

A LAND INFORMATION SYSTEM PLAN FOR WALWORTH COUNTY

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**COMMUNITY ASSISTANCE PLANNING REPORT
NUMBER 139**

A LAND INFORMATION SYSTEM PLAN FOR WALWORTH COUNTY

Prepared by the
Southeastern Wisconsin Regional Planning Commission
P. O. Box 1607
Old Courthouse
916 N. East Avenue
Waukesha, Wisconsin 53187-1607

September 1991

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September 6, 1991

Mr. George S. Lauderdale, Chairman, and
Members of the Walworth County
Board of Supervisors
Walworth County Courthouse
Elkhorn, Wisconsin 53121

Dear Chairman and Members of the County Board:

On September 12, 1989, the Walworth County Board of Supervisors created a Land Information Office pursuant to Section 59.88 of the Wisconsin Statutes. Subsequently, the County Board created a Land Information Committee to provide policy oversight for that Office, and designated the County Register of Deeds as the official contact person for the Office. On July 10, 1990, the Board requested that the Regional Planning Commission provide staff support to the Land Information Office in the preparation of a countywide plan for land records modernization. This report sets forth that plan as developed by the Land Information Committee in consultation with the local units of government and private utilities serving Walworth County and with the assistance of the Regional Planning Commission.

After careful review of pertinent information, the Land Information Committee concluded that a modernized land records system in Walworth County could best be created by providing a single automated mapping base for the entire County. This single mapping base would be prepared to a set of specifications sufficient to meet the most stringent of accuracy and map feature content requirements of all users concerned. Each organization, including Walworth County, intending to use the automated base would provide its own operating environment in terms of computer hardware, software, and supporting staff. Only the computerized maps and common parcel identification system would be shared. With the use of a shared automated mapping base in such a decentralized land information system, it would be possible for individual local units of government and utilities to proceed at their own pace in establishing an automated land information system, preserving, however, the capability for the ready exchange of data among the decentralized data banks that ultimately would be established.

The Land Information Committee recognized that it will take many years to develop the recommended common automated mapping base. Over the next six years, the Committee recommended that, at a minimum, Walworth County expend \$100,000 annually in work efforts to complete the geodetic reference framework, focusing those efforts on the southern one-half of the County where urban development pressures are the greatest. About one-half of the required revenue could be expected to come from the new Register of Deeds recording and filing fees authorized under state law; the remaining one-half would be drawn from the existing Walworth County Highway Department budget made available to the County Surveyor for remonumentation activities. The Committee also recommended that Walworth County seek a \$100,000 grant annually from the Wisconsin Land Information Board, using whatever monies the County may be able to obtain in this way toward accelerating completion of the geodetic reference framework. Thus, the plan recommends that all available monies during the next six years be focused on efforts to continue remonumentation of the U. S. Public Land Survey corners in the County and to establish State Plane Coordinates and elevations on such corners. The plan further encourages those local units of government in the County that may desire to accelerate the completion of an automated mapping base for a portion of the County to do so, but in a manner consistent with the standards and specifications for automated base mapping set forth in the plan.

In addition to continuing to build an automated mapping base, the Committee recommends that the County Board authorize the creation of an automated tract index and, further, that the existing county parcel identification system be converted to the standard parcel identification system recommended by the Wisconsin Land Information Board. The automated tract index would be a "day forward" system, being usable immediately upon the coding of the first document, but with the utility of the tract index significantly increasing with the passage of time and the coding of additional documents. Such an index may be expected to have significant benefits in terms of shortening the amount of time required to research questions attendant to ownership of and interest in land. The establishment of the automated tract index and the conversion to a new parcel identification system can be expected to be accomplished by existing Walworth County forces without any increased costs.

On September 5, 1991, the Land Information Committee acted unanimously to adopt the six-year plan set forth herein and to recommend adoption of the plan and its implementation to the County Board. The Committee further unanimously recommended that the plan be submitted by the County to the Wisconsin Land Information Board for endorsement in order to qualify the County and the local units of government in the County for grants from the State in support of the recommended plan implementation work.

Sincerely,



Kurt W. Bauer
Executive Director

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Chapter I

INTRODUCTION

BACKGROUND

On July 10, 1990, the Walworth County Board of Supervisors adopted a resolution asking the Southeastern Wisconsin Regional Planning Commission to help Walworth County prepare a plan for land records modernization, focusing on the development of an automated mapping and parcel-based land information system. A copy of the resolution is reproduced in Appendix A. This initiative by the County Board was a direct result of the establishment of the Wisconsin Land Information Program under 1989 Wisconsin Act 31 as amended by 1989 Wisconsin Act 339. The resultant plan is documented in this report.

LAND INFORMATION OFFICE

Under the Wisconsin Land Information Program, counties are encouraged to establish a Land Information Office. A Walworth County Land Information Office designation was initially made by the County Board on September 12, 1989. That designation was revised on May 15, 1990, to broaden the composition of the Committee which, in effect, comprises the Land Information Office (see resolution reproduced in Appendix B). As revised, the policy making body for the Land Information Office consists of a Committee comprised of the Chairman of the County Park and Planning Commission, the Chairman of the County Land Conservation Committee, the Chairman of the County Judicial Committee, the Chairman of the County Executive Committee, the Chairman of the County Data Committee, the Vice-Chairman of the County Board, the Register of Deeds, the County Surveyor, and the County Data Manager.

Acting on behalf of the Land Information Office, the Land Information Committee on August 9, 1990, designated the County Register of Deeds as the official contact person for the County Land Information Office. The present Register of Deeds is:

Ms. Lois M. Ketterhagen
Walworth County Courthouse
Elkhorn, Wisconsin 53121
(414) 741-4214

PURPOSE OF THE REPORT

The basic purpose of this report is to document a Walworth County land information system plan, with emphasis on the need for the development of an automated mapping and parcel-based land information system for the County. The report is intended to provide sufficient information to permit the Walworth County Board of Supervisors, the affected Walworth County departments, the concerned local units of government in the County, and the public and private utilities operating within the County to consider the need for such a system and to determine the desirability of proceeding with the creation of such a system. To this end, the report is intended to accomplish the following purposes:

1. To provide county and local officials, utility managers, and concerned citizens with a basic understanding of the components of an automated mapping and land information system and the manner in which these components must be assembled to provide a conceptually and technically sound operational system.
2. To identify and briefly describe existing automated mapping and land information systems whose operation pertains to all or portions of Walworth County.
3. To propose an organizational arrangement for the development of an automated mapping and land information system for Walworth County.
4. To identify those technical issues which, in the case of a shared, multi-user, automated mapping and parcel-based land information system, would need to be resolved before a shared system could be developed.
5. To identify the steps needed to implement an automated mapping and parcel-based land information system for Walworth County.
6. To recommend a course of action.

In addition to meeting the needs of Walworth County, the local municipalities in Walworth

County, and the public and private utilities operating in Walworth County, it is intended that the land information system plan set forth herein meet the requirements of the Wisconsin Land Information Program. Toward this end, it is recommended that, upon approval of the plan by the Walworth County Board of Supervisors, Walworth County seek approval of the plan by the Wisconsin Land Information Board.

LOCAL GOVERNMENT AND PRIVATE SECTOR INVOLVEMENT

In order to provide for the widest possible participation in the preparation of the Walworth County land information system plan, the Land Information Committee invited each city, village, and town in Walworth County and each public and private utility serving Walworth County to participate in the planning process. Each of the local governments and utilities that indicated a desire to so participate was provided with copies of the draft materials that were produced, was notified of the meetings of the

Land Information Committee at which preparation of the plan was to be considered, and was invited to participate directly in those meetings by providing comments to the Committee on the material and proposals set forth in the plan. Those local units of government and utilities which chose to so participate in the plan-making process were as follows:

Local Units of Government

- Cities of Elhorn, Delavan, Lake Geneva, and Whitewater
- Villages of Darien and Williams Bay
- Towns of Bloomfield, Darien, East Troy, LaFayette, LaGrange, Lyons, Spring Prairie, and Troy

Utilities

- Wisconsin Electric Power Company
- Wisconsin Power and Light Company
- Elkhorn Light Commission
- Wisconsin Southern Gas Company
- Wisconsin Natural Gas Company
- Wisconsin Bell
- State Long Distance Telephone Company
- Sharon Telephone Company

Chapter II

AUTOMATED MAPPING AND LAND INFORMATION SYSTEMS: AN OVERVIEW

INTRODUCTION

For over a decade, there has been growing interest in the United States in land information systems. This interest ranges from a relatively narrow concern about the need to modernize land title recordation systems to a relatively broad concern about the need to create entirely new land-related data banks for multipurpose applications. This growing interest has involved practitioners of many disciplines, ranging from surveyors, abstractors, assessors, and attorneys concerned with the fiscal and legal administration of real property to planners, engineers, public utility managers, public administrators, and elected officials concerned with resource management and community development. Much of the interest was initially centered on the use of electronic computers for the storage, manipulation, and retrieval of land-related information and, more recently, for the use of computer-assisted graphics collection and display hardware for the reproduction of the data in mapped as well as tabular form.

As interest in the area of land data systems has grown, the topic has become increasingly prominent as a subject of professional papers, reports, conferences, and the meeting programs of various professional organizations. Accordingly, a body of professional literature on the subject of automated mapping and land information systems has begun to coalesce and accumulate. During this same period, an increasing number of local units of government and private utilities have undertaken the creation of automated mapping and land information systems, including systems that currently cover all or parts of Walworth County. This chapter presents a summary of pertinent literature on automated mapping and land information systems and identifies and briefly describes currently operating automated mapping and land information systems which pertain to all or portions of Walworth County.

NATIONAL RESEARCH COUNCIL STUDIES

In 1979, the National Research Council convened a Panel on a Multipurpose Cadastre to review the status of cadastral activities at the federal, state, and local governmental levels and

in the private sector and to review a number of demonstration projects already undertaken at various locations. The Council was responding to the growing interest in land data systems and to the perceived increasing need for land-related information by all levels of government and by the private sector. In 1980, a report was issued, the principal finding of which was that:

There is a critical need for a better land-information system in the United States to improve land-conveyance procedures, furnish a basis for equitable taxation, and provide much needed information for resource management and environmental planning.¹

The report set forth the concept of the multipurpose cadastre as a basis for a dynamic public process that could effectively collect, maintain, and disseminate land-related information. It identified the land resource-related problems faced by public and private organizations and outlined the basic structure of a multipurpose cadastre to help to remedy those problems. However, the report did not address how governments, especially local governments, could carry out the recommendations made in the report.

To address the questions left unanswered by its 1980 report, the National Research Council prepared a second report, which set forth a set of recommended procedures and standards for the design and implementation of a multipurpose cadastre.² It was the intent of this report to assist the local units of government wishing to pursue the development of cadastral records

¹*National Research Council, Assembly of Mathematical and Physical Sciences, Committee on Geodesy, Panel on a Multipurpose Cadastre, Need for a Multipurpose Cadastre, National Academy Press, Washington, D. C., 1980.*

²*National Research Council, Assembly of Mathematical and Physical Sciences, Committee on Geodesy, Panel on a Multipurpose Cadastre, Procedures and Standards for a Multipurpose Cadastre, National Academy Press, Washington, D. C., 1983.*

systems for their own jurisdictions and also the many other regional, state, and federal agencies and private businesses whose participation will be needed for the development, over time, of true multipurpose land information systems.

The procedural model put forth by the Panel identified the basic components of a modern land information system as: 1) a spatial reference framework consisting of monumented geometric control points; 2) a series of accurate, large-scale topographic base maps; 3) a cadastral overlay to the base maps that delineates all cadastral, that is, real property ownership, parcels; 4) a cadastral parcel numbering scheme that provides for unique identification of each cadastral parcel; and 5) a series of compatible registers of interests in, and data about, the land parcels keyed to the parcel identifier. It is important to note, in this regard, that the creation of such land information systems requires as a foundation a means of spatial reference for the data. An adequate geometric framework for such spatial reference must, if it is to serve even the narrowest purposes of a land information system, permit identification of land areas by coordinates down to the individual ownership parcel level. A geometric framework of adequate accuracy and precision to permit system operation at the highly disaggregated parcel level is the most demanding specification possible, but, once achieved, permits ready aggregation, as may be necessary, of information from the more intensive and detailed level to the more extensive and general level.

The local mapping and survey control network recommended by the Southeastern Wisconsin Regional Planning Commission since 1964, described in greater detail in Chapter III of this report, provides two of the five basic components of a modern land information system as set forth by the Panel, namely: 1) the required spatial reference framework, and 2) the required accurate large-scale topographic base maps; and facilitates the creation of the third component, a cadastral map overlay. The spatial reference framework is provided by the relocation, monumentation, and placement on the State Plane Coordinate System of the U. S. Public Land Survey corners. The Commission-recommended topographic maps provide the base maps specified by the Panel. In addition, by placing the U. S. Public Land Survey corners on the State Plane Coordinate System, the Commission-

recommended system provides the basis for the ready and economical preparation of accurate cadastral, that is, real property boundary line, overlays to the topographic base maps, since all real property boundary descriptions in Wisconsin are, by law, tied to these corners. Less obvious, but of equal importance, is the fact that the Commission-recommended survey control network ties these real property boundary descriptions to the State Plane Coordinate System and, in turn, to latitude and longitude, thereby facilitating the precise correlation of real property boundary lines and earth science data, a necessary precondition to the creation of a modern, automated, land information system.

It is important to note in this regard that the Commission-recommended local mapping and survey control network program was one of a select few local land information system modernization efforts described by the Panel in its reports, and therefore put forth as a system for emulation across the nation. It is also important to note, particularly within the context of the development of this report, that both National Research Council reports determined that for much of the United States the county presented the most logical locus for the development of multipurpose land information systems.

WISCONSIN LAND RECORDS COMMITTEE

Within Wisconsin there has also been growing interest in land information systems and land records modernization. In 1985, then-Governor Anthony Earl appointed the Wisconsin Land Records Committee, a group representing state, regional, and local governmental interests, private utilities, and other private businesses that utilize local maps and land records. Over a period of two years, this group issued 13 reports on various aspects of automated mapping and land records modernization, and a final report that summarized the more important findings of the Committee's deliberations.³

³*Wisconsin Land Records Committee, Final Report of the Wisconsin Land Records Committee, Modernizing Wisconsin's Land Records, University of Wisconsin-Madison, Center for Land Information Studies, Madison, Wisconsin, 1987.*

Like the National Research Council Panel, the Wisconsin Land Records Committee determined a need for continued efforts directed toward land records modernization and recognized the contribution that could be made by computer technology in certain aspects of this modernization process. The Committee determined that the costs to develop modernized land records systems would not be trivial, but that these costs would be reasonable, nonetheless, in view of the sums already being expended for current outdated and inefficient land information management practices. The Committee recognized, correctly, that the ultimate costs of land records modernization would be borne by citizens in the form of tax bills and utility bills and accordingly recommended that various levels of government, private utilities, and other private businesses involved in the use of land information make every effort to develop, and use jointly, automated systems to minimize their total societal costs.

The Committee recognized that its recommendation for the development of shared approaches to land information systems modernization would create new organizational and institutional strains that would be as demanding in their solutions as the technical issues involved in the creation of new, automated land information systems. The Committee accordingly recommended that the educational and coordinative aspects of land records modernization receive as much attention as the technical issues.

The deliberations of the Committee and its published reports reaffirmed the validity of the procedural model advanced by the National Research Council Panel for the development of modern, automated, land information systems and, as did the National Research Council reports, highlighted the Commission-recommended local mapping and survey control network program as a basis for the development of modern, automated, land information systems.

Also, like the National Research Council Panel, the Wisconsin Land Records Committee recognized that there is a central role to be played by counties in the land records modernization process. Although the Committee chose not to define that role precisely, preferring instead to have individual counties make the determination that, at the minimum, a coordinative role was seen as necessary in view of the records maintenance functions given to the counties by the state constitution and state statutes.

WISCONSIN LAND INFORMATION PROGRAM

Among the final recommendations of the Wisconsin Land Records Committee was a proposal for the creation of a Wisconsin Land Information Program overseen by a state-level board that would provide a focal point for land records modernization issues and efforts within Wisconsin. During 1989, the Wisconsin Legislature enacted legislation creating the Wisconsin Land Information Program. The legislation was signed into law by Governor Tommy Thompson, and, late in 1989, the Wisconsin Land Information Board began to meet following the appointment of the Board members by the Governor. Voting members of the Board are defined by statute as follows:

1. The Secretary of the Department of Administration, the Secretary of the Department of Agriculture, Trade and Consumer Protection, the Secretary of the Department of Natural Resources, and the Secretary of the Department of Transportation, or their designees.
2. Four representatives from county and municipal government appointed by the Governor to six-year terms, including at least one member of a county board of supervisors, at least one member of a city council or village board, and at least one person who is a county officer active in land information management.
3. Four representatives chosen from public utilities and private businesses appointed by the Governor to six-year terms, including at least one public utility representative and at least one representative of a professional land information organization.
4. The State Cartographer.

In addition, the State Historic Preservation Officer, the Secretary of the Department of Revenue, the State Geologist, or their designees; a representative of a regional planning commission who is selected by the Board; a county employee active in land information management who is selected by the Board; and representatives of state and federal agencies active in land information management who are selected by the Board shall serve as nonvoting, advisory members of the Board.

As set forth in the legislation, the duties of the Board include:

1. The provision of technical assistance and advice to state agencies and local units of government with land information responsibilities.
2. The preparation of guidelines and standards to coordinate the modernization of land records and land information systems.
3. The creation and administration of a grant program for local units of government to assist in the development of modernized land records systems.

In its initial meetings, the Board identified the creation of a grants program to provide a source of partial funding for land records modernization as one of its high-priority issues and took steps to encourage the passage of a bill in the State Legislature that would provide such a funding mechanism. This bill was passed by both houses of the Legislature in March and April 1990. The Governor signed the legislation into law in April 1990.

Under the Wisconsin Land Information Program, it is envisioned that counties throughout the State will prepare and implement plans to modernize land records systems. Toward this end, the legislation provides for Wisconsin Land Information Board review and approval of countywide land information systems plans. On January 7, 1991, the Land Information Board adopted final guidelines pertaining to the preparation of such county plans.

To help fund the Wisconsin Land Information Program, including the preparation and implementation of county land information systems plans, the new legislation requires counties to increase register of deeds filing and recording fees from \$4.00 to \$8.00 in state fiscal year 1991, July 1, 1990, through June 30, 1991, and to \$10 in the five subsequent state fiscal years, resulting in a six-year program that under present state law would terminate on June 30, 1996. At that time, the present State law requires that the register of deeds filing and recording fee return to the \$4.00 level that preceded the new law.

For the first year of the six-year program, counties are permitted to retain \$2.00 of the \$4.00 increase in filing and recording fees. For the

remaining five years of the program, counties are permitted to retain \$4.00 of the increased fee. Such monies can be retained, however, only if: a) the county has established a Land Information Office; b) the county has received approval from the Land Information Board of a county plan for land records modernization; and c) the county uses the monies to develop, implement, and maintain the countywide plans.

The law also provides that counties must remit to the State the incremental register of deeds filing and recording fees not retained at the county level. Over the six-year period, this means that the State will receive \$2.00 for each filing in the State. Such monies under the new law are to be used by the State to fund the activities of the Wisconsin Land Information Board and to provide grants of up to \$100,000 to county and local governments for activities designed to implement approved county plans. Under the law, only counties are eligible to apply for such grants. Counties may act, however, on behalf of local units of government in the county to apply for grants. A minimum local match of 25 percent is required. The legislation is silent as to whether that 25 percent match can come from the retained county register of deeds recording fees.

ALTERNATIVE TYPES OF OPERATIONAL COMPUTER SYSTEMS AVAILABLE FOR THE DEVELOPMENT OF AN AUTOMATED MAPPING AND LAND INFORMATION SYSTEM

The professional literature currently categorizes operational automated mapping and land information systems into three general types: strictly automated mapping or computer-assisted drafting (CAD) systems; automated mapping-facilities management (AM-FM) systems; and geographic and land information systems (GIS/LIS). The distinction between these types of systems is somewhat artificial and stems from marketplace segmentation strategies adopted by vendors of computer hardware and software. Nevertheless, as long as it is recognized that operational systems comprise a continuum and that many systems will resist being neatly categorized as one or another of the three general types of systems, the tripartite division is a useful one for discussion purposes.

The computer hardware components comprising these three types of systems usually provide no

basis for categorization, and the different systems are virtually identical in a physical sense. Computer software available for operating the different system types generally provides a basis for distinguishing between CAD systems on the one hand and the AM-FM and GIS systems on the other; but the differences between the software utilized to operate AM-FM systems and GIS systems is often less clear. Indeed, a number of proprietary software products currently purport to support either type of operation equally well.

Functionally, the CAD systems are perhaps the easiest of the three to categorize since they tend to be almost exclusively automated mapping systems with little or no capability for the management of associated land records. Both AM-FM and GIS systems possess automated mapping and records management capabilities, although the distinction between the two as often as not is a function of the type of associated land information managed by the system rather than of any pronounced functional difference between system components. Typically, systems categorized as AM-FM systems are found where the predominant function is to manage information associated with networks: for example, water distribution systems, sanitary sewerage systems, telephone systems, and electric power and natural gas distribution systems. GIS systems are usually systems that manage information associated with areas: real property parcels, administrative districts, land use polygons, and soil mapping units. While these distinctions between predominant functions of AM-FM and GIS systems are helpful in a taxonomic sense, in practice these distinctions are often more apparent than real as virtually all currently available AM-FM software systems, while they may, in fact, be designed for optimal operation in network data analysis environments, are capable of analyzing polygon data. Likewise, virtually all currently popular GIS software is capable of performing network data analysis functions.

CONVERSION OF GRAPHIC DATA INTO A COMPUTER-COMPATIBLE FORMAT

Much of the current interest in the modernization of land data systems has been centered on the use of electronic computers for the storage, manipulation, and retrieval of the data and, more recently, the use of computer-assisted graphic collection and display hardware for the

reproduction of the data in mapped as well as tabular form. Nongraphic land information, such as parcel identification numbers, legal descriptions, and assessment information, for example, can be entered into a computer through standard keypunch data entry procedures. Land information that has traditionally been maintained in the form of maps, such as real property boundary lines, however, must be converted into a numeric, or digital, format before it can be entered into a computer. This is most often accomplished by a device, sometimes itself computer controlled, called a "digitizer," and the process by which the conversion is completed is often identified as "board digitizing."

A digitizer, therefore, is a machine system which transforms mapped information into a computer-readable form to facilitate information manipulation and display. A digitizer is usually comprised of the following hardware components:

1. A controller, which is often a small to medium size computer.
2. An on-line data storage device.
3. An operator work station, which consists of a keyboard for entering commands and nongraphic data into the system and a graphic display screen or screens for viewing collected information.
4. A digitizing board or tablet which allows for determining the accurate relative location of a point identified on the surface of the board using a device, a cursor, which is able to move freely over the surface of the board.

Additional equipment may include a printer, a computer tape unit, and graphic production devices called "plotters." Each component can vary greatly in size and capability depending on the operating requirements of the particular system.

The transformation of mapped information into computer-readable information requires maps which are related to some system of geometric control and which have at least two or three points for which an x-y coordinate pair can be determined. The coordinate system utilized can vary from an arbitrary scale unique to the base map to some more universal system such as the

State Plane Coordinate System. Once the base map has been placed on the digitizer board, the known coordinates of the map are entered into the digitizer and located on the base map with the cursor. When this operation is complete the map is said to be "scaled," and positions of other points on the map can be established based upon their relative positions to the known points.

Each line on the map is defined as a series of connected points. The cursor is used to identify each point, which is then assigned an x-y coordinate pair based on the position of the point relative to the known base points used to scale the maps. Each map line is then stored in the system as a series of x-y coordinates. Each line or segment can be stored separately or combined with other segments to form closed polygons with defined attributes and measurable areas.

Base map accuracy is an important consideration when digitizing. A digitizing system does not improve the accuracy of a base map but only replicates the map features, including errors and discrepancies. While the board digitizing procedure just described is the most common technique for conversion of map data into digital form, several other techniques have been developed which work well in certain specialized situations or with certain specific types of map information. These are optical scanning, direct digitizing from stereoscopic models, and coordinate geometry entry.

An optical scanning system is a machine system that is much like a board digitizing system in its physical arrangement. It merely substitutes an optical scanning device for the digitizing board or tablet. In operation, the document to be converted to digital form is mounted on a large drum that rotates at high speed under an optical device that scans the drum and "reads" the document. While these devices are capable of converting documents to digital form more rapidly than can board digitizing, they have typically required quite complex software to perform editing and categorizing of the converted data. For anything other than very simple maps, these devices have yet to supplant board digitizing.

Direct digitizing from stereoscopic models is relatively more recent in origin than either board digitizing or optical scanning. It is, however,

based upon long-established photogrammetric engineering procedures. In a direct, stereoscopic digitizing system, the digitizing board or tablet that would be present in a board digitizing system is replaced by a stereoscopic map compilation machine. Stereoscopic aerial photography acquired for map compilation purposes can be used to establish a stereoscopic model in the traditional manner, but rather than utilizing the model to prepare an analog map manuscript for subsequent board digitization, the operator optically "digitizes" map features directly from the model, thereby producing the digital map files directly.

An additional means of converting map information into maps is coordinate geometry entry, sometimes referred to as "precision digitizing." In coordinate geometry entry, there is no analog device present in the machine system for the conversion of map documents to digital maps. All of the information needed to construct a map is key entered and the map is constructed utilizing plane geometry relationships and formulae contained in highly specialized computer software. Conversion of map data by coordinate geometry is exceedingly tedious and is generally used only for relatively small project areas, or for areas where the quality and precision of the data available warrant the additional effort of this procedure. Of all the currently available methods of data entry, however, coordinate geometry procedures are the only procedures that do not result in a loss of precision and are the only conversion procedures that produce digital map data that are truly scale independent.

Once the initial map data are transformed into digital form with the digitizer, a variety of manipulations become possible. Data mapped at one scale can be reproduced at different scales, provided that the accuracy limitations of the original maps are recognized in any enlargement, as opposed to reduction, in scale. Graphic base files collected from different sources can be merged and reproduced at a uniform scale. Data for special study areas can be identified, reproduced, and measured; and information on the base maps can be identified in such a manner that only selected portions of that information are reproduced at a time.

CURRENTLY OPERATING AUTOMATED MAPPING AND LAND RECORDS SYSTEMS PERTAINING TO ALL OR PARTS OF WALWORTH COUNTY

There are several automated mapping and land information systems already in existence whose areas of operation cover all or portions of Walworth County. Since one of the primary purposes of this report is to determine the feasibility of some type of shared or joint operation of a countywide automated mapping and land information system, these existing systems are identified and their operations briefly described below.

The different map coordinate systems utilized by the different automated mapping operations in the Walworth County area represent an issue of central importance in any consideration of cooperative mapping efforts, and of the transfer of existing digital map information between the existing automated mapping sites. Therefore, the map coordinate system or systems utilized and the horizontal map datum upon which the coordinate system is based are identified for each operation.

The universe of all map coordinate systems is rather large, although currently only two such systems are in regular use in the Walworth County area: the State Plane Coordinate System and the Universal Transverse Mercator (UTM) coordinate system. Both of these systems are based upon the North American Datum of 1927 (NAD-27), which is, in turn, derived from the Clarke 1866 mapping spheroid. Since both the State Plane Coordinate System and the UTM coordinate system are based upon NAD-27, it is possible, albeit computationally tedious, to translate with mathematical precision from one of these coordinate systems to the other. It is, in an analogous fashion, further possible to move with mathematical precision between either of these two systems and any other map coordinate system derived from NAD-27, although again, the procedure is tedious.

Recently, the National Geodetic Survey of the National Oceanic and Atmospheric Administration, U. S. Department of Commerce, the federal government agency responsible for the maintenance of the nation's geodetic control system, has begun to move all federal mapping activity from the Clarke 1866 mapping spheroid onto the Global Reference System of 1980 (GRS 80), a

newly defined mapping spheroid. As part of this transfer, an entirely new horizontal datum, NAD-83, has been developed for use with GRS 80. Any precise conversion between NAD-27 and NAD-83 requires recomputation utilizing the original control survey field measurements. The implications for the conversion from NAD-27 to NAD-83 of the type of control network and related large-scale planimetric mapping typically prepared by local units of government and utilities are therefore both technically severe and operationally costly. A similar situation exists for large-scale topographic mapping with the proposed replacement of the National Geodetic Vertical Datum of 1929 (NGVD 29) by NGVD 87, which has been developed for use with GRS 80 and NAD-83. Importantly, the replacement of NAD-27 and NGVD 29 with NAD-83 and NGVD 87 will be costly, while offering no improvement in map accuracy or precision for locally oriented large-scale mapping operations.

Southeastern Wisconsin Regional Planning Commission

The Southeastern Wisconsin Regional Planning Commission installed CALMA hardware and software in 1976 to begin conversion to digital format of its land use and natural resource inventory data. Since then, the Commission has converted its analog land use inventories for 1963, 1970, and 1975 for its 2,689-square-mile planning area and has completed digital land use inventory updates for 1980 and 1985. In 1991, the Commission will begin a digital land use inventory update for the base year 1990. During 1990 the Commission completed digitization of the detailed operational soil surveys, which includes maps completed by the U. S. Soil Conservation Service under contract to the Commission in 1966 for the entire planning area. That area includes Walworth County. The primary Commission system products are land use maps, interpretive soil maps, wetland maps, wildlife habitat maps, floodplain maps, civil division boundary maps, watershed and related analytical hydrologic unit maps, summary areal extent statistics, and thematic maps prepared in support of regional and local planning activities. The Commission utilizes the State Plane Coordinate System, NAD-27, for its digital mapping activities.

The experience gained by the Commission in more than a decade of automated land use and natural resource mapping provided a valuable

base upon which to evaluate the available hardware and software products when, in 1986, the Commission reached a decision to acquire new computer hardware and software for its automated mapping operation. In 1987, a completely new automated mapping system was installed comprised of DELTAMAP software running on Hewlett-Packard and Calcomp hardware. The enhanced operational capability provided by this new system allowed the Commission staff to begin taking steps in 1988 to convert its large-scale and intermediate-scale base mapping operations from analog to digital format.

State of Wisconsin

Two agencies of state government currently possess and use automated mapping systems: the Department of Transportation and the Department of Natural Resources.

The Department of Transportation installed INTERGRAPH hardware and software in 1982. This system is used primarily for maintaining and updating the Department's official State Highway Map and the Department's statewide series of county highway maps. Some of the map data for these two programs were created by optical scanning of color separation plates that had been used for color map printing. The system is also used for project mapping in support of highway construction and improvement projects. The map data for this activity are usually acquired through direct digitization from stereoscopic models. All of the Department of Transportation's digital mapping currently utilizes the State Plane Coordinate System, NAD-27, although the Department is in the process of shifting its mapping datum to a modified NAD-83, the modification being based upon global positioning surveys.

The Department of Natural Resources began building a digital map data collection system in 1980. This system has been, in effect, custom built by Department staff who have configured purchased hardware components and written their own computer software. The system is used primarily in support of Department land acquisition, improvement, and management projects, but was used to create, and currently maintains, a statewide inventory of wetlands. The Department of Natural Resources has not chosen a standard coordinate system for its digital mapping, and, although it utilizes the UTM coordinate system, NAD-27, for some projects, it also

utilizes the State Plane Coordinate System, NAD-27, for some projects and local coordinate systems on occasion. The Department possesses computer software translation capability between UTM and State Plane coordinates. The Department of Natural Resources is in the process of evaluating whether or not to shift its mapping datum to NAD-83.

Recently, both the Department of Transportation and the Department of Natural Resources began to use the proprietary software ARC/INFO to develop network and polygon map data analysis capability, while continuing to maintain their automated mapping functions on the originally acquired systems. The Department of Transportation has acquired the software and is running it on Digital Equipment Corporation (DEC) hardware recently installed for that purpose. The Department of Natural Resources is running the software in a "time share" mode on the University of Wisconsin's DEC system, and has recently utilized this system to develop a statewide analysis, including a state map prepared by computer-assisted methods, of groundwater contamination susceptibility.

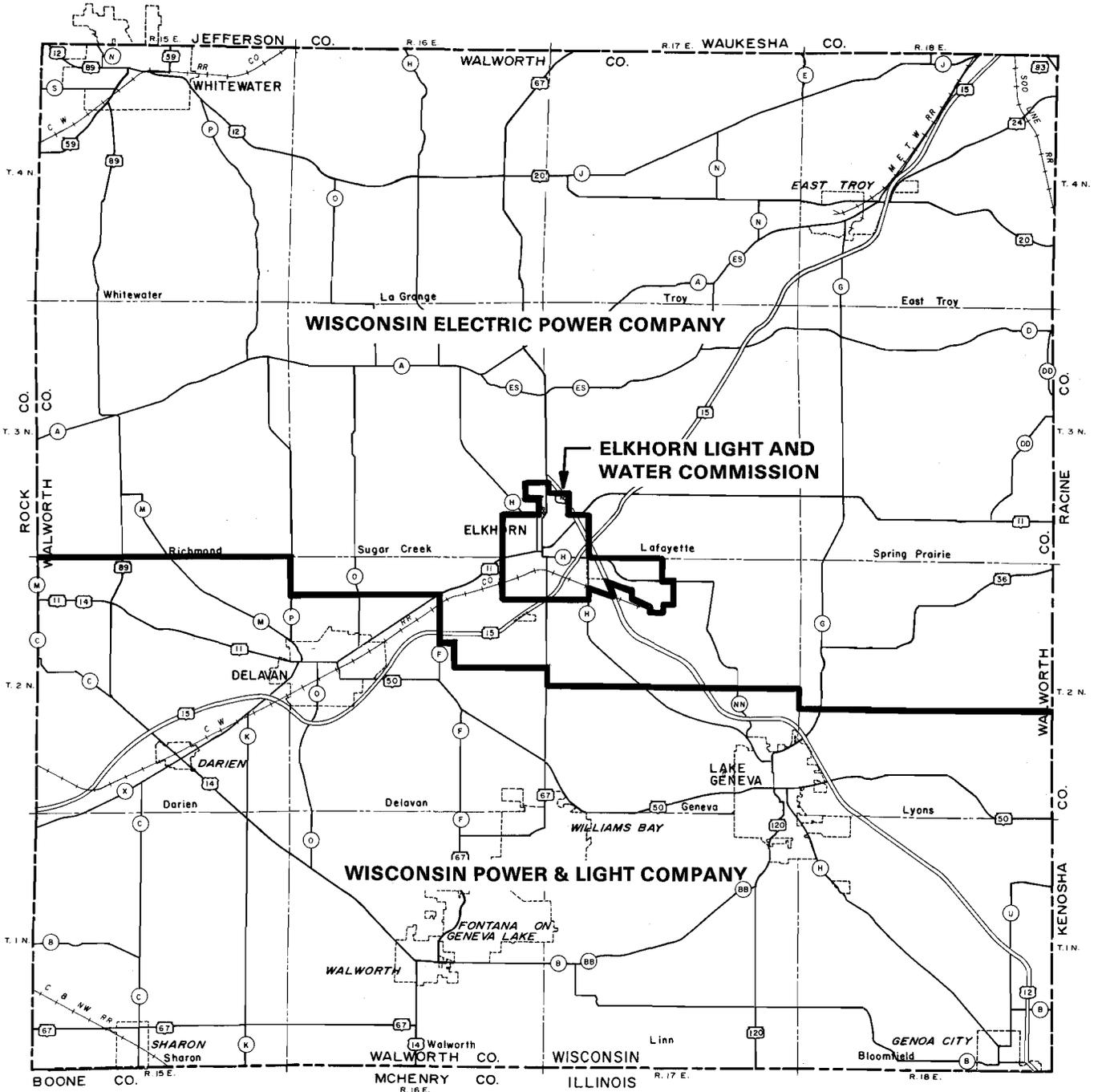
Wisconsin Electric Power Company and Wisconsin Natural Gas Company

The Wisconsin Electric Power Company (WEPCo) and the Wisconsin Natural Gas Company (WNG), both subsidiaries of Wisconsin Energy Corporation, have jointly developed a digital mapping base upon which to map their respective electric and gas service networks. This effort was initiated in 1979 with the installation of INTERGRAPH hardware and software at WEPCo. As shown on Map 1, WEPCo serves the approximate northern one-half of Walworth County. As shown on Map 2, WNG serves the Whitewater, Richmond, Troy, and East Troy areas of Walworth County. WEPCo and WNG completed the development of digital map coverage for the portions of Walworth County lying within their service territories prior to 1985.

Throughout much of the Southeastern Wisconsin Region, WEPCo and WNG utilized data from large-scale topographic mapping and control survey projects prepared to Commission-recommended specifications to establish their spatial reference framework. These data were acquired in State Plane Coordinate System, NAD-27, format and converted by WEPCo and WNG to the UTM coordinate system, NAD-27,

Map 1

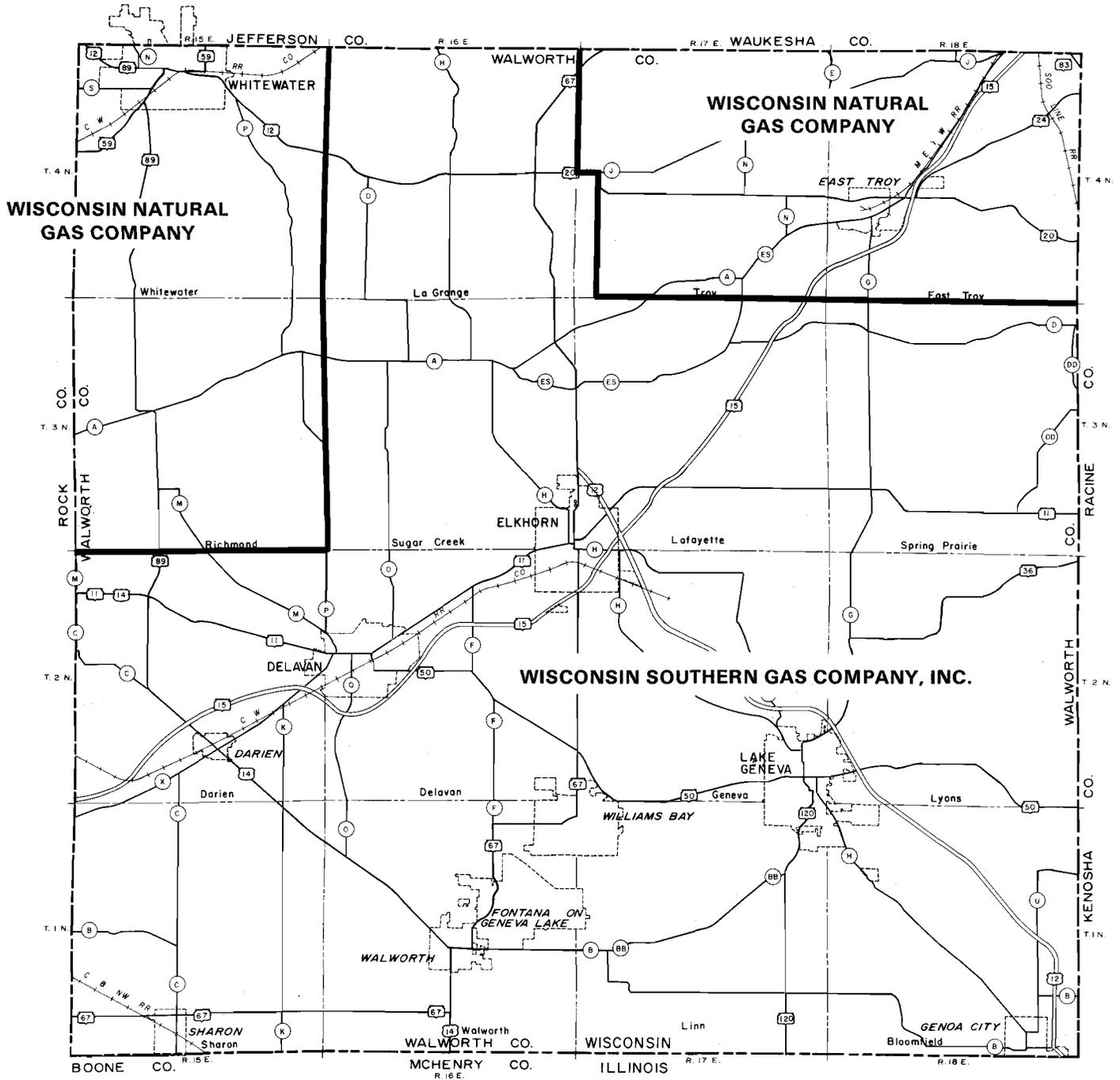
ELECTRIC UTILITY SERVICE AREAS IN WALWORTH COUNTY



Source: SEWRPC.

Map 2

NATURAL GAS UTILITY SERVICE AREAS IN WALWORTH COUNTY



Source: SEWRPC.

which the two companies continue to utilize for their digital mapping activity.

Both WEPCo and WNG have recently begun to transfer a portion of their automated mapping capability to IBM hardware and software in order to utilize the digital maps created on the INTERGRAPH system for the mapping of nongraphic attribute data stored on the Corporations' corporate data base, which is maintained on IBM equipment.

Wisconsin Power & Light Company

The Wisconsin Power & Light Company (WP&L) serves approximately the southern one-half of Walworth County (see Map 1). The WP&L is currently in the developmental stages of establishing an automated mapping program for its service area. The Company has acquired an INTERGRAPH system presently being used for computer-aided drafting. In addition, WP&L recently has acquired ARC/INFO software as a basis for expanding its capabilities. Wisconsin Power & Light currently utilizes the State Plane Coordinate System, North American Datum of 1927, for its surveying and mapping operations, but is considering converting to the modified NAD-83 proposed to be utilized by the Wisconsin Department of Transportation.

Wisconsin Southern Gas Company, Inc.

The Wisconsin Southern Gas Company, Inc., serves the majority of Walworth County (see Map 2). This company has not established any type of automated mapping capability and has indicated that it has no current plans to establish such a capability.

Telephone Utilities

Seven telephone utilities presently serve Walworth County. The approximate service areas of each of these utilities is shown on Map 3. The following briefly summarizes the automated mapping capabilities, if any, established by these telephone utilities:

1. Wisconsin Bell, Inc.

Wisconsin Bell, Inc., serves about 42 percent of the area of Walworth County, including the incorporated communities of Whitewater, Delavan, Lake Geneva, Genoa City, and Williams Bay. After several years of study, Wisconsin Bell decided in 1990 to acquire an INTERGRAPH system for the conversion of its facilities information. Wisconsin Bell anticipates beginning that

conversion process in 1991, possibly including its service areas in Walworth County. Wisconsin Bell is proposing to use the Universal Transverse Mercator Coordinate System, North American Datum of 1927, for its digital mapping, the coordinate system already being used for the Company's present analog mapping operations.

2. Northwest Telephone Company

The Northwest Telephone Company serves about 23 percent of the area of Walworth County, including the incorporated community of East Troy. This company has no plans at the present time to establish an automated mapping capability.

3. General Telephone Electronics

General Telephone Electronics serves about 15 percent of the area of Walworth County, including the incorporated communities of Darien, Fontana, and Walworth. This company has developed a digital mapping base built upon the TIGER files made available by the U. S. Bureau of the Census. The TIGER files are digitized from U. S. Geological Survey 1:100,000 (1 inch equals approximately 8,333 feet) scale quadrangle maps and based upon the spherical coordinates of latitude and longitude, North American Datum of 1927.

4. State Long Distance Telephone Company

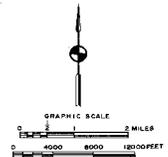
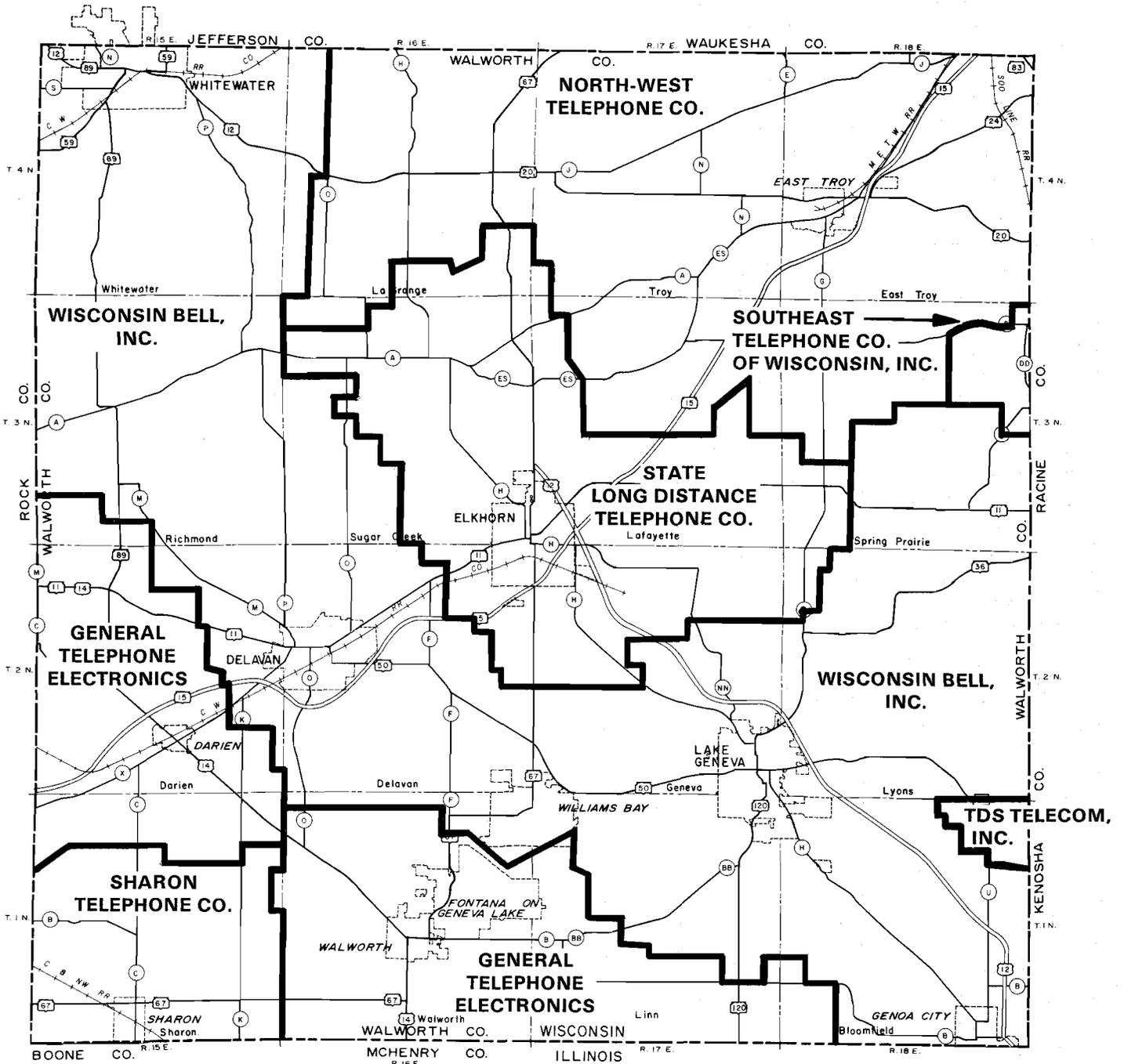
The State Long Distance Telephone Company serves about 14 percent of the area of Walworth County, including the incorporated community of Elkhorn. At the present time, this Company is discussing with the City of Elkhorn the possibility of a cooperative digital mapping program. This program would also involve the Elkhorn Light and Water Commission which provides electric power service to the City of Elkhorn and the Walworth Company Institutions complex. No firm decisions have been made as yet on any of the technical details of such a cooperative program.

5. Sharon Telephone Company

The Sharon Telephone Company serves about 5 percent of the area of Walworth County, including the incorporated community of Sharon. This company has no plans at the present time to establish an automated mapping capability.

Map 3

TELEPHONE UTILITY SERVICE AREAS IN WALWORTH COUNTY



Source: SEWRPC.

6. Southeastern Telephone Company of Wisconsin, Inc.

The Southeastern Telephone Company of Wisconsin, Inc., serves about 1 percent of the area of Walworth County, consisting of a portion of the Town of Spring Prairie. This company has no plans at the present time to establish an automated mapping capability.

7. TDS Telecom, Inc.

The TDS Telecom, Inc., telephone company serves less than 1 percent of the area of Walworth County, consisting of a portion of the Town of Bloomfield. This Company has established an automated mapping capability utilizing AUTOCAD software, but is also investigating GIS software for possible acquisition. TDS utilizes the North American Datum of 1927 having acquired its automated mapping base by digitizing U. S. Geological Survey quadrangle maps. TDS uses a mixture of UTM coordinates and map sheet specific coordinates.

City of Lake Geneva

In November 1990, the City of Lake Geneva received a report proposing the creation of a GIS system to modernize land records in that City.⁴ The report sets forth specifications for proposed computer hardware and software acquisition, independent of specific brands. The report recommends that a GIS system be developed to serve the planning, zoning, engineering, public safety, and sewer and water utility functions in the City. The report does not address datum issues. Presumably, however, the proposed system would utilize the City's large-scale topographic maps which were prepared to Regional Planning Commission specifications. Therefore, the program would utilize State Plane Coordinates, North American Datum of 1927.

Walworth County Departments and Offices

No Walworth County departments or offices currently possess or are in the process of developing large-scale automated mapping capability.

Walworth County, however, has developed nongraphic, automated data files keyed through land parcel and document identifiers that would form important component parts of a parcel-based land information system. An important effort of this kind is represented by the automated system developed for the Register of Deeds Office to store and retrieve file location information about, and abbreviated descriptions of, documents accepted for filing by the Register of Deeds. This system uses the document number as the key into the system and includes all documents submitted for filing, such as deeds, mortgages, easements, and liens that affect ownership or interests in land.⁵ Another automated system has been developed in the Property Lister's Office that uses the parcel identification number to access those records that relate to land ownership in the Register of Deeds system. The integration of these two systems allows records relating to ownership of land to be accessed by either document number or parcel identification number. The information in these files is used to support automated systems in the County Treasurer's Office for tax listing and tax collection. The County Sheriff's Department and the District Attorney presently have access to these systems for such activities as verifying property ownership for property bond applications and to verify current address information.

The Planning, Zoning, and Sanitation Department has begun to use the parcel identifier as one of the keys for managing various types of permit and code enforcement information such as zoning variances, on-site sewage disposal system permits, and sanitation violations. The Department also uses the parcel identifier to monitor information through the system in the Property Lister's Office to assist in determining state farmland preservation program tax credits. The County Surveyor's Office has recently begun to use an automated records system that uses the parcel identification number to identify the subdivision plat, certified survey map, plat

⁴Report on Needs Analysis & Land Record Modernization Study Geographical Information System, City of Lake Geneva, Walworth County, Wisconsin, Concad Technologies, Mosinee, Wisconsin, November 5, 1990.

⁵*There are about 125 unique document types identified in the Walworth County Register of Deeds system. Certain types of documents, such as deeds and mortgages always relate to land; other types of documents, such as marital property agreements, may or may not relate to land.*

of survey, or cadastral diagram in which the parcel is located.

The County's Data Processing staff estimate that the County has invested \$50,000 over the last five years in the development of automated systems to improve the accessibility and utility of the land records that are currently stored and managed. This includes the development of the Register of Deeds', Property Lister's, and County Surveyor's systems which form constituent parts of a County parcel-based land information system.

Digital Map Data Exchange Issues

The ability to exchange digital map data between different automated mapping sites and systems is an important consideration in the development of a county land records modernization plan. In this regard, it should be noted that the use of different hardware and software systems and the use of different map coordinate systems by the various governmental units and private utilities that currently maintain digital mapping capability in Walworth County may affect the ability to exchange digital map data between different automated mapping sites and systems.

Commercial software products are increasingly available that will provide for the "translation" of digital map data between specific sets of proprietary automated mapping and systems; however, basic incompatibilities between the instruction sets, data structures, and the basic architecture of different systems may render some digital map data "untranslatable," even between systems that supposedly have translators available. Accordingly, digital map data translation cannot be taken for granted. Generally speaking, translations will be most successful between systems that have a high degree of compatibility between basic software instruction sets, data structures, and hardware architectures; or in instances where the need to translate digital map data is anticipated in advance and influences the basic decisions on the manner in which digital map data will be captured and stored.

The use of different map coordinate systems does not affect the ability to exchange digital map data provided that the different map coordinate systems have been developed on the same horizontal datum. The use of mathematically unrelated horizontal datums, however, does pose potential problems for the exchange of digital map data. Simply stated, the relative mapped position of geographic features can be

expected to differ between maps prepared on mathematically unrelated datums. This situation can be expected to adversely affect, at least at higher required levels of precision, the correct integration of digital map data between sites using NAD-27 and NAD-83.

SUMMARY

Over the past 10 years, there has been a significant and growing interest in the United States in developing land information systems. The interest is indeed broad, involving many disciplines, and centers on the use of electronic computers to store, manipulate, retrieve, and, most recently, graphically display land and land-related information. This chapter presents an overview of the growing body of professional literature in this area and summarizes the automated mapping and land information systems which to date have been developed and which pertain to Walworth County. The following summarizes the material included in this chapter:

1. National interest on land information systems was focused in 1979 by a Panel on a Multipurpose Cadastre convened by the National Research Council. The report of this Panel found that there is a critical need to modernize land information systems in the United States and to thereby improve land conveyance procedures, to furnish a basis for equitable taxation, and to provide information for resource management and environmental planning. The Panel's report emphasized the concept of a multipurpose cadastre as a basis for a dynamic public process that could effectively collect, maintain, and disseminate land-related information. In a subsequent report issued by the Panel, the basic components of a modern land information system were identified as: 1) a spatial reference framework consisting of monumented geometric control points; 2) a series of accurate, large-scale topographic base maps; 3) a cadastral overlay to the base maps that delineates all cadastral, that is, real property ownership, parcels; 4) a cadastral parcel numbering scheme that provides for unique identification of each cadastral parcel; and 5) a series of compatible registers of interests in, and data about, the land parcels keyed to the parcel identifier.

2. The local mapping and survey control network recommended by the Southeastern Wisconsin Regional Planning Commission since 1964 possesses two of the five basic components of a modern land information system: the spatial reference framework and the accurate large-scale planimetric and topographic base maps. In addition, the Commission-recommended program facilitates the creation of the cadastral map overlay as a third component. Finally, the Commission-recommended survey control network provides a mechanism for relating real property boundary descriptions to the State Plane Coordinate System and, in turn, to latitude and longitude, thereby facilitating the precise correlation of real property boundary lines and earth science data, a condition necessary for the creation of a modern, automated land information system.
3. Following issuance of a report by the Wisconsin Land Records Committee, which recommended that counties perform a central role in the land records modernization process, new state legislation was enacted to create a Wisconsin Land Information Program. That Program is overseen by the Wisconsin Land Information Board. The duties of the Board include providing technical assistance to state agencies and local governments establishing land information systems; promulgating standards to coordinate the modernization of land records and the establishment of land information systems; and the administration of a grant program to assist local governments in developing modernized land records systems. The Wisconsin Land Information Program, which is scheduled to be carried out over the six-year period from July 1, 1990, to June 30, 1996, is being funded by increased register of deeds filing and recording fees. A portion of the increased fees is retained by counties and a portion is remitted by the counties to the State. In order to retain monies at the county level, however, counties must establish a land information office, prepare and receive Land Information Board approval of a county plan for land records modernization, and use the retained monies to implement the county plan. Counties are also permitted to apply for grants from the Wisconsin Land Information Board to help carry out the plans. In so doing, counties may act on their own behalf or on behalf of local units of government in the county.
4. Three general types of automated mapping and land information system operational structures are currently recognized: strictly automated mapping or computer-assisted drafting (CAD) systems; automated mapping/facilities management (AM-FM) systems; and geographic and land information systems (GIS/LIS). Although the distinctions between the types are not always clear, the CAD systems are perhaps the easiest of the three to categorize since they tend to be almost exclusively automated mapping systems with little or no capability for the management of associated land records. Both AM-FM and GIS/LIS systems possess automated mapping and records management capabilities, although the distinction between the two systems is quite often a function of the type of associated land information managed by the system rather than of any pronounced functional difference between the two system types. Typically, systems categorized as AM-FM systems are found in situations where the predominant function is to manage information associated with networks: for example, water distribution systems, sanitary sewerage systems, telephone systems, and electric power and natural gas distribution systems. GIS systems are usually systems that manage information associated with areas: real property parcels, administrative districts, land use polygons, and soil mapping units.
5. Much of the information that would be incorporated within a multipurpose cadastre or an automated mapping and land information system has traditionally been stored in the form of maps. Conversion of map information into a digital format where it can be manipulated and operated upon by a computer requires the use of a device called a digitizer. Alternatively, certain forms of specialized data conversion procedures, such as optical scanning, direct digitizing from stereoscopic models, or coordinate geometry entry, can be

utilized. Once the initial map data are transformed into numeric form, a variety of manipulations become possible. Data mapped at one scale can be reproduced at different scales, provided that the accuracy limitations of the original maps are recognized in any enlargement, as opposed to reduction, in scale. Graphic base files collected from different sources can be merged and reproduced at a uniform scale. Data for special study areas can be identified, reproduced, and measured; and information on base maps can be identified in such a manner that only selected portions of that information are reproduced at a time.

6. There are a number of automated mapping and land information systems already in existence whose areas of operation include all or portions of Walworth County. Several of these systems, those of the Southeastern Wisconsin Regional Planning Commission, and the Wisconsin Electric Power Company and Wisconsin Natural Gas Company, have been functional for a decade or more and have developed extensive digital map holdings. These existing systems currently utilize a variety of proprietary computer hardware and soft-

ware products in their operation, and are using several different map coordinate systems, all of which except for the Wisconsin Department of Transportation system are mathematically relatable to the State Plane Coordinate System, North American Datum of 1927. The use of different proprietary products, however, may affect the ability to readily exchange digital map data between different automated mapping sites and systems, as commercial software products may not be available that can "translate" digital map data between different proprietary automated mapping systems.

7. There is a growing interest at the local governmental level in Walworth County in developing automated mapping and geographic information systems. The City of Lake Geneva is considering a proposal to establish a geographic information system to serve that community's planning, zoning, engineering, and utility functions. The City of Elkhorn, which also operates the Elkhorn Light and Water Commission, is considering establishing a joint automated mapping system with the private telephone company serving the Elkhorn area.

Chapter III

COMPONENTS OF AN AUTOMATED MAPPING AND LAND INFORMATION SYSTEM

INTRODUCTION

This chapter provides a description of the major elements of a multipurpose cadastre, or parcel-based land information system, and discusses such a cadastre within the more general context of geographic information systems. In addition, the chapter describes remonumenting and base mapping efforts previously carried out in the Region and in Walworth County which provide the essential base for the establishment of an automated mapping and land information system.

THE CADASTRE AS PART OF A LARGER SYSTEM OF LAND INFORMATION

A cadastre may be defined as a record of interests in land, encompassing both the nature and extent of these interests. Historically, cadastres have been created and maintained for the purpose of taxing these interests, and evidence of the existence of cadastres goes back through hundreds of years of human civilization. It is possible to develop an automated version of a cadastre defined in this more narrow, historical sense; and, in fact, the development of such single-purpose cadastres has been advanced on the premise that the development of more complex multipurpose cadastres and land information systems ought to begin with the development of single-purpose cadastres relating only to the value of real property as a basis for taxation, and perhaps the registration of land ownership, being extended later in an evolutionary manner to other applications.

Thus, the development of a more narrowly defined cadastre can be considered a preliminary step in the development of a broader land-related information system. Additional information subsequently incorporated into such a system may include data on land use; certain natural characteristics of the land such as soil and geologic conditions; natural hazards such as flooding and shoreline erosion; environmentally sensitive areas such as woodlands and wetlands; permits; public and private infrastructure systems; and selected social and economic data, to

name just a few. These broader land information systems are considered to contain, in addition to the information considered to be part of a single-purpose cadastre, all types of land-related information both cultural and natural.

ELEMENTS OF A MULTIPURPOSE CADASTRE

A multipurpose cadastre can be conceptualized as a public, operationally and administratively integrated, land-related information system which provides continuous, readily available, and comprehensive information at the ownership parcel level. The Panel on a Multipurpose Cadastre of the National Research Council has proposed the procedural model shown in Figure 1 for the development of multipurpose cadastres. This model consists of the following five basic elements: 1) a geographic reference frame consisting of a geodetic survey network; 2) a series of current, accurate, large-scale base maps properly related to the geographic reference frame; 3) a cadastral map overlay delineating all cadastral parcels which is also properly related to the geographic reference frame; 4) a unique identifying number assigned to each parcel; and 5) a series of registers, or land data files, each including a parcel index for purposes of information retrieval and cross referencing with information in other land data files.

Additional elements in the form of maps and records of land-related information can be readily added to the base over time.

Geodetic Reference Framework

A reference frame, or survey control network, consisting of a system of survey monuments having geodetically based coordinates, is necessary for defining the relative spatial location of all land-related data and, as such, comprises the first component for a multipurpose cadastre. In the United States, two different, and heretofore largely uncoordinated, systems of survey control have evolved. One of these two systems, the State Plane Coordinate System, is founded in the science of measurement and is intended to be utilized as a basis for the collection of earth

science data and the preparation of earth science maps, such as topographic, geologic, soils, and hydrographic maps. The other of these two systems, the U. S. Public Land Survey System, is founded in the principles of property law, as well as in the science of measurement, and is utilized for the collection of cadastral data and the preparation of cadastral maps, such as real property boundary line maps.

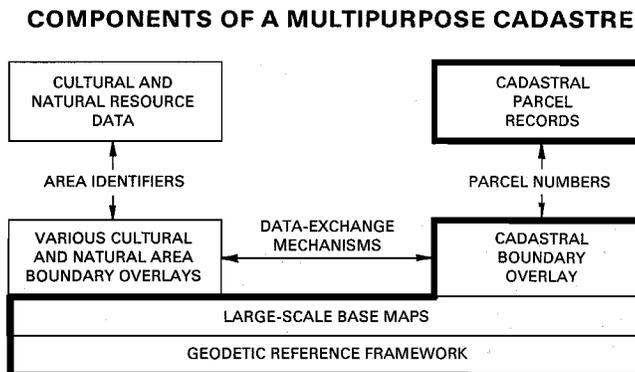
U. S. Public Land Survey System: For most of the United States, the federal government has provided the basic survey control system for cadastral mapping in the form of the U. S. Public Land Survey System. Under regulations imposed by the Congress, the U. S. Public Land Survey System has been extended into 30 of the 50 states, including Wisconsin.

This system is founded in the best features of the English common law of boundaries, superimposing on that body of law systematic land survey procedures under which the original public domain is surveyed, monumented, and platted before patents are issued; legal descriptions are by reference to a plat; lines actually run and marked on the ground control boundaries; adjoining are respected; and the body of law in effect at the time of the issuing of the deed is controlling, and forever a part of, the deed. Unlike scientific surveys, which are made for the collection of information and can be amended to meet improved standards or changing conditions, the original government land survey in an area cannot be legally ignored, repudiated, altered, or corrected as long as it controls rights vested in lands affected.

The U. S. Public Land Survey System is one of the finest systems ever devised for describing and marking land. It provides a basis for a clear, unambiguous title to land, together with the physical means by which that title can be related to the land it describes. The system is ingenious, being simple and easy to comprehend and administer; and without it, the nation would unquestionably have been poorer. The "rectangular" land survey system, however, has one serious flaw. Its use requires the perpetuation of monuments set by the original government surveyors, the positions of which are not precisely related to the surface of the earth through a scientifically established map projection.

State Plane Coordinate System: A strictly scientific control survey system designed to

Figure 1



Source: National Research Council and SEWRPC.

provide the basic control for all federal, and most private, topographic and other earth science mapping operations exists separate from the U. S. Public Land Survey System in the triangulation and traverse stations established by the National Geodetic Survey (formerly U. S. Coast and Geodetic Survey). The triangulation and traverse stations established by this agency comprise a nationwide network connecting thousands of monumented points whose geodetic positions, expressed in terms of latitude and longitude, are known. In order to make the National Geodetic Survey control network more readily available for local use, the U. S. Coast and Geodetic Survey devised the State Plane Coordinate System in 1933. This system transforms the spherical coordinates, latitudes and longitudes, of the stations established in the national geodetic survey into rectangular coordinates, eastings and northings, on a plane surface. This plane surface is mathematically related to the spheroid on which the spherical coordinates of latitude and longitude have been determined. The mutual relationship, which makes it practicable to pass with mathematical precision from a spherical to a plane coordinate system, makes it also practicable to utilize the precise scientific data of the National Geodetic Survey control network for the reference and control of local surveying and mapping operations. A limitation on such uses, however, is imposed by the relatively widespread location of the basic triangulation and traverse stations and the difficulties often encountered in the recovery and use of these stations.

Large-Scale Base Maps

To satisfy the growing need for an integrated, land-related information base, a system capable of handling a variety of information ranging from such earth science-related data as flood hazard boundary line locations, to such cadastral-related data as real property boundary line locations, is required. It is also mandatory that field work, data resolution, and information presentation be consistent with the most detailed level of land-related decision-making, that of the individual proprietary parcel. These requirements call for base maps at scales significantly larger than those generally available in the United States as the second component of a multipurpose cadastre. These maps should be topographic maps showing in their correct location and orientation the principal natural and cultural features of the area concerned and the elevation and configuration of the surface of the earth.

Cadastral Overlay

The third component of a multipurpose cadastre is the cadastral overlay. Preparation of the cadastral overlay requires identifying and delineating the most fundamental unit of land, a cadastral parcel. This unit of land becomes the basic building block for maintaining real property boundary line-related information, including information on rights and interests. A cadastral parcel is, therefore, an unambiguously and uniquely defined unit of land within which rights and interests are legally recognized and for which there is a unique and complete group of rights. The primary type of interest, for this definition, is land ownership associated with that set of rights and interests that may be acquired and transferred.

Parcel Number

The fourth component of a multipurpose cadastre is the parcel identifier, defined as a code for recognizing, selecting, identifying, and arranging information to facilitate storage and retrieval of parcel records. It may also be used for spatial referencing of information and as a means for referring to a particular parcel in lieu of a full legal description. There is general agreement that the identifier system used should provide for the assignment of a unique code to each parcel, should be easily understandable and usable to the general public, or at least to that segment of the public that may have cause to use the system, should be capable of serving a variety of different uses, and should be reasonably permanent.

Land Information Files

The fifth and last component of a multipurpose cadastre consists of the land information files, or land data files, which contain facts about the land parcel in question and are related to the cadastral map through the parcel identifier. The various types of information that may be compiled about the land are potentially voluminous, and may include information about both natural and cultural, that is, man-made, features of the parcel. Perhaps the most familiar land information files are those of local land-title records systems and tax assessment and collection records systems.

EXISTING FRAMEWORK FOR THE DEVELOPMENT OF MULTIPURPOSE CADASTRES WITHIN SOUTHEASTERN WISCONSIN

The first three elements of the procedural model for the creation of a multipurpose cadastre as proposed by the National Research Council have long been embodied in the Regional Planning Commission's recommended large-scale base mapping program. Recognizing the importance of good large-scale maps and attendant survey control to sound community development and redevelopment, the Commission has, for almost three decades, encouraged the preparation of large-scale topographic and cadastral maps within its 2,689-square-mile Planning Region. These maps are based on a unique system of survey control that combines the best features of the U. S. Public Land Survey System and State Plane Coordinate System. The large-scale maps and attendant control survey system, where they already exist, provide, in a highly cost-effective manner, the technical foundation for the creation of multipurpose cadastres within the Region. Because of their critical and central importance to the implementation of a multipurpose cadastre, these three elements, the geodetic reference frame, large-scale base maps, and the cadastral overlays, are discussed in greater detail in the following sections.

A Composite System for the Geodetic Reference Framework

From the preceding brief discussion of the U. S. Public Land Survey and State Plane Coordinate Systems, it is apparent that two essentially unrelated control survey systems have been established in the United States by the federal government. One of these, the U. S. Public Land Survey System, is founded in the legal principles

of real property description and location and was designed primarily to provide a basis for the accurate location and conveyance of ownership rights in land. The other, the State Plane Coordinate System, is founded in the science of geodesy and was designed primarily to provide a basis for earth science mapping operations and for the conduct of high-precision scientific and engineering surveys over large areas of the earth's surface. Both systems have severe inherent limitations for use as a geographic framework for a local land data system. By combining these two separate survey systems into one integrated system, however, an ideal system for the geometric control required for land data systems is created.¹ This ideal system includes the relocation and monumentation of all U. S. Public Land Survey section and quarter-section corners, including the centers of sections, within the geographic area for which the land data system is to be created, and the utilization of these corners as stations in second order traverse and level nets, both nets being tied to the National Geodetic Datum. The traverse net establishes the precise geographic positions of the U. S. Public Land Survey corners in the form of state plane coordinates, while the level net establishes the precise elevation above mean sea level of the monuments marking the corners.

Such a system of survey control has at least the following three advantages as a geographic framework for a multipurpose cadastre:

1. It provides an accurate system of control for the collection and coordination of cadastral data, since the boundaries of the original government land subdivision form the basis for all subsequent property divisions and boundaries. As all subsequent legal descriptions and plats must be tied to the U. S. Public Land Survey System, accurate reestablishment and monumentation of the quarter-section lines and corners permits the ready compilation of accurate property boundary line data

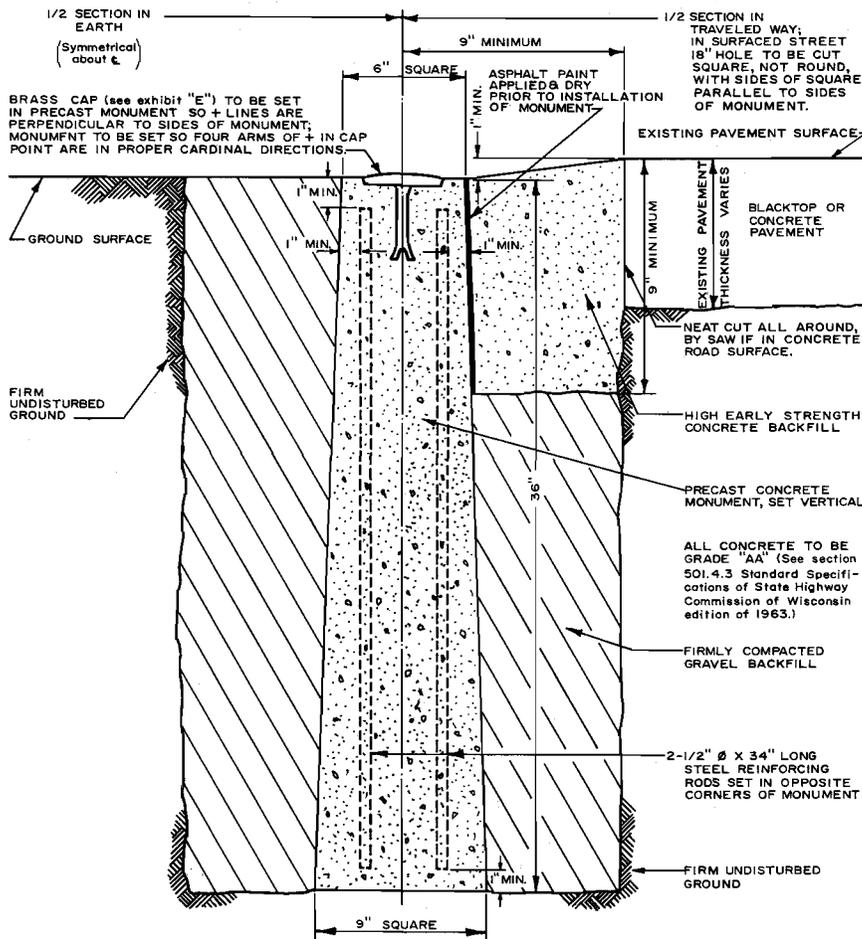
and the ready maintenance of these data in current form over time. These data can be readily and accurately updated and extended since, in Wisconsin, all new land subdivisions must by law be tied to corners established in the U. S. Public Land Survey, and since the accuracy of the surveys for these subdivisions can be readily controlled by state and local land subdivision regulations. The recommended survey control system thus fully meets the needs of a narrowly defined cadastre for the fiscal and legal administration of real property, yet this cadastre can be developed readily and soundly into a multipurpose land data system.

2. It provides a common system of control for the collection and mapping of both cadastral and earth science data. By relocating the U. S. Public Land Survey corners and accurately placing them on the State Plane Coordinate System, it becomes possible to accurately correlate real property boundary line information with earth science data. This placement of property boundary and earth science data on a common datum is absolutely essential to the sound development of any multipurpose land data system. Yet such a common control datum is rarely used. The establishment of state plane coordinates for the U. S. Public Land Survey corners permits the correlation with mathematical precision of data supplied by aerial and other forms of earth science mapping with property boundary line data compiled through the usual land surveying methods. Only through such a common geometric control system can all of the information required for a multipurpose land data system be accurately collected for, and correlated in, the system.
3. It permits lines and areas entered into the data base, whether these lines represent the limits of land to be reserved for future public uses, the limits of land to be taken for immediate public use, the limits of districts to which public regulations are to be applied, or the location and alignment of proposed new property boundary lines or of proposed constructed works, to be accurately and precisely reproduced upon the ground.

¹See K. W. Bauer, "Geometric Framework for Land Data Systems," *Journal of the Surveying and Mapping Division, Proceedings of the American Society of Civil Engineers, Volume 107, Number SU1, November 1981.*

Figure 2

DETAIL OF MONUMENT INSTALLATION
FOR SURVEY CONTROL STATIONS



DRAWN BY: L.H.K.
CHECKED BY: D.R.B.

NOT TO SCALE

APPROVED BY: K.W.B.
DATE: NOVEMBER 1967

Source: SEWRPC.

Commission Specifications for
Geometric Framework and Base Maps

As already noted, the Regional Planning Commission has, since 1961, promoted the preparation of large-scale topographic and cadastral base maps based upon a control survey system which combines the U. S. Public Land Survey and State Plane Coordinate Systems. The maps and attendant control survey system, in addition to providing essential municipal planning and engineering tools, were intended to provide the foundation for the eventual development of automated, multipurpose cadastres within the Planning Region. The following discussion

describes the specifications underlying the Commission-recommended system of control surveys, topographic base mapping, and cadastral mapping.

Specifications for Relocation, Monumentation, and Coordination of U. S. Public Land Survey

Corners: The Commission specifications governing the creation of the necessary survey control network requires the relocation of all U. S. Public Land Survey corners in the areas to be mapped, and the marking of the relocated corners by reinforced concrete monuments, having engraved bronze caps imbedded in the tops (see Figures 2 and 3). The bronze caps are inscribed with the corner notation, quarter section, town, and range. The monuments placed are referenced by ties to at least four witness marks. The specifications require that the survey engineer and land surveyor provide a dossier on each control station established in order to permit its ready recovery and use. The dossier sheets provide for each station a sketch showing the monument erected in relation to the salient features of the immediate vicinity, all witness monuments together with ties, the state plane coordinates of the corner, its U. S. Public Land Survey description, the elevation of the monument, and the location of appurtenant reference benchmarks referred to National

Geodetic Vertical Datum of 1929 (see Figure 4). These dossier sheets are recorded with the County Surveyor, as well as with the Commission, and are thereby readily available to all land surveyors and public works engineers operating in the area mapped.

The specifications require the control survey data to be summarized by means of a control survey summary diagram showing the exact grid and ground lengths and grid bearings of the exterior boundaries of each U. S. Public Land Survey quarter section; the area of each quarter section; all monuments erected; the number of

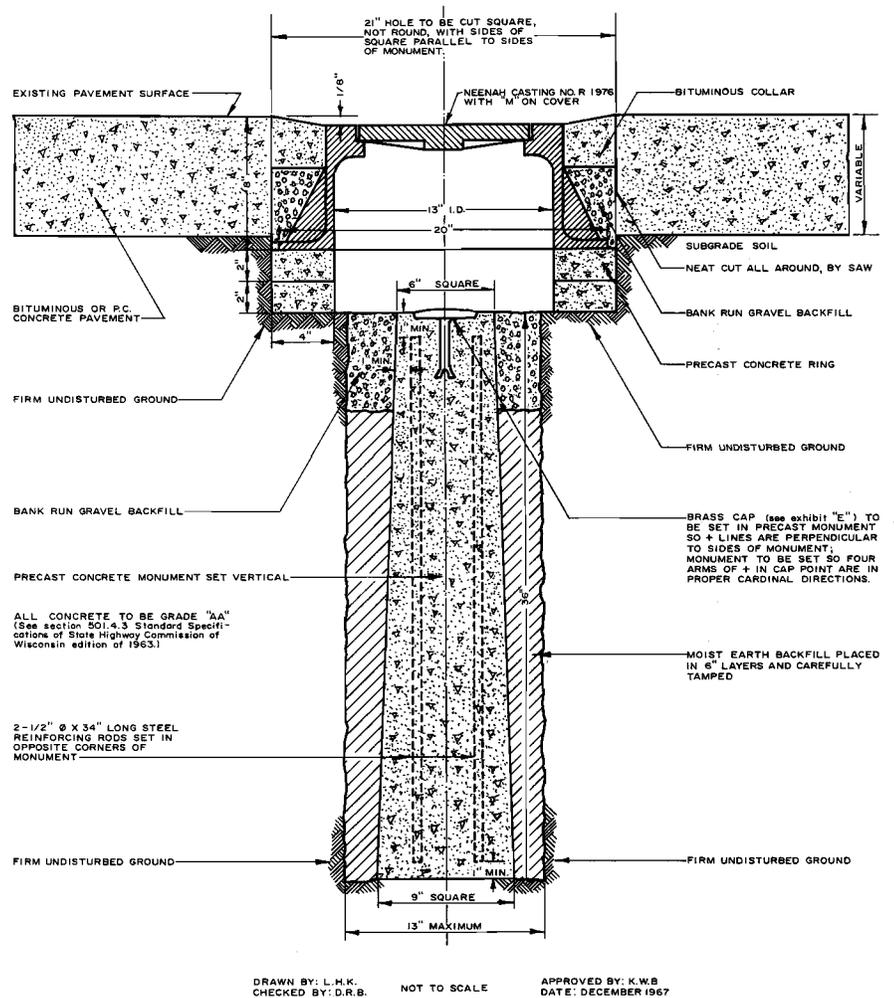
degrees, minutes, and seconds in the interior angles of each quarter section; the state plane coordinates of all quarter-section corners together with their Public Land Survey System identification; the benchmark elevations of all monuments set; and the basic National Geodetic Survey control stations utilized to tie the Public Land Survey corners to the horizontal geodetic control datum, together with the coordinates of these stations. The angle between geodetic and grid bearing is noted, as is the combination sea-level and scale-reduction factor (see Figure 5).

All the work necessary to execute the control surveys and provide the finished topographic maps described below has been done in southeastern Wisconsin on a negotiated contract basis with an experienced photogrammetric and control survey engineer. In this regard, it was considered essential to retain a photogrammetric and control survey engineer familiar with higher order field methods and procedures and with the attendant geodetic survey computations and adjustments, and whose crews were properly equipped with state-of-the-art survey instruments. Electronic distance-measuring equipment was employed in the work, as well as optically reading theodolites and appurtenant traverse equipment, automatic levels, and precision level rods. Indeed, the control survey system used is made economically feasible only through the application of these relatively recently developed instruments, particularly the electronic distance-measuring devices.

The specifications governing the work make the photogrammetric engineer responsible for overall supervision and control of the mapping work, as well as for the quality of the finished maps. In Walworth County the specifications should also require that the actual relocation of the public land survey corners be done by, or under

Figure 3

DETAIL OF ALTERNATIVE CONTROL SURVEY MONUMENT INSTALLATION IN SURFACE TRAVELLED WAY OF STREETS AND HIGHWAYS

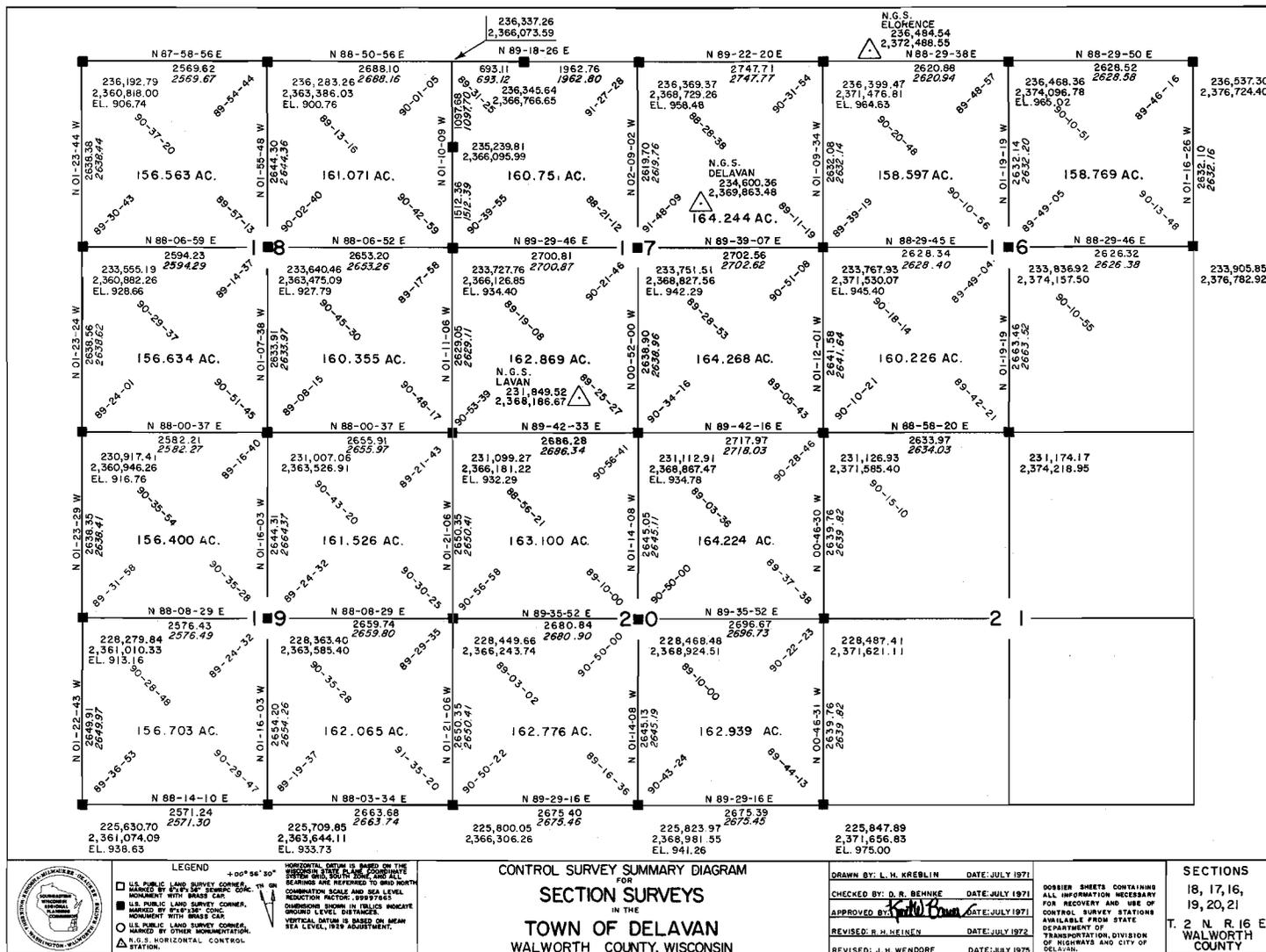


Source: SEWRPC.

the supervision of, the County Surveyor. The specifications thereby recognize that this portion of the work requires expert knowledge of local survey custom and boundary and title law, as well as the assembly and careful analysis of all authoritative survey information, such as title documents and attendant legal descriptions, land subdivision plats and certified survey maps, survey records, and, of cardinal importance, records on existing land survey monumentation and land occupation, in order to arrive at the best possible determination of the location of the land survey corners. In the areas mapped, the land survey portion of the control survey work requires a very high degree of professional

Figure 5

A TYPICAL CONTROL SURVEY SUMMARY DIAGRAM



Source: SEWRPC.

maps showing, in addition to the state plane coordinate grid, the U. S. Public Land Survey section and quarter-section lines and corners in their correct position and orientation, together with the attendant ground lengths and grid bearings, and such salient planimetric detail and hydrographic features as may be helpful in the subsequent plotting of real property boundary lines, including railway tracks, electric power transmission lines, principal structures, wetlands, and such hydrographic features as streams and lakes.

Utilizing recorded subdivision plats, certified survey maps, and legal descriptions, all real property boundary lines, including street right-of-way lines and major utility easement lines, are then constructed on the base sheets working within the framework of control provided by the ground lengths and grid bearings of the U. S. Public Land Survey quarter-section lines. The property boundary lines are constructed in a manner that parallels the location of these lines on the surface of the earth following land surveying practice in the State of Wisconsin. The

specifications require that all real property boundary lines be plotted within 1/30 inch of their true position based on analysis of all authoritative information available. Dimensions are shown for all platted areas as shown on the recorded subdivision plats. Wisconsin Statutes have long required that such plats be prepared to an accuracy of 1 part in 3,000, as compared to the accuracy of 1 part in 10,000 required by the specifications for the basic survey control network. Any overlaps or gaps between adjoining property boundary lines, as indicated by the constructions and plotting of those lines, are noted on the cadastral maps. Finally, a cadastral parcel identification number is added.

The property boundary line maps thus show the ground length and grid bearing of all quarter-section lines; the state plane coordinates of all quarter-section corners; the monuments marking these corners; the recorded dimensions of all street lines, alley lines, and boundaries of public property; recorded street widths; platted lot dimensions; and a parcel identification number. In unplatted areas, real property boundaries are shown by scale alone. Railway tracks, electric power transmission lines, principal structures, fences, wetlands, lakes, streams, and drainage ditches are also shown (see Figure 7). As previously noted, these boundary line maps can be readily and accurately updated and extended as new land subdivision plats and certified map surveys, utilizing the survey control, are made and recorded.

Status of Survey Control, Large-Scale Topographic Base Mapping, and Cadastral Mapping in Walworth County

As previously noted, the Regional Planning Commission Commission has long recognized the importance of good large-scale maps to the proper administration of local government functions and has encouraged counties, cities, and villages within the Region to prepare such maps. Over the last 25 years, four local units of government in Walworth County—the Cities of Delavan, Elkhorn, and Lake Geneva and the Village of East Troy—have undertaken large-scale base mapping projects, carrying out those projects according to Commission-recommended specifications (see Table 1). These four projects included the relocation, monumentation, and placement on the State Plane Coordinate System of those U. S. Public Land Survey corners

included in the mapped areas. Collectively, these four municipalities have mapped a total of 27.5 square miles, or about 5 percent of the 578-square-mile County area (see Map 4). While each of the four municipal-sponsored mapping projects resulted in the preparation of large-scale planimetric and topographic base maps, none of the four projects was carried forward to include the preparation of companion cadastral maps. Accordingly, no part of Walworth County is yet covered by large-scale cadastral maps prepared to Commission-recommended specifications.²

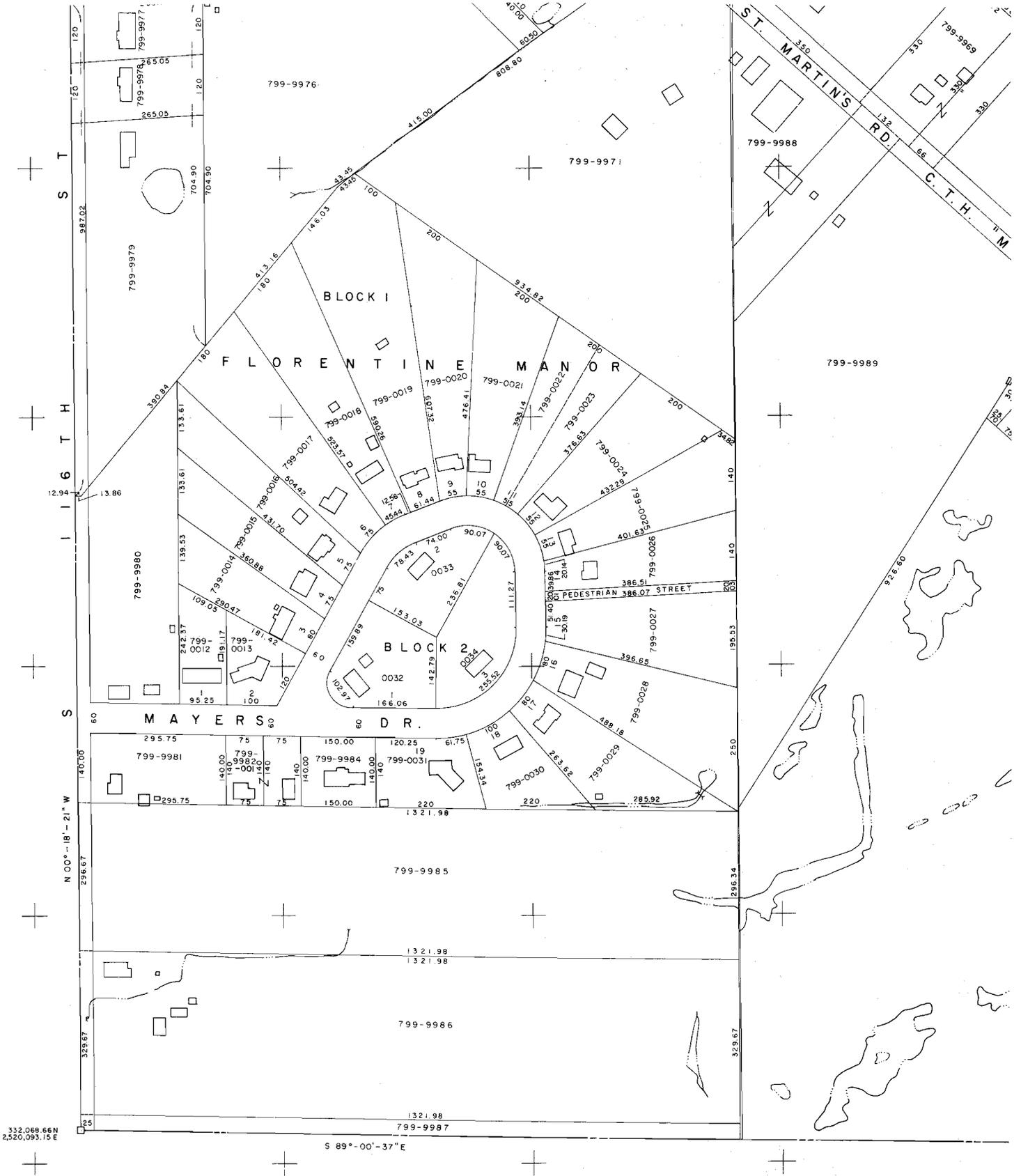
In addition to the four municipal-sponsored mapping projects, the Wisconsin Department of Transportation, as a part of the Rock Freeway project, carried out a mapping program to Commission-recommended specifications, but did not relate the resultant map sheets to the U. S. Public Land Survey sections. Rather, those map sheets were prepared in strip fashion along the Rock Freeway corridor. Since the maps were prepared prior to the construction of the freeway, they are of limited utility today.

Each of the four municipal base mapping programs, as well as the Wisconsin Department of Transportation Rock Freeway mapping program, involved the relocation and monumentation of U. S. Public Land Survey corners, together with the establishment of horizontal and vertical control survey data attendant to such corners. In addition, Kenosha, Racine, and Waukesha Counties, through county based large-scale mapping programs, have accomplished survey control work attendant to U. S. Public Land Survey corners along common boundaries with Walworth County. As shown in Table 2, there are an estimated total of 2,560 U. S. Public Land Survey section and quarter-section corners in Walworth County, including the centers of the sections. Under the mapping efforts completed through December 1990 collectively by the four local units of government in Walworth county,

²The Walworth County Tax Lister maintains a series of diagrams for the entire County which depict the location of subdivisions, certified survey maps, metes and bounds parcels, and public rights-of-way. Such diagrams are not true maps, being constructed for each U. S. Public Land Survey section on the basis of an assumed 5,280-foot square.

Figure 7

A PORTION OF A TYPICAL CADASTRAL MAP PREPARED IN ACCORDANCE WITH THE COMMISSION-RECOMMENDED SPECIFICATIONS



Source: SEWRPC.

Table 1

MUNICIPAL LARGE-SCALE BASE MAPPING PROJECTS IN WALWORTH COUNTY
CARRIED OUT ACCORDING TO SEWRPC-RECOMMENDED SPECIFICATIONS

Project Sponsor	Year	Area Mapped (square miles)	Scale	Planimetric and Topographic Maps	Cadastral Maps
City of Delavan	1969	7.00	1" = 200'	Yes	No
Village of East Troy	1971	3.75	1" = 100'	Yes	No
City of Lake Geneva	1975	7.75	1" = 200'	Yes	No
City of Elkhorn	1979	9.00	1" = 200'	Yes	No

Source: SEWRPC.

the bordering counties, and the Wisconsin Department of Transportation, a total of 266 corners, or about 10 percent of the County total, have been relocated and monumented and fully coordinated through the establishment of horizontal and vertical control survey data to Commission specifications. In addition, the Wisconsin Department of Transportation through its ongoing highway programs, as well as bordering counties, have relocated and monumented and established horizontal control survey data for a total of 200 additional corners in Walworth County. Finally, the Walworth County Surveyor, through a remonumentation program carried out annually as part of the County highway program, and others have relocated and monumented an additional 1,312 survey corners.³ Thus a total of 1,778 corners, or about 70 percent of all U. S. Public Land Survey corners within the County, have been monumented; a total of 466 corners, or about 18 percent of all corners within the County, have been placed on the State Plane Coordinate System; and a total of 266 corners, or about 10 percent of all corners within the County, have elevations established to National Geodetic Vertical Datum.

³The "others" in this reference includes the Wisconsin Department of Transportation and local surveyors working in Walworth County.

Needs Assessment

Given the conceptual framework of a multipurpose cadastre as set forth by the National Research Council and as summarized earlier in this chapter, given the progress made to date in developing the foundation elements necessary for the creation of a modern land records system, and given local perceptions of desirable activities, the following basic needs exist within Walworth County:

1. Completion of the Geodetic Reference Framework

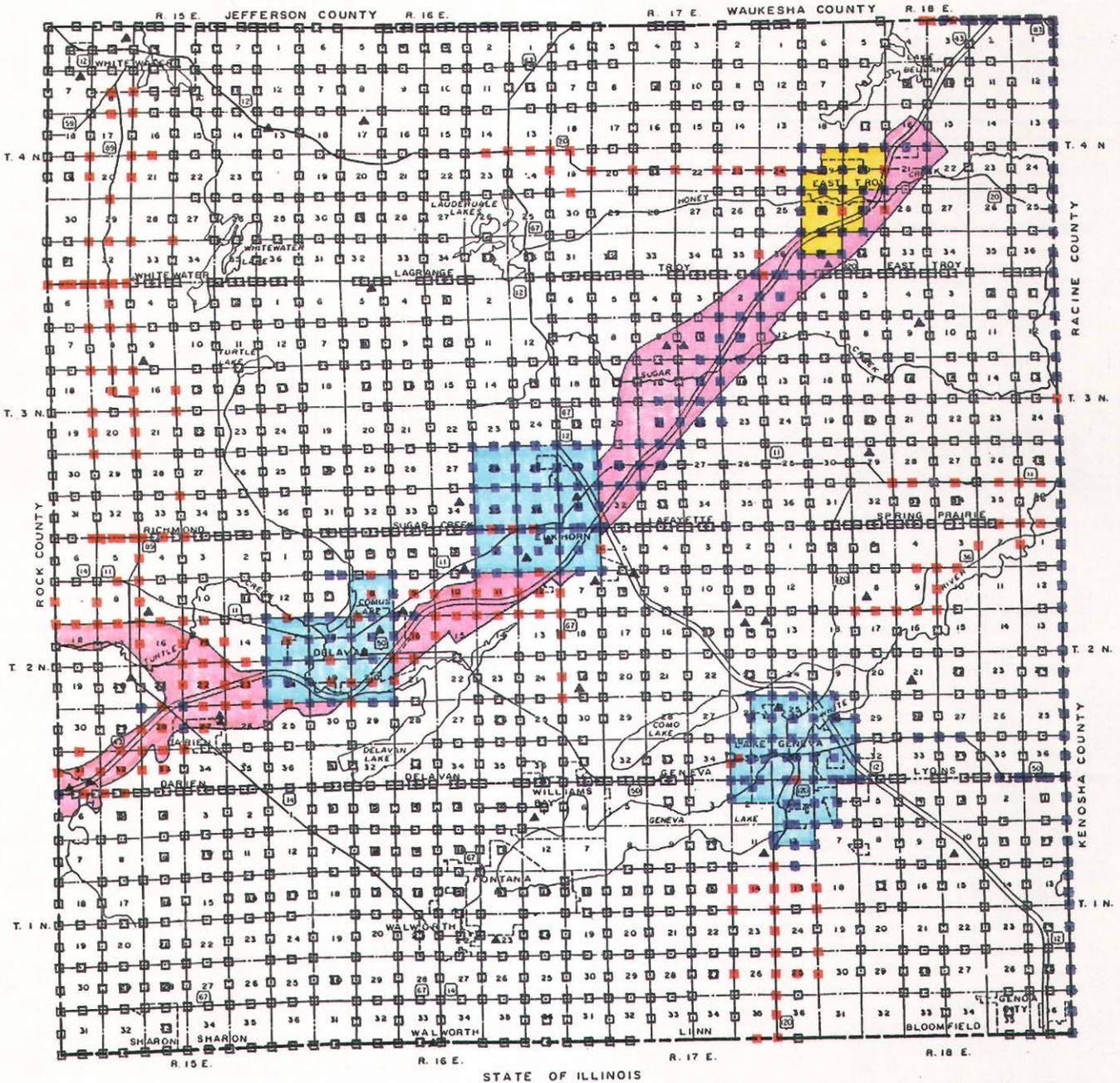
The most basic need to be addressed in the Walworth County land information system plan is the completion of the geodetic reference framework which combines the U. S. Public Land Survey System and the State Plane Coordinate System. More particularly, a need exists to relocate and monument the remaining 782 U. S. Public Land Survey section and quarter-section corners, including centers of sections, that have not been so monumented to date; to obtain horizontal survey control data attendant to 2,094 U. S. Public Land Survey corners where such data have not been established to date; and to obtain vertical survey control data attendant to the 2,294 U. S. Public Land Survey corners where such data have not been obtained to date.

2. Creation of an Automated Tract Index

A need exists to create an automated tract index to facilitate the identification and

Map 4

STATUS OF SURVEY CONTROL NETWORK AND LARGE-SCALE MAPPING IN WALWORTH COUNTY: JANUARY 1990



LEGEND

U. S. PUBLIC LAND SURVEY CONTROL NETWORK

- CORNER RELOCATED AND MONUMENTED
- CORNER RELOCATED AND MONUMENTED; HORIZONTAL CONTROL ESTABLISHED
- CORNER RELOCATED AND MONUMENTED; HORIZONTAL AND VERTICAL CONTROL ESTABLISHED
- ▲ USC & GS TRIANGULATION OR TRAVERSE STATION

LARGE-SCALE PLANIMETRIC AND TOPOGRAPHIC MAPPING

- MAP SHEETS COMPILED BY U. S. PUBLIC LAND SURVEY ONE-QUARTER SECTION; 1" = 100' SCALE, 2' CONTOUR INTERVAL
- MAP SHEETS COMPILED BY U. S. PUBLIC LAND SURVEY ONE-QUARTER SECTION; 1" = 200' SCALE, 2' CONTOUR INTERVAL
- MAP SHEETS UNRELATED TO U. S. PUBLIC LAND SURVEY SYSTEM; 1" = 200' SCALE, 2' CONTOUR INTERVAL

Source: Walworth County Surveyor and SEWRPC.

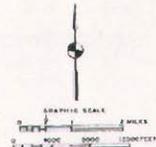


Table 2

**STATUS OF U. S. PUBLIC LAND SURVEY
CORNER MONUMENTATION AND CONTROL
SURVEY PROGRAM IN WALWORTH COUNTY
FEBRUARY 1991**

Item	Amount
Estimated Total Corners ^a	2,560
Corners Relocated and Monumented and Horizontal and Vertical Control Established by:	
Wisconsin Department of Transportation	96
Bordering Counties	59
Local Governments	111
Total ^b	266
Percent of Total Corners	10.4
Corners Relocated and Monumented and Horizontal Control Established by:	
Wisconsin Department of Transportation	186
Bordering Counties	4
Local Governments	10
Total ^b	200
Percent of Total Corners	7.8
Corners Relocated and Monumented by:	
Walworth County ^c	1,022
Others	290
Total	1,312
Percent of Total Corners	51.3
Summary	
Corners Relocated and Monumented	1,778
Percent of Total	69.5
Corners with Horizontal Control	466
Percent of Total	18.2
Corners with Vertical Control	266
Percent of Total	10.4

^aIncludes all corners along bordering counties.

^bMany of the corners for which control surveys were completed by WisDOT and local units of government were monumented by the Walworth County Surveyor.

^cWalworth County has also relocated and marked with a temporary iron pipe a total of 84 corners.

Source: SEWRPC.

retrieval of any deed, mortgage, or other instrument affecting the title to or referring to any quarter section; sectional lot; town, city, or village lot; or other subdivision of land in the County. The creation of such an index would facilitate the determination of

ownership and other interests in land by both County staff and the general public, improving the current indexing systems.

3. Parcel Number

A need exists to assign common parcel identifiers to all real property ownerships, and to facilitate the storage and retrieval of various parcel-related data. The existing parcel identification system in Walworth County needs to be reviewed and revised with reference to the data interchange standard attendant to parcel numbering systems promulgated by the Wisconsin Land Information Board.

4. Large-Scale Base Maps

A need exists to complete large-scale topographic base maps throughout Walworth County. As noted earlier in this chapter, only about 5 percent of the area of Walworth County has been so mapped.

5. Cadastral Overlay

A need exists to prepare cadastral maps for the entire area of the County. Such maps should be prepared as "overlays" to the topographic maps in order to permit the accurate correlation of earth science and cadastral information.

6. Land Information Files

A need exists to create a series of land information files containing needed information related to the topographic and cadastral maps through the parcel identifiers.

In considering the foregoing needs assessment, the following limitations and considerations should be taken into account:

1. Experience to date indicates that there will be insufficient fiscal resources to meet all of the stated needs. Accordingly, it is intended to direct available county resources toward meeting first the most basic need, that identified with respect to the geodetic reference framework. Insofar as Walworth County as a unit of government is concerned, only after that basic need is satisfied would county resources be directed toward meeting the large-scale base mapping, cadastral mapping, parcel identification, and eventually land information file needs.

2. With the geodetic reference framework in place, local units of government in Walworth County, in some cases in cooperation with public and private utilities, will be able to undertake subcounty area work efforts designed to complete the conceptual multipurpose cadastre framework, moving ahead at their own pace. Such efforts could be aided by state grants from the Wisconsin Land Information Board provided that the locally proposed work efforts would meet the program standards specified in Chapter IV of this report. In the cases of the communities of Delavan, East Troy, Elkhorn, and Lake Geneva, the local communities concerned have already invested in the preparation of the large-scale planimetric and topographic base maps. Accordingly, supplemental efforts in those communities could be concentrated on the cadastral overlay, the parcel identification, and the land information file elements. With those elements completed, conversion of the mapped data to digital form could be undertaken and hardware and software obtained to complete an automated mapping system.
3. Insofar as Walworth County as a unit of government is concerned, this approach would not result in a fully operational automated mapping system at the county level, and thereby would not in the near future meet, for example, planning and zoning automated mapping needs at the county level. Over time, however, it is envisioned that, as subareas of the County are completed by local governments and utilities, Walworth County may decide to invest in base and cadastral mapping and in the completion of the land information files so that ultimately a countywide automated land information system would evolve.⁴

SUMMARY

This chapter presents a description of the major elements of a multipurpose, parcel-based land information system, placing that system within the more general context of geographic information systems. In addition, this chapter summarizes the work that has been accomplished in Walworth County to date to provide the essential base for the establishment of an automated

mapping and land information system for the County. The following summarizes the material included in this chapter:

1. A multipurpose cadastre can be conceptualized as a public, operationally and administratively integrated, parcel-based land information system which provides for continuous, readily available, and comprehensive land-related information at the parcel level. The National Research Council has proposed that multipurpose cadastral systems consist of the following five elements: 1) a geographic reference frame consisting of a geodetic network; 2) a series of current, accurate, large-scale topographic base maps properly related to the geographic reference frame; 3) a cadastral map overlay delineating all cadastral parcels, which is also properly related to the geographic reference frame; 4) a unique identifying number assigned to each parcel; and 5) a series of registers, or land data files, each

⁴*It should not be expected that properly designed countywide automated land information systems can be developed quickly given fiscal resource constraints. By way of comparison, Kenosha and Milwaukee Counties have been making steady investments in building a foundation for an automated land information system for nearly 30 years. Consequently, with the geodetic reference framework and large-scale base mapping largely in place, Kenosha and Milwaukee Counties are now able to focus resources on completing cadastral mapping and parcel identification and, in the case of Kenosha County, also on building basic land information files useful for countywide planning and zoning. Viewed within the conceptual framework of the multipurpose cadastre outlined in this chapter, Kenosha County intends to complete by the mid-1990s all five elements of the cadastre framework. Milwaukee County has made a policy decision to complete the first four of the five elements, leaving to local units of government and utilities the fifth element dealing with land information files. The approach suggested for Walworth County within the time frame of this planning effort is that the County concentrate on completing the most basic element dealing with the geodetic reference framework, allowing local governments and/or utilities to proceed at their own pace in developing the rest of the system as their resources permit.*

including a parcel index for purposes of information retrieval and cross-referencing with information in other land data files.

2. The first three elements of the procedural model for the creation of a multipurpose cadastre as proposed by the National Research Council have long been embodied in the Regional Planning Commission-recommended large-scale base mapping and attendant survey control program. Recognizing the importance of good large-scale maps and attendant survey control to sound community development and redevelopment, the Commission has for almost three decades encouraged the preparation of large-scale topographic and cadastral maps within its 2,689-square-mile Planning Region. These maps are based on a unique system of survey control that combines the best features of the U. S. Public Land Survey System and State Plane Coordinate System. The large-scale maps and attendant control survey system, where they already exist within the Region, provide in a highly cost-effective manner the technical foundation for the creation of multipurpose cadastrals within the Region, providing the first two of the five elements of such a cadastre, and a part of the third element.
3. Through large-scale mapping programs conducted by the Cities of Delavan, Elkhorn, and Lake Geneva and the Village of East Troy, about 27.5 square miles, or about 5 percent of the 578-square-mile area of Walworth County, has been mapped to Commission-recommended specifications, although none of the four projects included the preparation of companion cadastral maps. Each of the four municipal projects included the relocation, monumentation, and placement on the State Plane Coordinate System of those U. S. Public Land Survey corners included in the mapped area. Within the context of the conceptual framework of a multipurpose cadastre, then, two of the five elements, geodetic reference framework and large-scale base maps, have been completed for these portions of Walworth County.
4. There are an estimated total of 2,560 U. S. Public Land Survey section and quarter-section corners in Walworth County,

including the centers of the sections. Taking into account the mapping efforts conducted by the four local units of government noted above, as well as efforts by the Wisconsin Department of Transportation and the Walworth County Surveyor, a total of 266 corners, or about 10 percent, have been relocated and monumented and fully coordinated through the establishment of horizontal and vertical survey control data to Commission specifications. An additional 200 corners have been relocated and monumented with attendant horizontal control survey data. An additional 1,312 corners have been relocated and monumented by the Walworth County Surveyor; however, no horizontal or vertical control survey data have been established for such corners. In total, then, 1,778 corners, or about 70 percent of all corners in the County, have been monumented; 466 corners, or about 18 percent of all corners in the County, have been placed on the State Plane Coordinate System; and 266 corners, or about 10 percent of all corners in the County, have elevations established to National Geodetic Vertical Datum.

5. Three basic needs should be addressed at this time in the Walworth County land information system plan. These consist of the completion of the geodetic reference framework based on the U. S. Public Land Survey Section system and State Plane Coordinate System; the creation of an automated tract index; and the establishment of a parcel numbering system to meet the guidelines established by the Wisconsin Land Information Board. Available county resources should be addressed first toward meeting these most basic needs.
6. Local units of government in Walworth County, perhaps in cooperative efforts with private utilities, can develop fully operational automated mapping and land information systems, building upon the County-supplied geodetic reference framework. Depending upon resources available, local units of government can move ahead at their own pace to complete the remaining elements of the conceptual framework of a multipurpose cadastre, including large-scale base maps where such maps have not already been prepared, cadastral overlays, parcel identifiers, and land information files.

Chapter IV

RECOMMENDED AUTOMATED MAPPING AND LAND INFORMATION SYSTEM FOR WALWORTH COUNTY

INTRODUCTION

The previous chapters of this report have presented an overview of the current status of automated mapping and land information system capability within Walworth County and have identified the National Research Council model for the creation of automated cadastres as the suggested model for the development of a multipurpose, multi-user automated mapping and land information system in Walworth County. The elements of such a system have been identified and the status of implementation of those elements within Walworth County has been reported.

This chapter sets forth a recommended automated mapping and land information system plan for Walworth County. The chapter begins with a statement of goals and objectives and follows with sections on the planning time period; system development standards; a multi-year program to begin to build the land information system, including consideration of system development costs and sources of potential revenue; and proposed organizational arrangements to carry out the program.

PROGRAM GOALS AND OBJECTIVES

The Walworth County land information system planning effort seeks to meet the following two basic goals:

1. To implement, over time, in Walworth County a multipurpose, multi-user, parcel-based, automated mapping and land information system which follows the National Research Council model and consists of the following five basic elements:
 - a. Geodetic reference framework.
 - b. Large-scale planimetric and topographic base maps.
 - c. Overlays, including cadastral boundaries and boundaries of various cultural and natural areas.

- d. Identifiers, including parcel numbers and codes associated with various cultural and natural areas.
- e. Nonspatial land information files, including cadastral parcel records and various cultural and natural resource data.

2. To reach agreement among Walworth County, the local units of government in Walworth County, and the various public and private utilities operating in Walworth County on the design of a common automated mapping and land information system to ensure economy and efficiency in the development and use of that system and to ensure the ready entry, retrieval, and exchange of data by and between the various users of the system.

To meet these two goals, the following are the specific objectives of the current planning effort:

1. To lay out a course of action that will focus available fiscal resources on efforts to continue the development of the geodetic reference framework throughout the entire County, to create an automated tract index for the County, and to revise the parcel identification system in the County in accordance with the guidelines for parcel numbering systems set forth by the Wisconsin Land Information Board.
2. To encourage local units of government in Walworth County who desire to move at a more rapid pace toward establishing an automated mapping and land information system for local government use to commit additional fiscal resources toward that end; recommending, however, that such resources be expended for work efforts which meet the agreed-upon system development standards.
3. To facilitate applications by Walworth County and by local units of government in Walworth County for state grants in support of the development of the recom-

mended automated mapping and land information system for Walworth County.

4. To encourage partnership efforts between public sector governments and utilities and private sector utilities that will contribute toward the development of the recommended automated mapping and land information system for Walworth County.

PLANNING PERIOD

The planning period for this initial land information system plan for Walworth County is the six-year period beginning January 1, 1991, and extending through December 31, 1996. This planning period corresponds with the current Wisconsin Statutes regarding the Wisconsin Land Information Program and its funding through supplemental Register of Deeds recording and filing fees.

RECOMMENDED STANDARDS

When discussing the design of an automated mapping and land information system, it is often assumed that the "system" is the computer hardware and software and that the "system" is physically centralized, that is, a single hardware configuration upon which reside all of the digital maps and associated land information of all system users. Users of this type of system operate in terminal fashion from the central computer. For many years, this type of operation was, in large part, dictated by the available computer technology. Recent advances in computer hardware and software technology, particularly decreasing unit costs for computational and mass data storage capability, networking between the hardware of different vendors, and translation capability of digital map data between some different proprietary software products, now permit a different type of "system" to be specified; that is, one in which the system users share digital maps and an agreed-upon set of map-related information, but maintain their own either separate or distributed computing capability.

If the centralized system concept is discarded, then a number of issues that have in the past been impediments to the development of shared automated mapping and land information systems are no longer obstacles. These are the

organizational structure and the cost allocation among participants of a centralized operation and the maintenance of data security on "proprietary" files in a centralized operating environment.

More importantly, perhaps, the ability to replace the centralized operating concept with a distributed operating concept permits attention to be focused on the true system components of an automated mapping and land information system. In a distributed operating environment, the "system" is not defined in terms of hardware and software, but in terms of an agreed-upon set of procedures and specifications for the production and maintenance of a basic set of digital maps and map-related information, and an agreed-upon set of procedures and specifications for the interchange of these data between system users. It must be stressed that no amount of state-of-the-art computer technology can compensate for the absence of a robust set of specifications and standards for those elements to be used in common.

The following recommended standards for an automated mapping and land information system for Walworth County assume that the following set of elements would be developed for joint use: a survey control network, large-scale topographic base maps, and a cadastral map overlay with parcel identifiers. Discussions held over the past several years among local operators of automated mapping systems indicate that these elements together represent a set of map feature information common to most of the users. The provision of a common automated mapping base in this manner would provide a base sufficient to support a wide variety of uses, including county and local government and utility preliminary site engineering, outside plant utility network mapping, the design and construction of public and private works, planning and zoning administration, vehicle routing, emergency services provision, and tax assessment, various types of statistical analyses, among others. It is envisioned, however, that more specialized applications would be developed by the users either singly or in small groups as may be appropriate or necessary, rather than being jointly developed.

System Accuracy

The issue of map accuracy in a multi-user environment has been the subject of intense debate among mapping organizations, particu-

larly as this issue may affect the allocation of the costs of shared development among the various participants in such a system. In spite of past discussion, however, the ramifications of this issue are still not fully understood or appreciated by all participants in the dialogue. Debate, unfortunately, has focused on the relative cost of various levels of accuracy and how those costs might be allocated rather than on the more basic issue, which is the level of accuracy required to support a true multipurpose, multi-user system of digital map resources. If the agreed-upon system is incapable of supporting the needs of the most demanding of the users, the development of multiple systems is inevitable and the creation of a multipurpose, multi-user system cannot, by definition, occur.

In this regard, the recommended standards for a joint automated mapping and land information system as set forth herein are based upon the Commission-recommended standards for the development of survey control networks and local large-scale mapping programs. These programs of the Commission already represent formally adopted or *de facto* standards for much of Southeastern Wisconsin, including Walworth County. In addition, these programs have been subjected to critical review by knowledgeable professionals who have judged them to be both conceptually and procedurally sound.

The large-scale mapping and survey control systems recommended by the Commission have been in use for more than 25 years in manual mapping environments, and within the most recent decade have been successfully carried into digital mapping environments. They therefore represent successfully "field tested" standards and specifications. The maps and attendant survey control have been demonstrated to support a wide variety of operations to necessary levels of accuracy in both the public and private sectors, and are, therefore, ideally suited to a multipurpose, multi-user environment.

Map Projection System

It is recommended that the State Plane Coordinate System, North American Datum of 1927 (NAD-27), be used as the map projection system for a countywide automated mapping and land information system. This system is already the system of choice of much of the local mapping community, and a great deal of effort and expense has been expended in its establishment and maintenance. Those organizations operat-

ing in the local area that have chosen to use the Universal Transverse Mercator (UTM) system have, in fact, converted much of their existing basic map information to the UTM system from the State Plane Coordinate System. The methodology for the precise conversion process between the two map projection systems already exists, provided both coordinate systems are based upon NAD-27, and the organizations concerned can continue to "load data" into their systems.

The map projection grid should be constructed inside the computer memory through key-entry procedures. This requirement, if combined with the key entry of all survey control network data, will produce a map projection that is essentially independent of map scale. Constructed in this manner, the map projection will be able to accept and accurately reference not only digitized data from mapped sources at any scale, but also numeric data derived from direct field measurements. This capability is as important as it is subtle, given the increasing availability and affordability of high technology survey instruments, such as "total stations."

Survey Control Network and Large-Scale Base Mapping

It was reported in Chapter III that the Commission-recommended survey control network and large-scale topographic base maps already exist in the Delavan, East Troy, Elkhorn, and Lake Geneva areas of Walworth County, and that such data are already being utilized by units of government and certain utilities in both analog and digital mapping. Accordingly, this program should be pursued, over time, in the remainder of Walworth County and it should be considered the standard for common use.

Control Surveys: The horizontal control survey work to be completed in Walworth County should include the recovery, or relocation, and monumentation of 782 U. S. Public Land Survey corners not previously recovered, or relocated, and monumented, including section and quarter-section corners, centers of sections, and correction corners. Having recovered, or relocated, and monumented these corners, high-order control survey traverses should be run which utilize and incorporate all of the monumented corners as stations to determine the coordinates of the corners and the lengths and bearings of all quarter-section lines. Coordinates of the corners should be computed upon the Wisconsin Coordi-

nate System, South Zone, (NAD-27) and sufficient survey connections should be made to basic National Geodetic Survey (NGS) control stations to permit the proper checks and adjustments to be made both in the traverse lengths and bearings and in the coordinate values of the monumented U. S. Public Land Survey corners. The procedures and accuracy of the horizontal control surveys should conform to the specifications for NGS Third-Order, Class I traverses. Such horizontal survey control work needs to be completed for 2,094 corners in Walworth County.

The vertical control survey work to be completed should be based upon National Geodetic Vertical Datum, 1929 Adjustment (NGVD-29), as established by the NGS. Closed level circuits should be run as necessary to establish permanent bench marks in the area eventually to be mapped. The procedures and accuracy of the vertical control surveys should conform to the specifications for NGS Second-Order, Class II level circuits. Elevations should be determined for the monuments marking the section, quarter-section, and center-of-section corners throughout the areas remaining to be mapped, and these monuments should serve as permanent bench marks, each monument being supplemented by at least one reference bench mark.

Large-Scale Topographic Base Maps: For those areas of Walworth County where large-scale base maps have yet to be prepared, such maps should be acquired in digital form. The digital map files should be prepared to National Map Accuracy Standards at a scale of 1:2400 (one inch equals 200 feet).¹ Use of these standards will ensure that all map projection grid lines, horizontal control stations, section corners, and quarter-section corners will be plotted on finished maps to within 1/100 of an inch of their true coordinate position. Ninety percent of all well-defined planimetric features will be plotted to within 1/30 of an inch of their true coordinate position, and no point will be more than 1/20 of an inch from its true coordinate position. Ninety

¹Local communities may desire to undertake such base mapping at a scale of 1:1200 (one inch equals 100 feet). Any local government in Walworth County desiring to obtain topographic maps at this larger scale should be encouraged to do so.

percent of the elevations determined from the solid-line contours of the map will have an accuracy with respect to elevation of one-half contour interval, and no elevation will be in error by more than a full contour interval.

The digital map files should contain the following map information:

1. Hypsometry by contour lines having a vertical interval of two feet.
2. All planimetric detail, such as pavements, curbs, walks, trails, railways, power lines, buildings, fences, wooded areas, dams, piers, dock walls, culverts and bridges, retaining walls, airport runways and taxiways, and other identifiable salient features on the aerial photography from which the maps are compiled.
3. All hydrographic features, such as marshes, lakes, streams, watercourses, and drainage ditches.
4. All section and quarter-section lines and U. S. Public Land Survey corners in their correct position and orientation, together with the attendant exact grid lengths and bearings.
5. Such lettering as may be secured from available maps of the area or as may be furnished by the participating organizations relative to the names of salient geographic features. The names of all state and county trunk highways, public streets, and major streams and lakes are shown on the maps.

In addition to ultimately obtaining, in digital form, new topographic base maps for all areas of Walworth County not yet so mapped, those large-scale maps prepared by the communities of Delavan, East Troy, Elkhorn, and Lake Geneva in past years in conventional form should be converted to an automated format through both digitizing and/or scanning procedures.

Cadastral Maps

Much of what has been historically identified as cadastral mapping in southeastern Wisconsin cannot be related with mathematical accuracy to the surface of the earth, and therefore does not meet the definition of a map. These "cadastral maps" are more properly identified as cadastral

diagrams and are manifestly unsuited to be digitized as the cadastral layer of an automated mapping and land information system in which one of the stated intents is the ability to correlate accurately real property boundary line information with earth science information, such as floodplain boundaries. To meet the rigorous requirements of a modern, parcel-based, land information system, it is usually necessary that the real property boundary line maps be recompiled on the map projection established for the land information system utilizing a permanently monumented survey control network as the mechanism for this recompilation. As reported in Chapter III, no such true cadastral maps have yet been prepared for any portion of Walworth County.

Each cadastral map should cover one U. S. Public Land Survey Section at a scale of 1:2400.² The maps utilize the Wisconsin State Plane Coordinate System as the map projection and should show all section and quarter-section lines and corners together with their grid and ground level lengths and grid bearings, all in their correct position and orientation. The State Plane Coordinate grid should be plotted to within 1/100 of an inch of its true position, and each U. S. Public Land Survey section and quarter-section corner likewise should be plotted to within 1/100 of an inch of its true position as expressed by the State Plane Coordinate values for the corner. Ninety percent of all well-defined planimetric features plotted on the maps as an aid in the delineation of real property boundaries, such as the threads of major streams and watercourses, fence lines, pavements, and principal buildings, should be plotted to within 1/30 of an inch of their true positions. Real property boundary lines should be plotted to within 1/40 of an inch of their true positions.

Determination of the location of real property boundary lines should be based upon the examination and interpretation of all recorded subdivision plats and certified survey maps within the area to be mapped; legal descriptions, and where

²*In those communities where base mapping is obtained at a scale of 1:1200, it would be desirable to also prepare the cadastral overlay at that scale and each cadastral map would cover one U. S. Public Land Survey quarter section.*

available, plats of all major public utility easements in the area to be mapped; copies of legal descriptions and, where available, plats of all street right-of-way openings, reservations, or dedications in the area to be mapped; and legal descriptions contained in the most recently recorded deed transaction in the records of the County Register of Deeds for all real property boundaries in the area to be mapped not included within recorded subdivision plats or certified survey maps.

Based upon review and interpretation of these materials, the cadastral maps should show, all in their correct position and orientation, all real property boundary lines, all street right-of-way lines, and all major cross-country public and utility easement lines. These lines should be graphically constructed in a manner which parallels the location of the lines on the surface of the earth following good land surveying practice in southeastern Wisconsin.

It is recognized that the recorded dimensions and orientation of real property boundaries plotted in this manner may not always agree with the horizontal control survey data also shown on the maps. This is to be expected, since most property descriptions were written using field survey data obtained prior to the relocation of section and quarter-section corners and completion of the horizontal control network tied to the Wisconsin State Plane Coordinate System. Some property descriptions were written without benefit of any field survey data other than that provided by the original government survey. Further, the required survey accuracy for property boundary descriptions for land subdivisions, as defined in Chapter 236 of the Wisconsin Statutes and generally adhered to in other property boundary surveys, is 1 part in 3,000, as compared with the Second-Order accuracy of 1 part in 10,000 for the horizontal control surveys.

For these and other reasons, overlapping or separated property boundary descriptions may be expected to exist. The property boundary line maps should record all dimensions as contained in the official records of the County Register of Deeds, and wherever an overlap or gap of 2.5 feet or more exists, such overlap or gap should be shown as a mapped line. Overlaps or gaps of less than 2.5 feet will be evident only from an examination of the recorded property line dimensions.

For areas covered by recorded subdivision plats and certified survey maps, the following map annotation is provided:

1. Subdivision name or certified survey map number.
2. Block and lot numbers.
3. Street names.
4. Street, alley, and other public way right-of-way widths to the highest degree of accuracy permitted by the data source.
5. Recorded lot dimensions to the highest degree of accuracy permitted by the data source.
6. Easement right-of-way widths to the highest degree of accuracy permitted by the data source together with the purpose of the easement.
7. Parcel identification numbers.

For all properties other than those contained in a recorded subdivision plat or certified survey map, the following map annotation is provided:

1. Street names.
2. Street, alley, and other public way right-of-way widths to the highest degree of accuracy permitted by the data source.
3. Recorded property dimensions to the highest degree of accuracy permitted by the data source.
4. Easement right-of-way widths to the highest degree of accuracy permitted by the data source together with the purpose of the easement.
5. Parcel identification numbers.

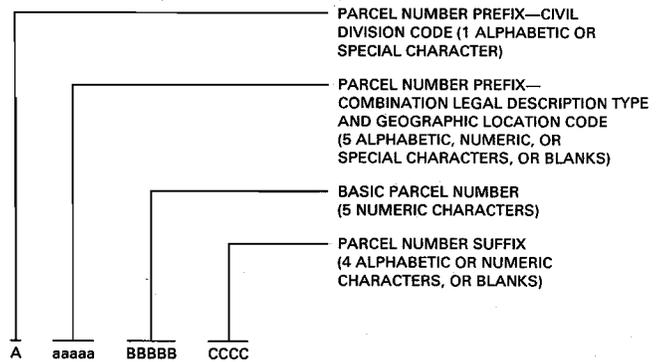
Once the cadastral maps are completed, they are ready for digitization. All line features are digitized directly from the cadastral maps. Textual information, including the parcel identification number, is key entered from the cadastral maps and placed in its approximate location on the digital maps.

Parcel Identification Numbers

The parcel identification number provides the link between the cadastral maps, which show

Figure 8

CURRENT WALWORTH COUNTY PARCEL IDENTIFICATION NUMBERING SYSTEM



Source: Walworth County and SEWRPC.

the location of a particular parcel, and the records, either computer-readable or traditional paper records, that contain information about the parcel. The parcel identification scheme utilized in Walworth County is administered by the County Treasurer's Office and consists of a fifteen-character identifier made up of three discrete fields. The first of these three fields contains two subfields. The format of the parcel identifier is "AaaaaaBBBBBCCCC" (see Figure 8).

"Aaaaaa" is the parcel number prefix field. "A" is a single alphabetic or special character³ code that identifies the minor civil division, that is, the civil town, village, or city, in which a particular parcel is located. For example, the character "A" identifies the Town of Sharon; the character "/" identifies the City of Whitewater. The "aaaaa" is a five-character subfield that can contain alphabetic, numeric, or special characters, and blanks. The composition of this field is dependent upon the type of legal description that exists for the parcel in question: subdivision or condominium plats, certified survey maps, and "metes and bounds" descriptions. Furthermore, parcels created by metes and bounds descriptions

³Special characters are nonalphabetic, nonnumeric characters available on most typewriter and computer terminal keyboards. These include punctuation marks and other characters such as slash (/) and asterisk (*).

and lying within incorporated civil divisions are coded differently in this field than are parcels created by metes and bounds descriptions and lying within unincorporated civil towns.

For parcels created as lots within platted subdivisions, or for ownership units created by condominium plats, in either unincorporated or incorporated civil divisions, an alphabetic mnemonic and blanks are used in this field; such as, "NP__" to identify "Nippersink Park", or "HS__" to identify "Hiemstra's Subdivision". Numeric characters may also appear in conjunction with the land subdivision mnemonics to account for subdivision names such as "Allynhurst Subdivision" (AS__), "Allynhurst Subdivision, Addition No. 1" (AS1__), and "Allynhurst Subdivision, Addition No. 2" (AS2__). For parcels created by certified survey maps in either unincorporated or incorporated civil divisions, the first position of this five-character subfield contains the alphabetic character "A" and positions two through five contain the certified survey map number, right justified, with blanks used rather than leading zeros; for example, "A__57" or "A1884".

For unplatted lands in civil towns, the first three characters of the five-character subfield are used for a combination of an alphabetic mnemonic and one or two blanks to identify the civil town. For example, the Town of Sharon is identified as "_S_", while the Town of East Troy is identified as "_ET" and the Town of Bloomfield is identified as "B_". The Town of Darien is identified as "_D_" as is also the Town of Delavan. Characters four and five of this subfield are numeric characters or blanks that identify the U. S. Public Land Survey section in which the parcel is located. For example, "_6" or "26".

For unplatted lands in villages and cities, the five characters of this subfield consist of a combination of alphabetic characters and blanks. For example, "WUP__" is used in the Cities of Delavan and Whitewater and the Villages of Walworth and Williams Bay; "WV__" is used in the Village of Sharon; "VGC_" is used in the Village of Genoa City; and, "U_NE_", "U_NW_", "U_SW_", and "U_SE_" are used in the City of Elkhorn.

"BBBBB" is the basic parcel number field. Only numeric characters appear in this field. All parcel numbers are right justified in this field

and leading zeros are used to fill out the field as needed. For parcels described as platted land, basic parcel numbers are assigned sequentially beginning with "00001" within each subdivision plat, condominium plat, or certified survey map within each civil division. For unplatted lands, basic parcel numbers are assigned sequentially beginning with "00001" within each U. S. Public Land Survey section within each civil town and within each group of separately identified unplatted parcels within each city and village.

"CCCC" is the parcel number suffix field and is used to identify subsequent splits of a parcel after the basic parcel number has been assigned. Both alphabetic and numeric characters and blanks are used in this field: the field is filled one character at a time in sequence from left to right as splits occur, the first character in the field is always alphabetic, and alphabetic and numeric characters are used alternately. "A__", "C1A_", and "___" are examples of valid parcel number suffixes.

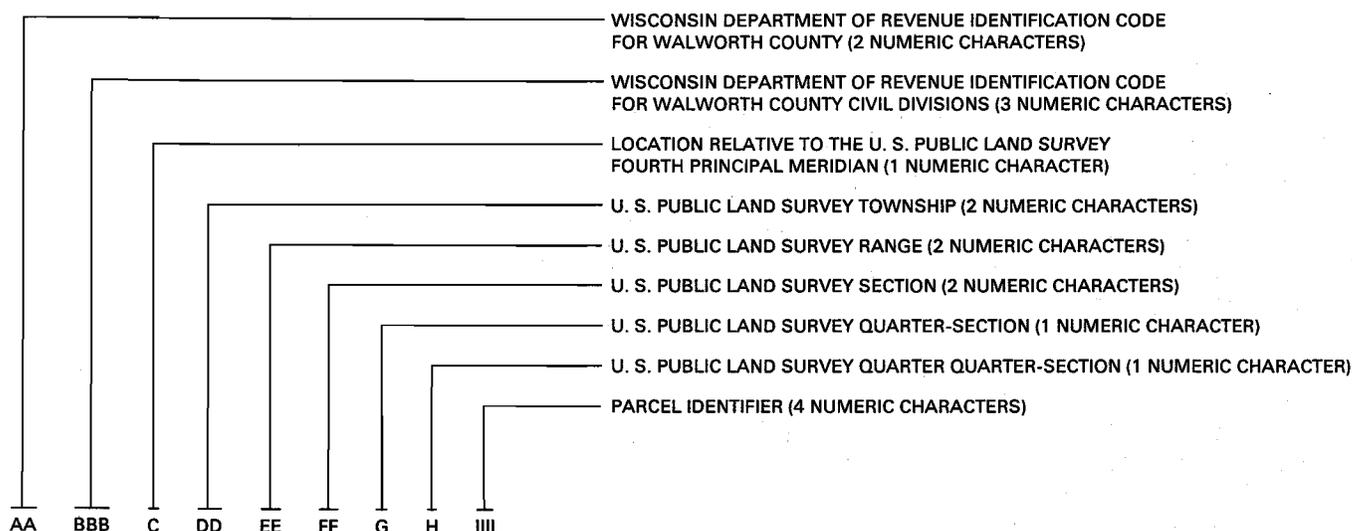
The County Land Information Committee has recommended that the current Walworth County parcel identification numbering system be converted to the parcel identification numbering system proposed by the Wisconsin Land Information Board. This parcel identification numbering system utilizes certain components of the Wisconsin Department of Revenue parcel numbering system as set forth in the 1990 Department of Revenue publication, Property Assessment Manual. This system is also related to the U. S. Public Land Survey System (USPLS). The parcel identification numbering system consists of an eighteen-character identifier made up of nine discrete fields. Only numeric characters are used and zeros are used in lieu of blanks. The format of the parcel identifier, as shown in Figure 9, is "AABBBCDDEEFFGHIII".

"AABBB" is a five-character, two-field, sequence that identifies the county and minor civil division in which the parcel is located. Both the county code "AA" and the minor civil division code "BBB" are identified in the 1990 Wisconsin Department of Revenue publication, Property Assessment Manual.

"CDDEEFFGH" is a nine-character, six-field, sequence that identifies the location of the parcel with reference to the U. S. Public Land Survey System. "C" locates the parcel relative to the Fourth Principal Meridian of the USPLS where

Figure 9

RECOMMENDED WALWORTH COUNTY PARCEL IDENTIFICATION NUMBERING SYSTEM



Source: Wisconsin Land Information Board and SEWRPC.

the number "2" indicates a parcel located east of the meridian and the number "4" indicates a parcel located west of the meridian. All of Walworth County is located east of this meridian. "DDEE" establishes the USPLS township in which the parcel is located where "DD" is the number of townships north of the USPLS base line, in this case the Wisconsin-Illinois border. "EE" is, in the case of Walworth County, the number of townships east of the Fourth Principal Meridian. "FF" identifies the USPLS section in which the parcel is located. "G" identifies the quarter-section in which the parcel is located where "1" indicates the northeast quarter, "2" indicates the northwest quarter, "3" indicates the southwest quarter, and "4" indicates the southeast quarter. "H" is an optional field in the Wisconsin Land Information Board system which Walworth County intends to use. This field identifies the quarter quarter-section in which the parcel is located, with "1" indicating the northeast quarter of the quarter-section, "2" indicating the northwest quarter of the quarter-section, "3" indicating the southwest quarter of the quarter-section, and "4" indicating the southeast quarter of the quarter-section.

"IIII" is the basic parcel number, unique within the USPLS quarter quarter-section.

This sequence of 18 characters provides for the unique identification of a parcel within both Walworth County and the State of Wisconsin. The use of this system is the standard for the Walworth County Land Information System.

Property Ownership and Assessment Records

The property ownership and property tax assessment records maintained by Walworth County already exist as computer-readable files. These files contain such information as an abbreviated legal description, owner's name and mailing address, acreage of the property if available, and assessed value of the land and any improvements to that land. These records can be readily integrated into an automated mapping and land information system in Walworth County utilizing a parcel identification numbering scheme which is common to both the maps and the records. The only operational step required for this integration is the establishment of proper programming access from the digital map files to the existing computer files of ownership and assessment records for the purpose of "reading" them.

Soil Unit Maps

Digital soil unit maps already exist for all of Walworth County through the efforts of the Southeastern Wisconsin Regional Planning Commission. A detailed operational soil survey

for all of southeastern Wisconsin was conducted by the U. S. Soil Conservation Service in 1963 under contract to the Regional Planning Commission. The soil survey conducted in southeastern Wisconsin departed from the standard soil survey conducted in other areas of the State and United States in one important respect, namely, the type of aerial photography used as a base map for the field operation. The work specifications prepared by the Commission required that the boundaries of all soil mapping units be identified on prints of then current (1963) Commission aerial photographs. These photographs consisted of ratioed and rectified enlargements at a scale of one inch equals 1,320 feet of Commission one inch equals 6,000 feet scale high-altitude photographic negatives. Each field sheet base map covered six U. S. Public Land Survey sections. The specifications also required that the Commission be furnished with reproducible half-tone positives of the field sheets on dimensionally stable base material at a scale of one inch equals 2,000 feet. The reproducible positives were to be suitable for the preparation of clear blue-line or black-line prints by diazo process, and were to show clearly the soil mapping units with delineations and identifying symbols so that the prints could be used in conjunction with a published Commission report on the soils of southeastern Wisconsin. The specifications further required that finished photo maps be prepared to accompany the published soil surveys at a scale of one inch equals 1,320 feet, also using the negatives of current photography provided by the Commission. Key planimetric features, such as major highways, railroads, streams, and lakes, were to be identified on the finished photo maps, as were all U. S. Public Land Survey township, range, and section lines.

These base mapping specifications for the soils mapping program in southeastern Wisconsin were unique in that the normal U. S. Soil Conservation Service practice up to that time had been to prepare controlled photomosaics for the soil mapping. The revised base mapping procedure required by the Commission, consisting of the preparation of ratioed and rectified enlargements to eliminate all distortion except that due to relief, provided instead "photo maps" on which distances and areas could subsequently be measured. Such distances and areas cannot be reliably measured on controlled photomosaics.

Soil mapping unit boundaries were digitized from the 1 inch equals 1,320 feet scale photo maps for use in the project, since at this scale a photo print was more convenient for the digitizer operators to scale and interpret. Because the salient features of the U. S. Public Land Survey System had been previously marked on these photos, they were readily scaled for digitization using the previously computed State Plane Coordinates for the section and quarter-section corners. Because the digital soil unit maps prepared by the Regional Planning Commission utilized the same geometric reference framework as that proposed for Walworth County, they are already "integrated" with the other land information being specified for that system.

Land Use

Historic and current land use information in digital form for Walworth County already exists for the entire County, again through the efforts of the Southeastern Wisconsin Regional Planning Commission. The Commission's land use inventory, which utilizes 63 different major land use categories, also incorporates the statutorily defined wetlands originally identified by the Wisconsin Department of Natural Resources as part of a statewide inventory of these areas. The digital land use maps were originally digitized from interpreted one inch equals 400 feet scale ratioed and rectified prints of aerial photography flown for this purpose by the Commission in 1963. The ratioing and rectification of the photographs was controlled to the U. S. Public Land Survey System corners as those corners had been coordinated with the State Plane Coordinate System. The digitized land use maps were subsequently updated using aerial photography flown in 1970, 1975, 1980 and again in 1985. These maps are scheduled to be updated to 1990 conditions by the Commission utilizing new aerial photography flown for this purpose during the spring of 1990. Because the digital land use maps prepared by the Regional Planning Commission, like the digital soil unit maps, utilized the same geometric reference framework as proposed for the Walworth County automated mapping and land information system, they, like the digital soil unit maps, are already "integrated" with the other land information in the system.

The aerial photo enlargements upon which the land uses were originally delineated had been

ratioed and rectified to provide, in effect, "photo maps" upon which distances and areas could subsequently be accurately scaled and measured. Some distortion due to relief, however, still exists in aerial photographs after ratioing and rectification. Accordingly, the cadastral maps, when completed, should be used to adjust the land use maps as may be necessary. Where discrepancies are noted between right-of-way and land/water boundary lines on the land use and cadastral maps, they should be resolved in favor of the positions recorded on the cadastral map and adjoining land use lines adjusted accordingly. Such adjustments should all be relatively minor.

Zoning Districts

Zoning district boundaries commonly follow real property boundary lines. For this reason, digital zoning district map overlays should not be prepared until digital real property boundary line maps have been completed. The digital zoning district map overlays should then be prepared by "copying" appropriate line segments from the real property boundary line maps and digitizing any additional line segments needed.

Flood Hazard and Shoreland Areas

The digitization of surface waters and stream channels occurs as part of the digital base mapping process and in the conversion to digital format of existing topographic maps. Two additional water-related areas, floodlands and shorelands, which have particular implications for planning, engineering, and for zoning administration, and which are related one to another, should also be digitized as part of the creation of a countywide automated mapping and land information system. As topographic maps are prepared, the limits of the 100-year recurrence interval floodplains can be delineated by the Regional Planning Commission on the large-scale topographic base maps based upon flood profiles prepared by the Commission as a part of its watershed planning programs. This information would then need to be digitally captured. Through the application of the statutory definition, the limits of shorelands in Walworth County on the large-scale topographic base maps should also be determined and digitally encoded.

Digital Graphic Data Exchange

In order to exchange digital map data between two or more physically separated automated mapping and land information systems, one of two conditions must exist. Either the systems

must have compatible data structures for the storage of digital map data or an interchange mechanism between the two systems must be provided. It has been noted in this report that the existing automated mapping and land information systems in the Walworth area are of several different proprietary types; therefore, before digital map data can be shared, agreement must be reached between the various organizations concerning the manner in which digital map data may be exchanged.

Currently there is no uniform, widely accepted and used mechanism for the exchange of digital map data. Such a mechanism, if it did exist, would constitute an industrywide, or formal, standard. For the present time, it will be necessary to exchange digital map data through the use of informal digital map data exchange mechanisms. Informal exchange standards are simply those methods and formats for exchanges that can be agreed upon between two or more data compilers and/or users that want to exchange digital map data. Examples of some currently available mechanisms of the informal type are: Drawing Exchange Format (DXF); Initial Graphic Exchange Standard (IGES); Intergraph Standard Interchange Format (ISIF); and Digital Line Graph 3 (DLG3). The specific informal exchange mechanism utilized between any two specific sites will be largely a function of the specific vendor software and hardware existing at the sites.

It should be noted that the majority of currently available digital map data exchange mechanisms are "batch-oriented," meaning that they are used to load entire files of digital map information. Therefore, to update digital map files involving a transfer of files between two different vendor sets of hardware and software, it is usually necessary to reload the entire affected file rather than to load only the revisions. "Transaction-oriented" file update capability, or the ability to load only the revisions to a file, is a less well-developed capability and may be relatively easy or relatively difficult between different vendor sets of hardware and software, depending upon the similarity or dissimilarity of the internal architecture of the involved systems. As a practical matter, transaction-oriented capability may be available only through custom computer programming or through the acquisition of the same hardware and software by the different operators involved.

In this regard, it should also be noted that the use of many of the currently available mechanisms for digital map data exchange may be expected to pose some problems for operations using IBM mainframe computers to operate automated mapping systems. IBM mainframe systems utilize digital map data storage models that differ from the models used by most other vendors; thus translation between IBM models and nonIBM models is not a trivial programming task. This issue has not been addressed in the commercial market to the extent that digital graphic data exchange between other systems has been. The efficient and effective exchange of digital map data between IBM and nonIBM sites, therefore, may well require custom programming.

Finally, it should be noted that the foregoing is intended to apply to map feature elements rather than to data that may relate to map features. The National Research Council model, proposed as the model to guide the creation of the recommended automated mapping system for Walworth County, utilizes the parcel identifier as a "key" to link location, or geometry, of features on maps to nongeometric information about the feature. The transfer of files of nongeometric, or attribute, data can be accomplished using existing procedures for the transfer of character data between different computer systems.

COST ESTIMATES TO CREATE THE RECOMMENDED AUTOMATED MAPPING AND LAND INFORMATION SYSTEM BASE FOR WALWORTH COUNTY

While recognizing that fiscal resources are limited and that the development of an automated mapping base for Walworth County likely will require a long period of time, the Walworth County Land Information Committee desired that cost estimates attendant to the creation of the entire base be included in the plan document. In this way, all parties concerned will have a good understanding of the capital investment that is required to complete an automated mapping base that is suitable for a multi-user environment of the most demanding kind. Accordingly, Table 3 summarizes the cost of completing the recommended automated mapping base for Walworth County, taking into account the geodetic reference framework and base mapping work completed to date in the County as reported in Chapter III.

The estimated cost of completing the entire automated mapping base is \$6.3 million expressed in current 1991 dollars. Of this total, nearly \$2.6 million, or about 41 percent, is required to complete the geodetic reference framework, including the recovery or relocation and monumentation of public land survey corners and the establishment of State Plane Coordinates and vertical elevations for those corners; about \$2.8 million, or an additional 45 percent, is required to prepare in digital form one inch equals 200 feet scale topographic base maps for nearly 551 square miles, or about 95 percent of the area of Walworth County, and to convert to digital form the existing large-scale base maps for the 27-square-mile area of the County already mapped; and the remaining \$0.9 million, or 14 percent, is required to compile cadastral maps for the entire County and convert those cadastral maps to digital form.

POTENTIAL SOURCES OF REVENUE TO SUPPORT PROGRAM

There appear to be four potential sources of revenue that could be used to support the work efforts needed to build the recommended automated mapping and land information system base for Walworth County. These four sources are:

1. Register of Deeds Filing and Recording Fees

Over the six-year period 1991 through 1996, it is estimated that a total of about \$333,300, or about \$55,550 annually, will become available to Walworth County from the state-mandated supplemental Register of Deeds recording and filing fees. This estimate assumes that the average number of applicable recordings and filings that obtained over the period 1985 through 1990 will continue over the period 1991 through 1996. The total number of such recordings is estimated at about 15,150 annually.

The number of annual recordings subject to document filing fees can be expected to vary with changes in the national and local economies, interest rates, tax legislation, and in urban and rural land market activity. Experience in southeastern Wisconsin indicates that fluctuations of about 10 percent more or less than the average

Table 3

SUMMARY OF COSTS TO COMPLETE RECOMMENDED AUTOMATED MAPPING AND LAND INFORMATION SYSTEM BASE FOR WALWORTH COUNTY

Program Element	Description of Work Needed to be Completed	Average Unit Cost of Work	Total Cost to Complete Work
Geodetic Reference Framework	Relocate and monument 782 U. S. Public Land Survey corners	\$800 per corner	\$ 625,600
	Establish State Plane Coordinates for 2,094 U. S. Public Land Survey Corners	\$600 per corner	1,256,400
	Establish vertical elevations for 2,294 U. S. Public Land Survey corners	\$300 per corner	688,200
	Subtotal	--	\$2,570,200
Large-Scale Base Maps	Prepare digital 1" = 200' scale topographic base maps for 550.5 square miles	\$5,000 per square mile	\$2,752,500
	Convert existing large-scale base maps to digital form for 27.5 square miles	\$3,500 per square mile	96,250
	Subtotal	--	\$2,848,750
Cadastral Maps	Compile cadastral maps for entire County—578 square miles containing 52,150 parcels	\$7.50 per parcel	\$ 391,125
	Convert cadastral maps to digital form for entire County—578 square miles containing 52,150 parcels	\$10.00 per parcel	521,500
	Subtotal	--	\$ 912,625
Total		--	\$6,331,575

Source: SEWRPC.

may be expected. Accordingly, the annual revenue available from this source may be expected to vary and the amount of program work that can be supported by such revenue may also be expected to vary from year to year.

2. State Grants from Wisconsin Land Information Board

Upon approval of the Walworth County land information system plan, Walworth

County will be eligible to apply for state grants of up to \$100,000 to support work program activities consistent with the plan. The competition for such state grants is expected to be intense. Until the Wisconsin Land Information Board adopts rules governing the process by which such grants are to be determined, it is not known how well Walworth County might fare in the grant competition. A provision of the state budget bill, 1991 Wisconsin

Act 39, has eliminated the originally required 25 percent local match attendant to state land information system grants. However, it is likely that those counties and communities which propose to expend local revenues in support of plan implementation efforts will be favored in the competition for such state grants.

3. Contributions by Local Governments and Utilities

A third potential source of revenue to support the recommended Walworth County work program consists of contributions by local governments in the County and by public and private utilities operating in the County. Depending upon the intensity with which a local government wishes to secure an operational automated mapping base for local planning, engineering, and other municipal purposes, that local government may be willing to commit local monies toward that end. For example, the City of New Berlin in Waukesha County has committed local funds to accelerate the process of completing the automated mapping base in that portion of Waukesha County. Similarly, in Kenosha County, the Kenosha Water Utility has committed funds to accelerate the process of completing the automated mapping base within its utility service area.

A potential new source of revenue discussed by the Land Information Committee would result from fees that could be imposed by Walworth County attendant to the issuance of permits to utilities to install facilities in county highway rights-of-way. Currently, such permits are issued without a fee. The Land Information Committee will give consideration to the establishment of such a fee in future years as one potential source of revenue to help complete an automated mapping base in Walworth County over time.

4. County Tax Levy

At the present time, county tax levy monies expended through the Walworth County highway maintenance budget are being used to fund a county program to recover, or relocate, and monument U. S. Public Land Survey corners. The Walworth County Surveyor is responsible for this annual work program. Over the five-year

period 1986 through 1990, Walworth County expended an average of \$68,720 annually for support of the monumentation program. Of this total, about 90 percent, or \$61,850 annually, was spent on development work, that is, the recovery or relocation of U. S. Public Land Survey monuments. The remaining 10 percent, or \$6,870 annually, was spent on maintenance work attendant to the system of monuments. At the present level of expenditure, then, about \$61,850 annually is available to support further development of the geodetic reference framework element of the recommended automated mapping base for Walworth County.

PROPOSED WALWORTH COUNTY
WORK PROGRAM: 1991-1996

County Program to Continue
Geodetic Reference Framework

Given the limitations on the potential revenue sources cited in the foregoing section of this chapter, it is proposed that Walworth County, over the six-year period 1991 through 1996, continue its efforts to complete the required geodetic reference framework as a basic first step in developing an ultimate automated mapping base for the County. The specific proposed work program over this period is summarized in Table 4, with the areas concerned shown on Map 5. This program is premised on the following basic assumptions:

1. That at a minimum, Walworth County will expend \$100,000 annually over the six-year period toward completing the geodetic reference framework. The sources of revenue for this level of work effort would be as follows:

Register of Deeds	
filing fees	\$ 55,550
County Highway	
Department budget	44,450
Total	\$100,000

Drawing upon funds provided through the County Highway Department budget, the County Surveyor currently expends about \$68,720 annually in U. S. Public Land Survey remonumentation work efforts, of which about \$6,870 is used for maintenance

of previously recovered corners. The above proposal would permit the focusing of about \$44,450 annually in completing geodetic survey control work in certain portions of the County, leaving the County Surveyor with about \$24,270 annually in County Highway Department budget funds to spend on an ad hoc basis in other portions of the County where local surveyors need remonumentation efforts completed or where maintenance work is required.

- That Walworth County would apply for a \$100,000 annual grant over the six-year period from the Wisconsin Land Information Board and use those monies to accelerate the completion of the geodetic reference framework, thus providing for a maximum program twice as large as the minimum program.

It is proposed that the geodetic reference work effort be concentrated in the 12 priority areas identified on Map 5. Each of these areas represents approximately \$100,000 worth of effort in terms of completing the geodetic reference framework, taking into account work already completed under the County Surveyor program, the state highway program, and local large-scale mapping programs. At a minimum, it should be expected that, over the six-year period, the first six priority areas, representing nearly one-quarter of the County, could be completed. Under a maximum effort that would presume Walworth County would be successful in obtaining a \$100,000 grant annually from the Wisconsin Land Information Board, all 12 priority areas could be completed by the end of the planning period. It should be noted that, as shown in Table 4, the work effort being proposed includes the relocation and monumentation of 351 U. S. Public Land Survey corners, the establishment of State Plane Coordinates for 979 corners, and the establishment of vertical elevations for 1,110 corners within the 12 priority areas.

Potential Local Programs to Complete Automated Mapping Base

It is recognized that over the six-year period one or more local units of government in Walworth County may desire to proceed independently with completion of an automated mapping base for a portion of the County as the foundation of a land information system for that community. At least one local unit of government, the City of Lake Geneva, has taken steps toward this end. It is recommended that Walworth County

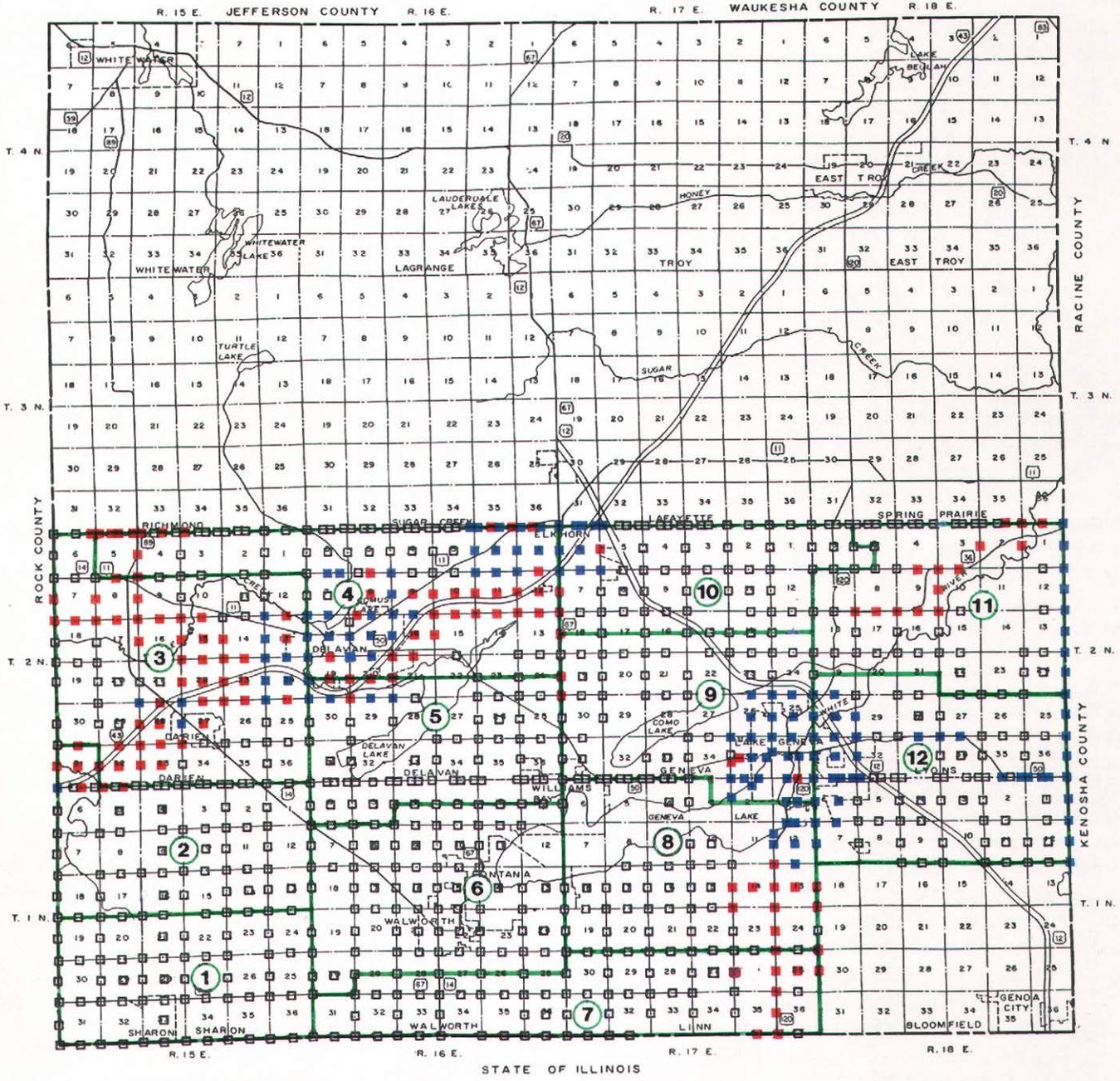
Table 4
PROPOSED WALWORTH COUNTY
REMONUMENTATION AND
CONTROL SURVEY PROGRAM: 1991-1996

Area (see Map 5)	Work Required to Complete the Geodetic Reference Framework (related to U. S. Public Land Survey corners)	Estimated Cost
1	Relocate and monument 24 corners Establish State Plane Coordinates for 91 corners Establish vertical elevations for 91 corners	\$ 19,200 54,600 27,300
	Total	\$ 101,100
2	Relocate and monument 26 corners Establish State Plane Coordinates for 87 corners Establish vertical elevations for 94 corners	\$ 20,800 52,200 28,200
	Total	\$ 101,200
3	Relocate and monument 29 corners Establish State Plane Coordinates for 71 corners Establish vertical elevations for 115 corners	\$ 23,200 42,600 34,500
	Total	\$ 100,300
4	Relocate and monument 27 corners Establish State Plane Coordinates for 73 corners Establish vertical elevations for 113 corners	\$ 21,600 43,800 33,900
	Total	\$ 99,300
5	Relocate and monument 26 corners Establish State Plane Coordinates for 87 corners Establish vertical elevations for 89 corners	\$ 20,800 52,200 26,700
	Total	\$ 99,700
6	Relocate and monument 22 corners Establish State Plane Coordinates for 91 corners Establish vertical elevations for 91 corners	\$ 17,600 54,600 27,300
	Total	\$ 99,500
7	Relocate and monument 27 corners Establish State Plane Coordinates for 84 corners Establish vertical elevations for 94 corners	\$ 21,600 50,400 28,200
	Total	\$ 100,200
8	Relocate and monument 36 corners Establish State Plane Coordinates for 77 corners Establish vertical elevations for 87 corners	\$ 28,800 46,200 26,100
	Total	\$ 101,100
9	Relocate and monument 38 corners Establish State Plane Coordinates for 77 corners Establish vertical elevations for 80 corners	\$ 30,400 46,200 24,000
	Total	\$ 100,600
10	Relocate and monument 25 corners Establish State Plane Coordinates for 88 corners Establish vertical elevations for 89 corners	\$ 20,000 52,800 26,700
	Total	\$ 99,500
11	Relocate and monument 37 corners Establish State Plane Coordinates for 73 corners Establish vertical elevations for 87 corners	\$ 29,600 43,800 26,100
	Total	\$ 99,500
12	Relocate and monument 34 corners Establish State Plane Coordinates for 80 corners Establish vertical elevations for 80 corners	\$ 27,200 48,000 24,000
	Total	\$ 99,200
Total	Relocate and monument 351 corners Establish State Plane Coordinates for 979 corners Establish vertical elevations for 1,110 corners	\$ 280,800 587,400 333,000
	Total	\$1,201,200

Source: SEWRPC.

Map 5

AREAS PROPOSED FOR COMPLETION OF GEODETIC REFERENCE FRAMEWORK IN WALWORTH COUNTY: 1991-1996



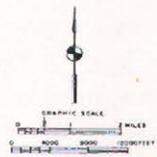
LEGEND

STATUS OF U. S. PUBLIC LAND SURVEY CONTROL NETWORK

- CORNER RELOCATED AND MONUMENTED
- CORNER RELOCATED AND MONUMENTED; HORIZONTAL CONTROL ESTABLISHED
- CORNER RELOCATED AND MONUMENTED; HORIZONTAL AND VERTICAL CONTROL ESTABLISHED

PROPOSED WORK PROGRAM AREAS: 1991-1996

- BOUNDARY OF AREA
- ③ AREA NUMBER (SEE TABLE 4)



Source: SEWRPC.

support any such local effort to the extent possible, provided that the local effort meets the standards and specifications set forth earlier in this chapter for the development of an automated mapping base. Support by Walworth County is envisioned to consist of the following two steps:

1. The redirection, as may be necessary, of available county resources for completing the geodetic reference framework from one or more of the priority areas noted above to that area of Walworth County where a local unit of government wishes to proceed on its own with the development of an automated mapping base.
2. County support for a state grant from the Wisconsin Land Information Board to aid in the development of a local land information system.

To provide perspective on what a local effort might involve in terms of completing an automated mapping base for a community, Table 5 provides cost estimates associated with completing the recommended automated mapping base for the City of Lake Geneva and its immediate environs. As discussed earlier in this report, the City of Lake Geneva carried out the Commission recommended large-scale topographic base mapping program some years ago. That program was applied to an area of about 7.75 square miles. Accordingly, for that area, the geodetic reference framework has been completed and the topographic maps are in hard copy form. What remains to be completed in terms of an automated mapping base for Lake Geneva consists of the conversion of the existing large-scale topographic base maps to digital format; the compilation to recommended standards of cadastral maps involving about 3,300 parcels; and the conversion of those cadastral maps to digital format. The total cost associated with that work effort is about \$84,900. With the automated mapping base completed, the City of Lake Geneva would be in a position to add information to that base, particularly including sewer and water utility information.

Once the City of Lake Geneva had completed the automated mapping base and any additional information "layers" it desired, the City would be in a position to begin to use the land information system. At that time, the City would have to invest in computer hardware and soft-

Table 5

ESTIMATED COST TO COMPLETE AN AUTOMATED MAPPING BASE FOR THE CITY OF LAKE GENEVA

Work Item	Estimated Cost
Convert Existing Large-Scale Base Maps to Digital Format: 7.75 Square Miles at \$3,500 per Square Mile	\$27,125
Compile Cadastral Maps: 3,303 Parcels at \$7.50 per Parcel	24,775
Convert Cadastral Maps to Digital Format: 3,303 Parcels at \$10.00 per Parcel	33,030
Total	\$84,930

Source: SEWRPC.

ware. Depending upon the type and capacity of the equipment required, the number of municipal departments involved, and the types of applications involved, it should be expected that about \$40,000 to \$100,000 would be required in capital investment to provide the hardware and software needed to utilize the automated land information system.

Consideration of Potential of Acquiring and Using Existing Automated Mapping Base of the Wisconsin Natural Gas Company and Wisconsin Electric Power Company

In considering the proposed Walworth County work program, the County Land Information Committee, taking note that the Wisconsin Natural Gas Company and Wisconsin Electric Power Company had jointly developed an automated mapping base for at least a portion of Walworth County, explored the potential of acquiring and using or adapting that automated mapping base for Walworth County needs. The results of the Committee's analysis of this possibility may be summarized as follows:

1. The Wisconsin Natural Gas Company and the Wisconsin Electric Power Company jointly indicated a willingness to sell to the County that portion of their automated mapping land base which lies in Walworth County. The area of coverage, which approximates 60 percent of Walworth County, is shown on Map 6 and consists of the entire northern one-half of Walworth

County plus portions of the Towns of Delavan, Geneva, and Lyons. The two companies would jointly sell the automated mapping land base to Walworth County at a cost of \$33,000. A copy of the letter offering to sell the base to Walworth County is reproduced in Appendix C.

2. One of the primary factors which caused the Land Information Committee to consider the potential of acquiring this privately developed automated mapping base is the need to automate zoning maps in the offices of the Walworth County Park and Planning Commission. Such zoning maps involve not only traditional zoning areas related to parcel boundaries, but also an increasing array of zoning districts related to land and water features. Accordingly, it would be important that any automated mapping base be capable of properly correlating property boundary line data with earth science data.
3. To test the functionality of the privately developed automated mapping base in the foregoing respect, the Committee examined the details of that digital data base in a portion of the Village of East Troy, comparing the parcel, right-of-way, and surface water data from that data base to the known locations of roads, buildings, surface water, and floodplains as derived from the previously acquired large-scale topographic maps prepared to Regional Planning Commission specifications by the Village of East Troy. Map 7 was developed by the Committee to illustrate that comparison. As shown on this map, the two data bases do not correlate well and would not permit Walworth County to use the privately developed data base for zoning mapping purposes. In some cases, the known locations of pavements fall outside of street rights-of-way as depicted on the privately developed data base; the known locations of buildings do not correspond with their respective parcels as shown on that data base; and the known location of the mill pond and attendant flood hazard area on Honey Creek does not correspond with the depiction of that pond in the digital data base.

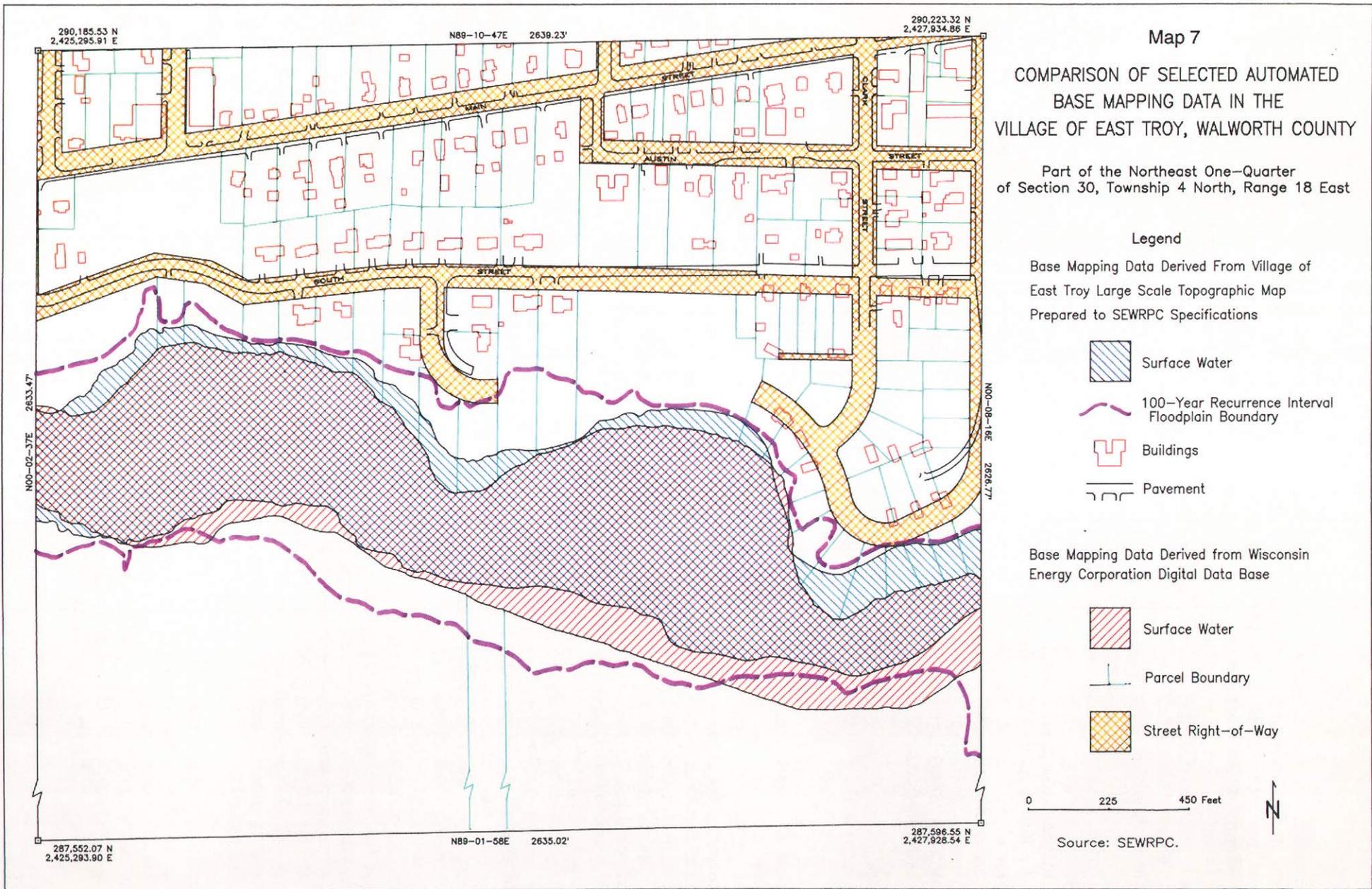
Since much of the existing privately developed digital data base was constructed from Walworth County cadastral diagrams, the results of the comparison of the data shown on Map 7 should not be surprising. The private utility firms simply converted to digital form cadastral data that was prepared without reference to "ground truth." Accordingly, the Land Information Committee determined to recommend that Walworth County give no further consideration to acquiring and building upon this privately developed digital data base.

Other Potential County Land Records-Related Automation Needs

In proposing the foregoing Walworth County program to continue building the geodetic reference framework that will ultimately support an automated mapping base as the foundation of a modern land records system in the County, the County Land Information Committee took note that there may be other land records related automation needs that will arise in the coming years. By recommending the foregoing program to the Walworth County Board of Supervisors, the Land Information Committee does not mean to foreclose other potential work in land records modernization during the planning period. One such work effort, the creation of an automated tract index, is being specifically recommended by the Committee and is described in the following section of this chapter. Another potential land records automation activity involves the utilization of optical disk technology to create an electronic page storage and retrieval system in the Register of Deeds office. While the Committee did not study the benefits and costs associated with such a system, they recognized that it might be desirable to convert to this technology in the coming years. There may be other types of land records modernization activities that would similarly be appropriate for further consideration as the necessarily long-term process of building an automated mapping base proceeds.

CREATION OF AN AUTOMATED TRACT INDEX AND CONVERSION OF THE PARCEL IDENTIFICATION SYSTEM

In addition to the need to build over time an automated mapping base, the Walworth County Land Information Committee identified two work activities essential to the modernization of



land records in the County. These are the creation of an automated tract index and the conversion of the existing Walworth County parcel identification numbering system to the parcel identification numbering system recommended by the Wisconsin Land Information Board. Since the creation of a tract index, whether automated or manual, requires the ability to identify uniquely each parcel of land in the index, and since the parcel identification numbering system proposed by the Wisconsin Land Information Board results in the assignment of a unique parcel identification number to each parcel of land in the County, these two needs are best addressed through a single work effort designed to ensure that the necessary coordination is achieved to complete the two desired end products efficiently and effectively.

Walworth County is one of eleven Wisconsin counties that does not currently have a tract index. The creation of a tract index, the information contained in a tract index, and the manner in which the information in a tract index is organized and reported are matters addressed in Section 59.55 of the Wisconsin Statutes. Given the statutory requirements, before any actual work is undertaken to create an automated tract index, it would first be necessary for the Walworth County Board of Supervisors to adopt an ordinance calling for the creation of a Walworth County tract index. Under the Statutes, "...no such index, when once made in any county, shall ever thereafter be discontinued, unless such county has or shall adopt, keep and maintain a complete abstract of title to the real estate therein as a part of the records of the office of the register of deeds thereof." Finally, it must also be noted that during the time it takes to implement the proposed parcel identification numbering system, it will be necessary to continue the use of the current parcel identification numbering system. Accordingly, for a period of time, it will be necessary to maintain two parallel parcel identification numbering systems on the affected automated records systems and possibly on the associated parcel location diagrams.

Assuming that the Walworth County Board of Supervisors determines to order the creation of an automated tract index, then the work efforts already undertaken by Walworth County staff to automate the records functions of the Register of Deeds Office and the Property Lister's Office, as

previously described in Chapter III of this report, provide much of the foundation for the creation of an automated tract index. The specific steps that need to be undertaken to create the automated tract index and to convert the parcel identification numbering system are as follows:

1. Modification of the file structure of the existing Register of Deeds document recording system to create the necessary fields for the proposed parcel identification numbering system, as well as the modification of one existing field from a "free form" text field to a "fixed format" coded character field for the coding of the document type. This second modification is needed to distinguish between and permit reporting by the four basic document categories, mortgages; deeds; attachments, sales, and notices; and miscellaneous documents, required by Wisconsin Statutes for a tract index.
2. Modification of the file structure of the existing Property Lister's Office tax assessment roll system to add the necessary fields for the proposed parcel identification numbering system. The presently existing fields for the current parcel identification numbering system would also continue in use until the conversion to the proposed parcel identification numbering system was carried out.
3. Modification of the current document recording system and tax assessment roll system computer processing and reporting programs to accommodate the file structure changes made to the two systems.
4. Modification of the current clerical steps involved in the document recording process to provide for the additional coding needed for the tract index of the document type by the Register of Deeds Office staff and the additional coding of the geographic location of the subject land parcel to U. S. Public Land Survey township, range, section, quarter-section, and quarter quarter-section by the Property Lister's Office staff needed for the parcel identification numbering system conversion. This coding effort will result in the "day forward" capture of the needed additional

information for these two work elements. The additional effort needed to code the geographic location for parcel records already in the Property Lister's tax assessment roll system would be undertaken as parcel records were revised for other reasons and on a "time available" basis by existing County staff.

The tract index is essentially a "day forward" system and will be usable immediately upon the coding of the first document. Its utility would be limited at first, but would increase with the passage of time and the coding of additional documents. Its implementation may be expected, again with the passage of time, to shorten the amount of time required by county staff and the public to research questions attendant to ownership of and interests in land.

When all parcel records have had the additional geographic locational information noted above coded, the remaining elements of the Wisconsin Land Information Board recommended parcel identification numbering system, such as the county code, the municipal code, and the principal meridian code, can be added to the parcel records by computer processing, because these codes are either constants within Walworth County or their appropriate values can be determined by examination of equivalent values in the current parcel identification system. The assignment of the four-digit individual parcel number can also be accomplished at this time through computer processing steps.

The conversion to the use of the new parcel identification numbering system would probably best be carried out at the beginning of a tax year, following appropriate notification of local civil divisions and affected parties. The County Data Processing Division would maintain a file showing the correspondence between the old and new parcel identification numbers for a number of years following the conversion to enable the use of either parcel identification numbering system to access document and parcel records.

The County Data Processing Department has determined that the computer programming work needed to accomplish these two work tasks is relatively modest, and can be readily accomplished by existing county programming staff. If the needed coding of document and parcel records is carried out on a work-flow basis as

proposed, these two work tasks can be carried out by existing staff in the Register of Deeds Office and the Property Lister's Office. Accordingly, all of these tasks can be accomplished by existing staff under existing operating budgets at no direct cost to the land records modernization program. Given the current annual volume of document transactions and changes in Walworth County, it should be possible to complete the change to the recommended parcel identification numbering system by the end of the six-year planning horizon of the recommended work program.

STATE GRANT APPLICATIONS

It may be expected that both Walworth County as a unit of government and perhaps one or more local units of government within Walworth County will over the six-year period, seek grants from the State in support of the development of the recommended automated mapping and land information system. It is recommended that any such grant applications, before being submitted to the Wisconsin Land Information Board, first be found to be consistent with the program objectives and standards set forth in this document. It is recommended that upon such a finding, Walworth County submit to the Wisconsin Land Information Board any application by a local unit government in the County with a recommendation for approval.

PROPOSED ORGANIZATIONAL ARRANGEMENTS

Institutional Structure to Conduct Program

The following institutional structure is recommended to carry out the aforedescribed work program during the period 1991 through 1996:

1. It is recommended that all activities related to the development of the proposed Walworth County automated mapping base be under the policy direction of the Walworth County Land Information Committee. That Committee was designated by the Walworth County Board of Supervisors as having policy responsibility for land information matters. It is further recommended that the Walworth County Register of Deeds be designated as the County Land Information Officer, and work with

the Land Information Committee in carrying out the recommended work program. Working with the County Surveyor, County Treasurer, County Highway Commissioner, and County Data Processing Manager, the Register of Deeds and the County Land Information Committee should oversee the recommended monumentation, survey control, and, potentially, large-scale mapping efforts, as well as the work efforts needed to create an automated tract index and to establish a new parcel identification system.

2. It is recommended that the Walworth County Land Information Officer serve as the agent for Walworth County in the preparation and submittal of grant applications for Walworth County that seek grants from the Wisconsin Land Information Board. It is further recommended that the Land Information Committee serve as the body for reviewing any applications submitted by a local unit of government in Walworth County for state funds in support of land information system development work. If the Land Information Committee finds that an application by a local unit of government is consistent with the plan objectives and standards set forth in this document, it should forward the application to the Wisconsin Land Information Board with a favorable recommendation for approval. If the Committee cannot make such a finding, then it should return the application to the local unit of government, including a statement of the reasons why the application is inconsistent with the objectives and standards set forth in this plan and including any suggestions that the Committee might have to modify the application to make it consistent with the plan.

Public Access to Records

The information that comprises the Walworth County Land Information System base, including monumentation and survey control data, potential planimetric and topographic base mapping data, cadastral mapping data, and parcel identification data, may constitute public information under the Wisconsin Open Records Law. Consequently, Walworth County will have to make such data available to both public and

private sector interests upon request. In adopting this plan document, the County recognizes the County Land Information Officer as the official custodian of all data attendant to the Walworth County Land Information System base. In accordance with established Walworth County policy, all requests for data from that base should be submitted to the Land Information Officer on such forms and in such manner as may be prescribed. All reasonable costs associated with fulfilling such requests shall be paid for by the requesting party.

As Walworth County in future years builds upon the automated mapping base described in this plan, it may be expected that additional data sets, or "flat files", will be added to that base. Some of those data sets may consist of data that under Wisconsin law is to be kept confidential in order to protect individual rights of privacy. As such information is developed over the years, Walworth County should explicitly address public access considerations related to these additional sets of information.

Administrative Considerations

The guidelines promulgated by the Wisconsin Land Information Board call for the explicit response of Walworth County to certain administrative standards and requirements. The following explicitly addresses those guidelines:

1. Relationship to Wisconsin Land Information Program
By adopting the Walworth County Land Information System Plan set forth in this document, Walworth County agrees to observe and follow Wisconsin Statutes attendant to the Wisconsin Land Information Program.
2. Access to Books, Records, and Projects
By adopting the Walworth County Land Information System Plan set forth in this document, Walworth County agrees to permit the Wisconsin Land Information Board, upon reasonable notice, access to books, records, and project materials for inspection and audit purposes.
3. Annual Report
By adopting the Walworth County Land Information System Plan set forth in this document, Walworth County agrees to

prepare an annual report on the status of plan implementation and to submit that report to the Wisconsin Land Information Board.

4. Plan Update and Revision

By adopting the Walworth County Land Information System Plan set forth in this document, Walworth County agrees to revise, update, and extend the Walworth County plan, with such updating work to be undertaken during calendar year 1995.

SUMMARY

This chapter sets forth a recommended automated mapping and land information system plan for Walworth County. The following summarizes the salient elements of that plan:

1. It is the goal of Walworth County to implement, over time, a multi-purpose, multi-user automated mapping and land information system, following the National Research Council model. The system would have five basic elements including a geodetic reference framework; large-scale planimetric and topographic base maps; overlays, including cadastral boundaries and boundaries of various cultural and natural areas; identifiers, including parcel numbers and codes associated with various cultural and natural areas; and nonspatial land information files, including cadastral parcel records and various cultural and natural resource data. It is also the goal of Walworth County to assist in the modernization of the land records system by creating an automated tract index and by establishing a parcel identification system consistent with that recommended by the Wisconsin Land Information Board.
2. The planning period for the initial land information system plan for Walworth County is the six-year period beginning January 1, 1991, and extending through December 31, 1996. It is intended that as much work as possible in completing the geodetic reference framework for an automated mapping and land information system be completed by the end of that period recognizing, however, that there are fiscal constraints. It is further intended

that the automated tract index and the parcel identification revision efforts be completed by the end of the six-year period.

3. The recommended standards for the automated mapping and land information system for Walworth County are based upon the standards for the development of survey control networks and local large-scale mapping programs promulgated by the Southeastern Wisconsin Regional Planning Commission. The standards have been used for many years throughout Southeastern Wisconsin, including Walworth County, and have proven to be both conceptually and procedurally sound. The standards include the use of the State Plane Coordinate System, North American Datum of 1927 (NAD-27) as the map projection system for the Walworth County automated mapping and land information system; the recovery, or relocation, and monumentation of U. S. Public Land Survey corners, including section and quarter section and center of section corners; the establishment through high order control surveys of coordinates for such corners based upon the Wisconsin Coordinate System, South Zone, (NAD-27); the establishment through high order control surveys of elevations of all such corners based upon National Geodetic Vertical Datum, 1929 adjustment (NGVD-29); the preparation to National Map Accuracy Standards of large-scale planimetric and topographic base maps; the preparation of companion large-scale cadastral maps identifying real property boundary lines and related information; and development of a system of parcel identification numbers.
4. The total cost of completing the entire recommended automated mapping and land information system base for Walworth County is estimated at \$6.3 million. Of this total, nearly \$2.6 million, or about 41 percent, is required to complete the geodetic reference framework, including the recovery, or relocation, and monumentation of public land survey corners and the establishment of State Plane Coordinates and vertical elevations for such corners; about \$2.8 million, or an addi-

tional 45 percent, is required to prepare large-scale one inch equals 200 feet topographic base maps for the entire County; and the remaining \$0.9 million, or 14 percent, is required to compile cadastral maps for the entire County and convert those maps to digital form.

5. Four potential sources of revenue were identified to support the recommended work program. These include the supplemental Register of Deeds recording and filing fees mandated under the Wisconsin Land Information Program, potential state grants from the Wisconsin Land Information Board, contributions by local governments and utilities, and County tax levy monies. The Register of Deeds filing and recording fees retained by the County are anticipated to total about \$333,300 over the six-year planning period, or about \$55,550 annually. state grants of up to \$100,000 can be sought on an annual basis with a required 25 percent local match. At the present time, no local government or public or private utility in the County has come forth with a commitment to provide additional funds to support the program. Also at the present time, tax levy monies payable to the County in the amount of about \$68,720 annually are being made available through the County Highway Department budget to the County Surveyor to recover, or relocate, and monument the U. S. Public Land Survey corners in the County and to maintain the recovered and monumented system.
6. The Land Information Committee recommended that, at a minimum, Walworth County expend \$100,000 annually over the six-year period 1991 through 1996 toward completing the geodetic reference framework. About one-half of the revenue needed to support this work effort would be available from the new Register of Deeds recording and filing fees; the remaining one-half would be drawn from the existing County Highway Department budget made available to the County Surveyor for remonumentation activities. In addition, the Committee recommended that Walworth County seek a \$100,000 grant annually over the six-year period from the Wisconsin

Land Information Board and use those monies to accelerate the completion of the geodetic reference framework in the southern one-half of the County. A total of 12 priority areas for the expenditure of available monies in completing the geodetic reference framework were identified. Such work includes the relocation and monumentation of U. S. Public Land Survey corners, the establishment of State Plane Coordinates for such corners, and the establishment of vertical elevations for such corners. Finally, the Committee recognized that local units of government in the County may desire to accelerate the completion of an automated mapping base for a portion of the County. The Committee recommended that Walworth County support such local government efforts, redirecting as may be necessary available county resources in completing the geodetic reference framework and supporting local applications for state grants from the Wisconsin Land Information Board provided that the local government concerned proposes to spend such state monies in a manner consistent with the standards and specifications for automated base mapping set forth in this report.

7. In addition to the continuation of work on building an automated mapping base, the Land Information Committee recommended that two related work activities essential to the modernization of land records in the County be undertaken over the next six years. These activities consist of the creation of an automated tract index and the conversion of the existing Walworth County parcel identification system to the parcel identification system recommended by the Wisconsin Land Information Board. The creation of a tract index, whether automated or not, requires the adoption of an ordinance by the Walworth County Board of Supervisors pursuant to Section 59.55 of the Wisconsin Statutes. As a "day forward" system, the proposed automated tract index will be usable immediately upon the coding of the first document. The utility of the tract index will be limited at first, but will significantly increase with the passage of time and the coding of additional documents. A tract

index may be expected to have significant benefits in terms of shortening the amount of time required by county staff and the public to research questions attendant to ownership of and interests in land. The establishment of a new parcel identification system while the tract index is built will ensure that all parcels in Walworth County will be uniquely coded to the U. S. Public Land Survey quarter quarter-section. The establishment of the automated tract index and the conversion to a new parcel identification system can be expected to be accomplished by existing Walworth County forces without any increased costs.

8. Upon approval of the Walworth County land information system plan by the Walworth County Board of Supervisors and by the Wisconsin Land Information Board, local units of government in Walworth County would be eligible to seek state grants from that Board. It is recommended that any locally sponsored land information project seeking such state funds meet the system standards identified

in this chapter. In that way all projects will contribute toward achieving the overall objectives underlying the Walworth County plan. All local applications for state grants should be reviewed by the County Land Information Committee. Upon a finding by that Committee that an application is consistent with the Walworth County plan, the application should be forwarded to the Wisconsin Land Information Board with a favorable recommendation for approval.

9. In order to meet the administrative standards and requirements promulgated by the Wisconsin Land Information Board, Walworth County by adopting this document agrees to observe and follow the Wisconsin Statutes attendant to the Wisconsin Land Information Program; to permit the Wisconsin Land Information Board access to books, records, and project materials for inspection and audit purposes; to prepare and submit to the Wisconsin Land Information Board an annual report on the status of plan implementation; and to revise, update, and extend the Walworth County plan by the end of calendar year 1995.

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Chapter V

SUMMARY AND CONCLUSIONS

INTRODUCTION

On July 10, 1990, the Walworth County Board of Supervisors adopted a resolution requesting the Southeastern Wisconsin Regional Planning Commission to assist the County in the preparation of a plan for land records modernization, focusing on the development of an automated mapping and parcel-based land information system. The County Board also created a Land Information Committee to help guide the preparation of the plan. This report sets forth the findings and recommendations of that Committee. The Committee was chaired by the Chairman of the County Board; Committee members included the Chairmen of key County Board Committees and key county staff members, including the County Register of Deeds, who was designated by the County Board as the official contact person for the County Land Information Office. In the making of the Walworth County land information system plan, Walworth County solicited the participation of all local governmental units in the County and all private utilities operating in the County. Representatives of local governments and private utilities actively participated in the Committee meetings which resulted in the formulation of a recommended plan by the Land Information Committee.

The Land Information Committee reviewed the pertinent conclusions of previous research efforts in the area of land records modernization, including, importantly, the reports of the National Research Council of the National Academy of Sciences, the reports of the Wisconsin Land Records Committee, the guidelines promulgated by the Wisconsin Land Information Board, and the long-standing recommendations of the Southeastern Wisconsin Regional Planning Commission. The Land Information Committee also reviewed the accomplishments to date of public and private efforts to create automated mapping and land records systems covering all or portions of Walworth County.

The Land Information Committee concluded that a modernized land records system in Walworth County could best be created by provision of a single automated mapping base for the entire County. This single mapping base

would be prepared to a set of specifications sufficient to meet the most stringent of accuracy and map feature content requirements of all of the users concerned. Such specifications are set forth in Chapter IV of this report. Each organization using the automated base would provide its own operating environment, that is, computer hardware and software. Only the digital maps and parcel identification system would be shared. This basic system would provide an automated mapping capability suitable for the development by individual operators of a wide variety of applications such as land ownership and title recordation systems, real property assessment and taxation systems, public and private utility inventory and management systems, environmental inventory and management systems, zoning and other code monitoring and enforcement systems, and emergency and service vehicle response and routing systems. The Land Information Committee also concluded that the land modernization efforts of Walworth County should include the creation of an automated tract index and the conversion of the existing Walworth County parcel identification system to the uniform system recommended by the Wisconsin Land Information Board.

The plan set forth in this document is recommended to the Walworth County Board of Supervisors for adoption. Upon adoption of the plan, the Committee recommends that the plan be formally submitted to the Wisconsin Land Information Board with a request that the plan be approved by that Board. Upon approval by that Board, Walworth County would be in a position to begin expending the supplemental Register of Deeds filing and recording fees authorized under the Wisconsin Land Information Program in a manner consistent with the plan recommendations. In addition, Walworth County would be in a position to submit applications for the state grants in support of the activities specified in the plan. Finally, local units of government in Walworth County would also be in a position to submit applications for state grants. Such applications under state law would have to come through Walworth County and be endorsed by the County so that any state funds expended are directed at activities consistent with the adopted plan.

RECOMMENDED CONCEPTUAL FRAMEWORK

The conceptual framework for a multipurpose cadastre as set forth by the National Research Council and as adapted for use by Walworth County consists of the following elements:

1. A geodetic reference framework to identify the spatial location of all land-related data. This reference framework, or survey control network, consists of a system of survey monuments for which geodetically based coordinates have been determined through high order control surveys. In accordance with the long-standing recommendations of the Southeastern Wisconsin Regional Planning Commission, the geodetic reference framework to be used in Walworth County is to consist of the corners of the U. S. Public Land Survey System tied to the State Plane Coordinate System.
2. Large-scale topographic base maps showing in their correct location and orientation the principal natural and cultural features of the area concerned and the elevation and configuration of the surface of the earth. Within the context of the Walworth County program, large-scale means one inch equals 200 feet scale, two-foot contour interval topographic maps, although those local units of government in the County that desire to prepare one inch equals 100 feet scale, two-foot contour interval topographic maps should be encouraged to do so. In either case, these maps must meet National Map Accuracy Standards in accordance with specifications promulgated by the Southeastern Wisconsin Regional Planning Commission.
3. A cadastral overlay to the topographic base map which identifies and delineates the most fundamental unit of land ownership, the cadastral parcel. Such cadastral overlay maps are also to be prepared in accordance with specifications promulgated by the Southeastern Wisconsin Regional Planning Commission.
4. A parcel identifier constituting the means for linking all spatially related data to the mapping base and of storing, retrieving, and exchanging such data. Every parcel must have a unique identifier code.

5. Land information files which contain data about the land parcels and which are related to the mapping base through the parcel identifier. Such files can be either graphic or nongraphic in nature.

It is intended that the first four of the five elements of the multipurpose cadastre in Walworth County ultimately be provided by the County and that such elements be made available in digital, that is, computer-readable, form. These elements collectively would constitute the automated mapping base. Building upon that base, Walworth County, the local units of government in the County, and public and private utilities operating in the County can create the fifth element of the cadastre, namely, the supplemental land information files required to support the particular functions of the public and private agencies concerned. It is recognized that resource constraints will prohibit the full development of the automated mapping base by Walworth County in the relatively near future. Accordingly, the Land Information Committee encourages those local units of government in the County which may desire to do so to proceed at their own pace with the development of the automated mapping base attendant to their jurisdictional area. Such base, however, should be constructed in accordance with the standards recommended in the Walworth County plan.

The recommended standards for the automated mapping and land information system for Walworth County are based upon the standards for the development of survey control networks and local large-scale mapping programs promulgated by the Southeastern Wisconsin Regional Planning Commission. These standards have been used for many years throughout the Region, including Walworth County, and have proven to be both conceptually and procedurally sound. The standards include the use of the State Plane Coordinate System, North American Datum of 1927 (NAD-27), as the map projection system for the Walworth County automated mapping and land information system; the recovery, or relocation, and monumentation of U. S. Public Land Survey corners; the establishment through high order control surveys of coordinates for such corners based upon the Wisconsin Coordinate System, South Zone, (NAD-27); the establishment through high order control surveys of elevations of all such corners based upon National Geodetic Vertical Datum,

1929 Adjustment (NGVD-29); the preparation to National Map Accuracy Standards of large-scale planimetric and topographic base maps; the preparation of companion large-scale cadastral maps identifying real property boundary lines and related information; and parcel identification numbers.

STATUS OF DEVELOPMENT OF AUTOMATED MAPPING BASE

The following summarizes the status of the development of the recommended automated mapping base in Walworth County as of December 31, 1990:

1. The Regional Planning Commission, Walworth County, and certain local units of government in the County have collectively contributed to the development of the required geodetic reference framework over the past three decades. Of the estimated 2,560 U. S. Public Land Survey corners in Walworth County, 266 corners, or about 10 percent, have been relocated and remonumented and fully coordinated through the establishment of horizontal and vertical survey control data to the recommended specifications. An additional 200 corners have been relocated and monumented with attendant horizontal control survey data. An additional 1,312 corners have been relocated and monumented by the Walworth County Surveyor; however, no horizontal or vertical control survey data have been established for such corners. In total, then, 1,778 corners, or about 70 percent of all corners in the County, have been monumented; 466 corners, or about 18 percent of all corners in the County, have been placed on the State Plane Coordinate system; and 266 corners, or about 10 percent of all corners in the County, have elevations established to National Geodetic Vertical Datum (NGVD).
2. Through large-scale mapping programs conducted by the Cities of Delavan, Elkhorn, and Lake Geneva and the Village of East Troy, about 27.5 square miles, or about 5 percent of the 578-square-mile area of Walworth County, has been mapped to the recommended specifications. Each of these four municipal mapping programs

involved the preparation of topographic base maps but did not include the preparation of companion cadastral maps.

3. Cadastral maps have not been prepared for any part of Walworth County. The cadastral mapping process includes the assignment of the required parcel identifier. Cadastral maps need to be completed for all of Walworth County, replacing the cadastral diagrams that are now in place. All cadastral maps would need to be converted to digital form.

RECOMMENDED PLAN

The recommended Walworth County land information system plan was prepared for the six-year period 1991 through 1996. This planning period corresponds with the state legislation establishing the supplemental Register of Deeds recording and filing fees. Based on current state law, the additional filing fees expire at the end of state fiscal year 1996. It would be desirable to complete the entire automated mapping base recommended for Walworth County by the end of 1996. The Land Information Committee recognizes, however, that there are fiscal constraints that will preclude reaching that goal by the end of this initial six-year planning period.

The total cost of completing the entire recommended automated mapping and land information system base for Walworth County is estimated at \$6.3 million. Of this total, nearly \$2.6 million, or about 41 percent, is required to complete the geodetic reference framework, including the recovery, or relocation, and monumentation of U. S. Public Land Survey corners and the establishment of State Plane Coordinates and vertical elevations for such corners; about \$2.8 million, or an additional 45 percent, is required to prepare large-scale one inch equals 200 feet topographic base maps for the entire County; and the remaining \$0.9 million, or 14 percent, is required to compile cadastral maps for the entire County and convert those maps to digital form.

The Land Information Committee identified four potential sources of revenue to support the recommended work program. These include the supplemental Register of Deeds recording and filing fees mandated under the Wisconsin Land Information Program, potential state grants

from the Wisconsin Land Information Board, contributions by local governments and utilities, and county tax levy monies. The recording and filing fees are expected to total about \$333,300 over the six-year planning period, or about \$55,550 annually. State grants of up to \$100,000 can be sought on an annual basis. At the present time no local government or public or private utility in Walworth County has come forth with a commitment to provide additional funds to support the program. Also at the present time, County tax levy monies in the amount of about \$68,720 annually are being made available through the County Highway Department budget to the County Surveyor to recover, or relocate, and monument the U. S. Public Land Survey corners in the County and to maintain the recovered and monumented system.

The Land Information Committee recommended that, at a minimum, Walworth County expend \$100,000 annually over the six-year period 1991 through 1996 toward completing the geodetic reference framework. About one-half of the revenue needed to support this work effort would be available from the new Register of Deeds recording and filing fees; the remaining one-half would be drawn from the existing County Highway Department budget made available to the County Surveyor for remonumentation activities. In addition, the Committee recommended that Walworth County seek a \$100,000 grant annually over the six-year period from the Wisconsin Land Information Board and use those monies to accelerate the completion of the geodetic reference framework in the southern one-half of the County. A total of 12 priority areas for the expenditure of available monies in completing the geodetic reference framework were identified. Such work includes the relocation and monumentation of U. S. Public Land Survey corners, the establishment of State Plane Coordinates for such corners, and the establishment of vertical elevations for such corners. Finally, the Committee recognized that local units of government in the County may desire to accelerate the completion of an automated mapping base for a portion of the County. The Committee recommended that Walworth County support such local government efforts, redirecting as may be necessary available County resources in completing the geodetic reference framework and supporting local applications for state grants from the Wisconsin Land Information Board provided that the local government

concerned proposes to spend such state monies in a manner consistent with the standards and specifications for automated base mapping set forth in this report.

In addition to the continuation of work on building an automated mapping base, the Land Information Committee recommended that the County Board authorize the creation of an automated tract index and that the existing Walworth County parcel identification system be converted to the parcel identification system recommended by the Wisconsin Land Information Board. The automated tract index would be a "day forward" system, being useable immediately upon the coding of the first document, but with the utility of the tract index significantly increasing with the passage of time and the coding of additional documents. Such an index may be expected to have significant benefits in terms of shortening the amount of time required to research questions attendant to ownership of and interest in land. The establishment of the automated tract index and the conversion to a new parcel identification system can be expected to be accomplished by existing Walworth County forces without any increased costs.

It is recommended that the Walworth County Land Information Committee oversee all work associated with the development of the Walworth County automated mapping and land information system base over the next six-year period. It is further recommended that the Walworth County Register of Deeds be designated as the County Land Information Officer and work with the Land Information Committee in carrying out the work program. The close cooperation of the County Surveyor, County Treasurer, County Highway Commissioner, and County Data Processing Manager will be required to successfully carry out the recommended work program.

The Land Information Committee also recommends that Walworth County agree to meeting all of the administrative requirements for county land information programs established by the Wisconsin Land Information Board. In particular, Walworth County should prepare and submit to that Board an annual report on the status of plan implementation. Furthermore, Walworth County should pledge to revise, update, and extend this plan by the end of calendar year 1995.

CONCLUDING STATEMENT

The Walworth County Land Information Committee has herein set forth a plan and program for the development over time of an automated base map suitable for the development within the County of a parcel-based land information system usable by all Walworth County departments, by local governments in Walworth County, and by public and private utilities. The plan includes technical specifications for the mapping work involved, a six-year program to advance the completion of the geodetic

reference framework, an outline of a proposed work effort to create an automated tract index and to convert the Walworth County parcel identification system to the state-recommended system, and recommends an organizational structure for the conduct of that work. The Land Information Committee recommends that the plan and program set forth herein be approved by the Walworth County Board of Supervisors and that work efforts proceed over the next six years in accordance with the outline and organizational structure recommended in this report.

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APPENDICES

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Appendix A

**RESOLUTION OF THE WALWORTH COUNTY BOARD OF SUPERVISORS
REQUESTING THE SOUTHEASTERN WISCONSIN REGIONAL PLANNING
COMMISSION TO HELP PREPARE A COUNTY LAND INFORMATION SYSTEM PLAN**

RESOLUTION NO. 39-07/90

REQUEST FOR COUNTY-WIDE PLAN FOR LAND RECORDS MODERNIZATION

WHEREAS, the Legislature has amended Wisconsin Statute Sec. 59.88 to provide for an increase in certain user fees to be collected by the Register of Deeds and retained for use to develop, implement and maintain a county-wide plan for land record modernization, and

WHEREAS, modernization expenses can be funded through both the statutorily established retained fee and grants from the State Board to modernize land records, and

WHEREAS, a county-wide plan for land records modernization is required to be implemented within a two-year period of the formation of a county land information office in order to obtain said grants.

NOW, THEREFORE, BE IT RESOLVED that the Walworth County Board of Supervisors does hereby request a county-wide plan for land records modernization from SEWRPC, (Southeastern Wisconsin Regional Planning Commission), whose service is offered to Counties gratis.

Dated this 10th day of July, 1990.

EXECUTIVE COMMITTEE

George Lauderdale
Bob Key
Joseph H. Schaefer
Gerald Byrnes
Frank Janowak
Harriette Kruger
Larry Scharine

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Appendix B

**RESOLUTION OF THE WALWORTH COUNTY BOARD OF SUPERVISORS
ESTABLISHING A COUNTY LAND INFORMATION OFFICE**

RESOLUTION NO. 11-05/90

REVISED COUNTY LAND INFORMATION OFFICE

WHEREAS, the Wisconsin Legislature has established a Land Information Board within the 1989-91 State Budget, and

WHEREAS, Land Information System means an orderly method of organizing and managing land information and land records in Walworth County, and

WHEREAS, the County may establish a County Land Information Office and shall direct whom shall perform any duties pertaining to the office.

NOW, THEREFORE, BE IT RESOLVED that the Walworth County Board of Supervisors does hereby establish a County Land Information Office as directed under 59.88(3) Wisconsin Statutes. The Walworth County Board of Supervisors does hereby appoint the following members to the land Information Office to perform the duties required of said office: Chairman of the Park & Planning Commission; Chairman of the Land Conservation Committee; Chairman of the Judicial Committee; Chairman of the Executive Committee; Chairman of the Data Committee; Vice-Chairman of the County Board; Register of Deeds; County Surveyor and Data Manager.

BE IT FURTHER RESOLVED that upon passage of this resolution, Resolution No. 68-09/89, adopted November 8, 1989, is rescinded.

Dated this 15th day of May, 1990.

EXECUTIVE COMMITTEE

George Lauderdale
Gerald Byrnes
Joe Schaefer
Frank Janowak
Larry Scharine

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Appendix C

LETTER FROM WISCONSIN NATURAL GAS COMPANY



233 Lake Ave., Racine, WI 53401

(414) 637-7681

June 27, 1991

Mr. Kurt W. Bauer
Executive Director
Southeastern Wisconsin Regional
Planning Commission
916 N. East Avenue
P. O. Box 1607
Waukesha, WI 53187-1607

Dear Mr. Bauer:

Wisconsin Natural and Wisconsin Electric look forward to the possibility of providing that portion of their automated mapping land base which lies in Walworth County to help meet the requirements of the county's land information program. As you are aware, we have mapped approximately 60% of Walworth County's 328 square mile area.

In response to your June 3, 1991 letter, the cost to Walworth County would be \$33,000 (\$25,480 payable to Wisconsin Electric and \$7,520 payable to Wisconsin Natural) regardless of the format in which the data is presented. We currently have the ability to translate our 1" equals 400' land base files to an AutoCAD DXF format. This is a somewhat "neutral" format, however, the data will still be referenced to the Universal Transverse Mercator Coordinate system. We are presently unable to deliver these files referenced to the State Plane Coordinate system.

It should be mentioned, that the sale of this mapping information would be done on an "as is" basis, with no guarantee on the accuracy and completeness of the information, and that the cost covers a one-time transfer of all land base data, current as of the date extracted from our system. Also the data does not include gas or electric facility information.

Please let me know if you require any further information regarding our land base mapping system.

Very truly yours,

A handwritten signature in cursive script, appearing to read 'J. C. Place'.

J. C. Place
Manager Systems Engineering

vls

cc: Lois Ketterhagen, Register of Deeds,
Walworth County