records ¹	Monument Positions With No Records ¹	Status of Remonumentation 1970 ²	Status of County Surveyor 1975 ³	1975 Surveying Budget ⁴
Kanabec	1,725	345	515	865	None ⁵	P-R	\$ 13,000
Kandiyohi	2,600	650	200	1,750	Act.T	P-R	?
Kittson	3,499	0	0	3,499	None	0	0
Koochiching	10,300	4,000	5,785	515	Act.T	0	8,700
Lac Qui Parle	2,592	1,200	600	792	None	0	0
Lake	9,037	200	800	8,037	Act.T	0	0
Lake of the Woods	4,334	0	0	4,334	None	0	0
LeSueur	1,522	457	456	609	None	P-N	0
Lincoln	1,766	450	150	1,166	None	0	0
Lyon	2,269	454	1,361	454	Act.T	P-R	0
McLeod	1,650	907	413	330	Act.S	P-R	20,000
Mahnomen	1,825	0	0	1,825	None	P-N	0
Marshall	6,129	20	0	6,109	None	0	0
Martin	2,255	23	1,623	609	None	P-R	0
Meeker	2,600	200	840	1,560	None	P-R	?
Mille Lacs	2,100	210	840	1,050	Act.T	P-R	0
Morrison	3,600	118	200	3,282	None	0	0
Mower	2,231	446	670	1,115	None	0	0
Murray	2,269	850	850	569	None	0	0
Nicollet	2,000	400	1,200	400	Act.S	P-R	4,000
Nobles	2,269	1,450	419	400	None	0	0
Norman	2,700	120	580	2,000	None	0	0
Olmsted	2,116	1,291	508	317	Act.S	F-R	61,710
Otter Tail	10,000	1,193	544	8,263	None ⁵	P-R	10,000
Pennington	1,962	0	0	1,962	None	P-N	0
Pine	4,700	470	940	3,290	None ⁵	P-R	8,000
Pipestone	1,525	785	115	625	None ⁵	0	0
Polk	4,500	0	0	4,500	None	P-R	0
Pope	5,200	1,040	0	4,160	None	P-N	0
Ramsey	735	660	25	50	None ⁵	0	60,000
Red Lake	1,600	26	400	1,174	None	0	0
Redwood	2,734	200	100	2,434	None	0	0
Renville	3,120	950	1,000	1,170	None	0	0
Rice	2,000	1,300	0	700	Act.R	P-R	24,000
Rock	1,579	179	0	1,400	None	0	0
Roseau	6,480	0	0	6,480	None	P-N	0
St. Louis	25,000	11,250	7,500	6,250	Act.S	F-R	88,200
Scott	1,235	741	247	247	None ⁵	F-R	33,008
Sherburne	1,450	870	160	420	Act.T	P-R	51,009
Sibley	2,000	200	400	1,400	None	P-R	10,000

County	Total Gov't Corners ¹	Existing Monuments ¹	Monument Positions With Some Records ¹	Monument Positions With No Records ¹	Status of Remonumentation 1970 ²	Status of County Surveyor 1975 ³	1975 Surveying Budget ⁴
Stearns	5,500	1,815	1,210	2,475	None ⁵	F-R	\$ 93,000
Steele	1,409	268	436	705	Act.R	P-R	10,000
Stevens	1,874	50	124	1,700	None	0	0
Swift	2,561	100	461	1,900	None	0	0
Todd	3,181	64	572	2,545	None ⁵	P-R	4,000
Traverse	1,659	206	203	1,250	None	0	0
Wabasha	1,671	167	417	1,087	None	P-R	0
Wadena	3,000	30	0	2,970	None	P-R	0
Waseca	1,360	136	200	1,024	None	0	0
Washington	1,600	880	320	400	Act.R	F-R	130,000
Watonwan	1,418	400	400	618	None	0	0
Wilkin	2,417	167	200	2,050	None	0	0
Winona	2,100	840	0	1,260	None	0	0
Wright	2,415	851	1,464	100	None ⁵	F-R	?
Yellow Medicine	2,400	332	262	1,806	None	0	0
State Totals	310,481	70,881	84,280	155,320			

¹Minnesota Land Surveyors Association, County Surveyor's Subcommittee Report on Remonumentation Program and State Land Survey Authority, 1975. These figures are based on a questionnaire sent to each county surveyor during 1975.

²Jesse E. Fant and William A. Maher, Platting and County Survey Records in Minnesota, Department of Civil Engineering, University of Minnesota, (Minneapolis, 1970). This column reflects the status of remonumentation programs in Minnesota counties. "None" means no program and "act" means active. The letters R, S, T designate the type of program: R for request (monuments replaced by need), S for systematic (program to replace all corners), T for token (requires a sum of money be paid to either the County Surveyor or a private surveyor).

³County Surveyors Report, 1975. The status of the County Surveyor position is indicated by: F-R, full time registered land surveyor; P-R, part time registered land surveyor; P-N, part time non-registered surveyor; and 0, no county surveyor.

⁴County Surveyors Report, 1975.

⁵The County Surveyors Report indicates that by 1975, these counties had a remonumentation program.

APPENDIX D

"Selected County Statistics on Population,
Area, and Taxes"

County	Population 1970 ¹	Land Area (Acres) ¹	Assessed Real Property Value 1976 ²	Deed Transfer Tax 1977 ³	Mortgage Registry Tax 1977 ⁴
Aitkin	11,403	1,164,502	\$ 38,497,229	\$ 33,996	\$ 29,958
Anoka	154,401	273,736	589,966,218	481,527	368,014
Becker	24,372	837,689	60,593,572	49,458	44,131
Beltrami	26,373	1,608,519	39,250,982	45,641	42,189
Benton	20,841	257,799	51,471,506	32,326	33,444
Big Stone	7,941	316,501	24,438,999	8,735	9,541
Blue Earth	52,322	477,159	178,767,404	94,527	81,279
Brown	28,887	387,267	103,727,570	50,780	35,969
Carlton	28,072	550,092	73,697,088	35,957	38,919
Carver	28,331	226,811	107,471,345	102,478	73,330
Cass	17,323	1,302,315	53,286,027	50,083	35,535
Chippewa	15,109	370,270	49,663,739	25,010	21,231
Chisago	17,492	269,370	58,836,219	54,345	46,632
Clay	46,608	668,118	120,889,445	106,776	97,302
Clearwater	8,013	640,689	19,849,293	12,336	8,565
Cook	3,423	936,427	16,137,932	8,796	4,979
Cottonwood	14,887	407,635	67,989,808	30,012	20,327
Crow Wing	34,826	649,083	126,493,398	96,169	72,262
Dakota	139,808	365,191	675,882,223	551,270	436,
Dodge	13,037	280,639	46,628,397	42,464	35,410
Douglas	22,910	401,477	68,979,949	70,043	61,405
Faribault	20,896	454,724	89,275,959	44,530	26,118
Fillmore	21,916	553,101	66,856,018	37,978	34,850
Freeborn	38,064	449,242	137,015,257	82,979	59,437
Goodhue	34,804	491,466	246,851,320	81,533	66,877
Grant	7,462	348,226	28,225,116	12,089	9,784
Hennepin	960,080	354,225	4,159,223,944	1,232,757	2,166,524
Houston	17,643	364,080	40,309,184	33,222	26,529
Hubbard	10,583	596,329	32,552,352	29,704	25,454
Isanti	16,500	281,303	50,222,453	42,305	32,961
Itasca	35,530	1,729,322	136,091,500	64,671	81,801
Jackson	14,352	446,068	75,336,311	26,793	16,179
Kanabec	9,775	337,536	21,760,205	18,297	15,871
Kandiyohi	30,548	497,293	99,621,307	79,569	62,200
Kittson	6,853	700,373	29,841,135	11,979	13,382
Koochiching	17,130	1,989,189	35,397,431	21,745	27,031
Lac qui Parle	11,164	492,699	47,076,578	15,622	15,951
Lake	13,351	1,367,808	26,184,374	20,715	12,451
Lake of the Woods	3,987	833,822	6,449,323	5,539	5,878
Le Sueur	21,332	283,693	64,348,341	44,747	46,971
Lincoln	8,143	334,365	29,346,981	14,714	12,161
Lyon	24,273	453,073	80,870,527	42,054	39,771
McLeod	27,662	311,489	89,972,304	54,005	44,033
Mahnomen	5,638	360,983	12,928,075	4,991	4,033
Marshall	13,060	1,142,622	39,383,486	16,659	16,729
Martin	24,316	450,521	112,207,994	57,001	49,475

County	Population 1970 ¹	Land Area (Acres) ¹	Assessed Real Property Value 1976 ²	Deed Transfer Tax 1977 ³	Mortgage Registry Tax 1977 ⁴
Meeker	18,349	382,892	\$ 59,753,825	\$ 37,783	\$ 22,701
Mille Lacs	15,703	365,473	40,410,200	27,669	24,684
Morrison	26,949	719,593	57,636,115	47,045	37,426
Mower	44,919	453,205	137,272,788	78,520	45,898
Murray	12,508	444,657	54,884,408	24,020	16,907
Nicollet	24,518	280,866	79,142,385	53,952	44,088
Nobles	23,208	454,877	83,310,794	49,258	33,662
Norman	10,008	558,689	38,225,665	13,958	13,561
Olmsted	84,104	422,400	319,590,049	374,056	340,853
Otter Tail	46,097	1,267,003	129,658,100	90,499	92,679
Pennington	13,266	391,606	28,171,841	24,336	22,246
Pine	16,821	906,367	35,998,842	26,738	21,765
Pipestone	12,791	296,888	39,935,855	20,834	14,442
Polk	34,435	1,260,513	108,461,796	63,618	74,239
Pope	11,107	426,102	31,730,883	23,754	19,484
Ramsey	476,255	101,032	1,495,843,084	444,220	666,125
Red Lake	5,388	274,619	10,929,595	9,052	7,568
Redwood	20,204	557,475	92,971,412	32,645	23,088
Renville	21,139	621,130	102,723,329	29,906	31,154
Rice	41,582	319,163	115,434,739	88,848	79,516
Rock	11,346	307,716	49,068,043	20,736	15,630
Roseau	11,569	1,073,345	19,434,392	15,453	20,631
St. Louis	220,693	4,043,532	473,806,540	303,808	258,617
Scott	32,423	225,901	137,527,939	110,723	100,714
Sherburne	18,344	280,525	106,868,871	66,083	58,185
Sibley	15,845	372,901	60,834,777	23,462	25,718
Stearns	95,400	864,522	250,457,969	188,161	159,054
Steele	26,931	273,455	94,883,300	79,070	53,351
Stevens	11,218	355,336	36,914,626	18,561	15,149
Swift	13,177	475,593	41,689,183	19,276	16,129
Todd	22,114	604,287	38,547,503	35,015	34,142
Traverse	6,254	363,463	27,576,213	10,286	4,368
Wabasha	17,224	344,324	48,518,214	34,395	33,205
Wadena	12,412	341,127	20,814,667	17,916	16,705
Waseca	16,663	268,159	68,244,869	45,040	37,186
Washington	82,906	254,869	354,210,717	195,484	237,901
Watonwan	13,298	277,152	53,508,290	24,130	17,564
Wilkin	9,389	476,389	38,546,068	17,238	17,667
Winona	44,409	406,320	117,298,856	84,338	75,685
Wright	38,933	424,388	162,858,696	118,738	100,187
Yellow Medicine	14,523	481,687	57,882,184	23,660	17,343
State Totals			\$13,631,443,220	\$7,091,208	\$7,456,885

¹1970 Population and Land Area, Minnesota Legislative Manual, 1977-78.

²Assessed Real Property Value, (1976 assessments, taxes payable 1977), Property Taxes Levied in Minnesota, Property Tax Bulletin No. 6, Minnesota Department of Revenue.

³Deed Transfer Tax (year ending 12-31-77), Minnesota Department of Revenue, Special Taxes Division.

⁴Mortgage Registry Tax (year ending 10-31-77), Minnesota Department of Revenue, Special Taxes Division.

MINNESOTA HOUSE OF REPRESENTATIVES

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