GIS and Land Records Integration
A PRIA White Paper

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Introduction

Although Geographic Information System (GIS) is a relatively new tool for anyone interested in land records, the recording of property records has been in existence since records were created. The integration of these two systems can help to create modern property record systems, which provide:

- New, online tools, both maps and web resources, for all stakeholders to research and locate properties of interest before recording.
- Indexing of correct parcel identification numbers (PIN) in land record systems for subsequent searches and queries.
- Land record, assessment, and GIS map queries.
- New and improved indexes with property-based references.
- Document identification by location and not just by grantor/grantee.
- Better services through availability of data information.
- Capabilities for open records initiatives.
- Authoritative content from the recorder’s office.
- Improved public relations and constituent engagement by offering expanded available services.
- Notification on parcel searches for transactions/liens.
- Document recording notification by property which can help identify fraud.

This PRIA GIS work project is designed to help members understand the value of integration of GIS and land records and provide tools for operational support of that integration.
GIS Overview

GIS Defined
A Geographic Information System (GIS) is a computer-based tool that stores, analyzes, manipulates, and allows information to be visualized with a spatial component (location) on a map. By displaying information on a map, relationships between spatial components come to life. GIS can be used to obtain available information about a specific property.

GIS is comprised of layers of structured data each with a specific geographic property. Each layer needs a geographic reference point common with all other layers so they will align properly. Accurate alignment is the key to mapping relationships with the different layers. Geographic elements, such as datum, coordinates, and projection must have a common reference to establish accurate alignment.

Layers of Information – Organizing Information by Location

Spatial analysis gives perspective to understand relationships between geographic and tabular information. GIS uses spatial analysis to establish correct ownership and parcel location, parcel size, and valuation. Zoning regulations, districts for voting, and school locations can be identified through GIS information.

Many early uses of GIS arose from the need for emergency management routing (getting from point A to point B) for 911 emergency response systems. Variables such as speed limits, traffic volume, and road conditions can be assigned to street segments and layers. These assignments contribute to the determination of the desired route, ensuring that emergency responders arrive at the scene quickly.

While GIS software promotes the creation of layers, the industry is moving toward configuring user-specific applications for the needs of a variety of end-users. For example, users see only the layers pertinent to their agency through a simple focused application. This specificity is especially useful for non-traditional GIS users.
Mapping and GIS

Mapping with GIS is trending away from producing static paper maps and instead is utilizing interactive web-based maps that are constantly updated. Although some data is historical and needs to be static, parcel boundaries can change over time. The capability to capture time slices that correspond to specific property records is important.

The integration of GIS with property records better enables the selection of a specific location on a map. The common method of searching property records is via tabular indexes, and although information filters are available within Land Records Management Systems (LRMS), the filtering of information can become much more specific and unique when the land records system is integrated with GIS.
Property Records Overview

Ownership of property in the United States, as in other developed economies, is a vital economic tool that distinguishes it from many other countries. It allows citizens to produce and use capital efficiently. Property record documents are created to define, buy, sell, or encumber property. These records are also fundamental to many functions of local government, including property assessment and taxation. Recording jurisdictions provide the formal, public notification by which a claim to a piece of property is established. This ministerial process is a system for safeguarding the ownership of land.

Over time, property records attempt to capture all the recorded transactions, in sequential order, related to parcels of property. This may include documents related to ownership such as deeds, liens, encumbrances on the property, and boundary line adjustments. This data is also valuable for GIS integration.

The complex rights and interests in land are reflected in the bundle of rights Figure 1 below.
Property Records/GIS Integration

There are two overarching methods for GIS and property records integration:

- Manual Process
- Automated Integration

Manual integration requires staff to physically enter data into one or more systems to establish relationships for integration. One system may be used to enter document information from the point of recording and assign important key fields such as the instrument number and the recording date and time. One or more pieces of data would then be passed to another agency and entered manually into a second system to relate it to either an existing parcel or to create a new parcel for assessment and mapping purposes. At this point, information such as acreage, land use, and zoning may be related by a key field such as the PIN. Consumers need to search several systems separately to obtain all the data necessary for their business.

Automated integration generally begins in the recorder’s office where information is entered into a LRMS, either by scanning documents and indexing data or electronically via an eRecording portal. Pre-selected data can then be automatically transferred through various software systems that link the information, such as parcel description, assessment, and map, through the PIN and/or other key fields. In addition, data can be automatically transferred to various state and local agencies and even to the consumer. In an automated system, while it is not necessary to have the same software for each office, it is critical to use open data exchange standards for easy integration and to enable accurate and efficient data communication. Data should flow in both directions, as appropriate.
Even in an automated system, there are sometimes steps in the workflow where manual input or review is necessary. If a parcel is split, all data needs to be related to both parcels.

The result of integration, whether manual or automated, allows the public to search in one place all possible information associated with a parcel of land. This search can include data about sub-surface rights in the ground and air rights above the ground. Additionally, it can include information locating the closest hospitals, schools, and churches.

**Web Services** are the modern form of shared data for system integration. Multiple applications communicate with each other via the Internet or Intranet using open standards. Web services allow organizations to securely share data without intimate knowledge of each other’s business systems.

**Opportunities for the Future**
Proper standards-based integration today allows for rapid and easy integration for other systems in the future. Maintaining reliable and accurate web services will encourage other integrations in the future.

All parcel data should be recorded and defined in the GIS, including easements such as utility and conservation, as well as mineral rights.

PINs should be consistent, accurate and shared among all participating agencies. With good integration and workflow the quality of data improves over time.
Important Keys

A key is a field used to identify, sort, and query data. A primary key is assigned to provide a unique value for each record. This key value should be identical in both the GIS and Land Record systems. A common key is essential when integrating systems. Examples follow.

- **Property Record Keys** – Recording keys enable indexing and are often defined by statutory requirements. However, keys important for GIS integration are usually optional and added as an additional service to the customers using the data.
  
  o Grantor/Grantee – Names on the document that reflect the parties. Capturing these fields may vary based on the jurisdiction’s protocol.

  o Instrument Number – Unique identifier for every document assigned when recorded. In many jurisdictions, this number key either supplements or has replaced the Book and Page numbering of documents.

  o Parcel Identification Number (PIN) – Unique number that may have other names such as an Assessor’s Identification Number (AIN). This unique number is often referenced in property records and is one of the few keys that identify the location of land. In a few states, the PIN is required to be included and indexed on documents to be recorded. Even though optional in other states, many recording jurisdictions are beginning to index the number. Documents may contain multiple PINs representing the property.

  o Time and Date Stamp – Reflects when the document was recorded and provides notice of the sequence of ownership. This key aids in establishing time relevancy with GIS. For example, a deed in a new subdivision would not be reflected on an older GIS map.

- **Assessment keys** – These keys are primarily used by the assessor to identify and link parcel information with ownership information. They are also used to integrate GIS with the computer-assisted mass appraisal systems (CAMA) used by assessors.

  o PIN – Unique reference number typically created and maintained by the assessor’s office to identify property. The PIN is determined by location and legal description; however, there is little standardization of format. PINs should be unique over time. If a PIN must be reused for any part of another parcel, the uniqueness of the PIN should still be maintained.

  o Property Owner – Key to update and maintain data on all property and property owners. This information is received from the recorder’s office after documents are
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recorded and is a primary element of a cadastral map. A cadastral map is an official register or map of property that depicts ownership, parcel boundaries, and related information.

- Situs Address – Physical location of the property and possibly different from mailing address. Sub-addresses, such as suites, apartments, and room numbers, can also exist. Vacant land may not have an address assigned until the land is improved. Situs address keys should be unique by jurisdiction.

The most commonly used key among the recorder, the assessor, and GIS, is the PIN. “The use of PINs to link a wide variety of records of both the nature and extent of land features and interests is essential for the development of a modern land records and information system.”¹ Due to splits, mergers, and subdivisions of property, PINs can change over time; there is GIS technology to manage this. For the PIN to be useful, it must be accurate. If a PIN is on a recorded document and there is no corresponding PIN in the GIS, the link connecting the document to the map will fail. In addition to the keys referenced above, there are other potential keys that are used for geocoding, which transform a description of a location (address or coordinates) to a location on the earth’s surface thus identifying a specific spot on a map; however, the PIN is widely considered the best practice.

System Integration

It is important to consider both the technical and human elements in the integration of systems. As technology improves, integration becomes more commonplace. Modern integration techniques, such as web services, enable the functionality of data sharing while maintaining the independence of individual systems. State laws address what type of data from recorded documents must be indexed and in what format. Consumer use dictates the type of data and the format that creates a value-added product.

The human element of integration can be more difficult. Improving workflow for the departments providing and using the data, without interfering with custodial rights and statutory authority, can be challenging. The property records industry needs to provide data and services in formats that can be connected to other systems, now and in the future. Data standardization for common keys is needed for integration among agencies.

Agencies need to identify what data is to be linked and updated. Comparing and evaluating data from critical functions, such as 911 emergency response systems and assessment/taxation, can identify differences in the data, which will hinder integration. The PIN has been identified as the most important and common key among agencies; therefore, it is critical that the PIN is standardized and accurate.

Integration provides access to information that can be supplied to stakeholders for use in preparing documents. This information integration will help to reduce document errors and improve GIS accuracy.

Creating shared locations for exports allows various software applications, both internally and externally, to import identified data. Databases should be in a common format so they can easily link, join and relate data. There should be a method to identify the custodian (source) of specific data.
Workflow Considerations

Prior to Recording

Property records are created by the parties conducting transactions. Title companies and closing agents create the majority of property record documents, often with the assistance of surveyors and attorneys. Lenders are involved if there is financing required as part of a transaction. It is common for prior documents, such as the previous deed, to be used as the source for creating new documents; however, if any errors existed in the original document, they will likely be propagated in the new document.

Including the PIN on the document is an important component in the integration of the property records and GIS and is beneficial even if not required by law. The PIN should be validated with the GIS or assessor’s information to assure accuracy. Addresses and legal descriptions are used as standard identifiers but are not a substitute for PINs.

In order to be correctly represented in GIS, a document must include an accurate description of the property. With property records/GIS integration, some steps may be unique to each state, county or jurisdiction. In some states, by either legislation or local ordinance, the PIN is required on all recorded documents relating to real property. The document preparer is responsible for researching and including the proper PIN(s).

In some jurisdictions, the mapping or GIS staff is involved in examining and verifying the PIN prior to recording. With the use of technology, this validation takes only a few moments and does not delay the recording process.

Challenges can arise where there is not a simple “one-to-one” relationship from the property to the document. One example is a change (widening) in the dedicated right-of-way which affects the legal description of multiple properties along both sides of the street. Another example could be a sewer utility easement across multiple, adjoining properties. An easement may be related to just “part of” a parcel or property. The same type of easement, as in the graphic below, may be on both sides of a property.
Easements may affect multiple properties but are usually primary to one property and secondary to another property, for example ingress/egress easements. GIS enables greater visibility of easement identification and location, such as those on the property next door or down the street.

**Recording Steps**

Documents submitted for recording come into the recorder’s office in one of three ways: walk-in, mail, or electronic submission. They are processed and indexed for searching.

The recorder’s LRMS should contain a field to capture the PIN. The document being recorded should include a PIN which would be entered into the LRMS. The PIN(s) should be verified when recording to become an accepted and reliable way to search land records.

Currently, recorders typically do not verify the PIN or legal description at the time of recording.

**After Recording**

By joining or subdividing parcels, new property parcels and corresponding PIN(s) are created based on recorded documents such as deeds, plats, easements, and declarations of condominium. Property transfers are used as the basis for cadastral map updates. Data from the cadastral map is used by the
assessor and the tax collector, along with other agencies, to provide property owner identification and notification. Those same recorded documents provide information for updating and maintaining the GIS layers for plats, subdivisions, lots, parcels, easements, mineral rights, and condominiums.

It is essential that the property records data be shared with offices responsible for GIS information. If the PIN is included in the recorded document, there will be a direct link between the land, property records and the parcel layer. This information transfer is the beginning of data integration and the PIN is the key.

By establishing a link between the document and the related property, the workflow from submission to property assessment to GIS mapping is strengthened. The workflow is more direct and less error prone.

Integration provides the opportunity to include multiple types of land records in the GIS framework. The map below displays recorded documents, by type, shown by municipalities for one month. The map also illustrates the significance of recorded documents as an indicator of market activity. GIS and property record integration creates a value-added product for all property records stakeholders.

All of these key workflow steps will do much to improve data quality, lessen data redundancy, and minimize possible errors.

The following map photo shows the on-line GIS map aerial photograph possible with land record integration.
Source: Lake County, FL
Instruments and Legal Descriptions

The legal descriptions will form the framework for the base mapping for the GIS. The legal descriptions identify the limit or boundaries of individual land owners’ claim of ownership.

Examples of common legal descriptions include metes and bounds, tract, condominium, and lot and block as shown on a subdivision plat.

Once the legal description of a parcel or property is determined, that legal description is often carried forward upon each transfer of the property or parcel. Incorrect legal descriptions can be perpetuated through this process. Most property record documents have a legal description included although it may not be indexed by the recorder in some jurisdictions.

To create accurate GIS maps, it is necessary to begin with legal descriptions provided in recorded documents, subdivision plats and maps, and individual property surveys when available. The data from these documents are entered into a mapping system to create the cadastral or other layers. The cadastral layer is the key in the GIS mapping system and may expose gaps or overlaps that might exist between parcels of land.

The cartographic function of GIS helps identify potential problems with legal descriptions. When gaps or overlaps appear on a map, it may indicate a problem with the legal description. Proper legal descriptions are prepared based upon a ground-run land survey. Frequently, measurements of the property contained in the legal descriptions do not match what actually exists on the ground. These discrepancies occur for various reasons, including the changes over time in techniques and tools used to take measurements, typographical errors in descriptions, and descriptions prepared without the benefit of a land survey.

The description may have been written and surveyed correctly, but may not match the boundaries of the adjoining parcels on GIS. Tracking down the origin of the problem and developing a resolution may require the intervention of multiple parties, including but not limited to title examiners, surveyors, attorneys, judges and the involved property owners. Working together, land records professionals can utilize GIS tools to identify inaccuracies of legal descriptions.

These descriptions have four important properties that require caution when using geometry alone to define their locations.

It must be kept in mind always that title to property is a right more than a collection of geometric values. A proper description of a parcel is written with those rights in mind.

1. All measurements are subject to mathematical error. Therefore, throughout history physical evidence always trumps dimensional definitions.
2. The most reliable evidence of boundary extents is natural monuments, as parts of the landscape. Primary examples include bodies of water, which form ambulatory boundaries not
well described by geometry.
3. All properties in question exist on the earth. As such, they are subject to plate tectonics. Thus the coordinates of ALL property corners are constantly changing.
4. Given the above, property records are written so that the so-called common person may understand their meanings and defend legal rights without special training or advanced computerized tools.
LRMS Perspective

An essential component of an LRMS is the ability to integrate with multiple systems through the use of one or more application program interfaces (APIs), to transmit and receive data and images. Examples of APIs include GIS, CAMA, and financial systems. When integration is needed, the LRMS vendor should provide standardized formats and communication protocols so the application development required to share data is minimal.

Integration delivers the ability for automated notifications, auto-population of data and images from other systems, and management for multiple exports and imports. Through an integrated relationship with multiple systems, data can be displayed to the public or exported for title plant maintenance. Whatever the method or use, the LRMS should provide a flexible solution that allows for easy, standardized output to other systems.

Data tables within applications are useful in validating key elements, such as street names and situs addresses, needed for integration. This validation process improves accuracy among multiple applications like LRMS, GIS, CAMA, and 911 emergency response systems.
Individual Roles and Perspectives

As workflows become more connected and automated through integration, stakeholders and their roles are expanded.

The following are examples of those typically involved with the process of transacting real estate (in no particular order):

- Real estate professionals - list, buy and sell property
- Attorneys - provide legal services
- Mortgage/banking institutions - provide financing
- Appraisers - determine value
- Title preparers/researchers - research title, identify proper legal descriptions, prepare documents for recording
- Surveyors - provide surveys, plats or legal descriptions
- Notaries - authenticate the signers
- Closing agents - complete the transaction
- Recording staff - record the real estate transaction in the official record
- Assessment staff - update the property tax assessment records for sale prices and current owner’s name, mailing address of owner
- Tax collection staff - collect property taxes
- GIS staff - update maps
- Right-of-way agents - define ownership for easements and other utility corridors
- Land men - define ownership for oil, gas and mineral rights
- Planning and zoning agencies - approve development
- General public – search and use data

Better system integration will allow for efficient verification of parcel identification, validation of legal descriptions, and map updating. Including the proper PIN(s) on the document assures that the legal description pertains to the correct property. The GIS map and aerial photographs can further confirm the location of the property.
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Considerations

1. GIS information can be a potential revenue source for county offices.
   a. Additional parcel information could be marketable to the industry.
   b. Some jurisdictions have statutory authority to collect fees for validating PINs.
2. Formatting of the PIN should be consistent with all connected systems.
3. Accuracy of the PIN(s) is critical when integrating multiple systems.
   a. To ensure accuracy, the PIN should be validated for correct reference.
   b. The recorder’s index should allow a correct PIN number to be added and note incorrect entities.
   c. All land-related documents should include a PIN, e.g., mortgages, satisfactions, deeds, utility easements, lake districts.
4. Validation increases the quality and accuracy of data entered.
   a. Validation should begin prior to the creation of a document.
   b. The PIN can be validated as part of the recording process.
5. Historical PINs should be linked to the current PIN.
Conclusion

The GIS integration considerations listed in this document may seem overwhelming to implement but, with today’s LRMS, these tasks become a routine part of day-to-day business activities. Integrated data, from the beginning when a document is created to when the data is published for the public, is a valuable tool for data management, now and in the future.

For additional information regarding this paper or any other PRIA work product, send an Email to info@pria.us.
Resources

More in-depth GIS and land records information can be found in the following:

- “GIS for Dummies,” by Michael N. DeMers – first published February 17, 2009, available through Amazon and Barnes and Noble
- “ESRI Training Online” - https://www.esri.com/training
- “GIS Guidelines for Assessors,” second edition, joint publication by URISA and IAAO, 1999