Montana's Cadastral Layer Business Impact

Prepared for the Montana Land Information Advisory Council
by

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A. Summary

Introduction

Almost all government data has a geographic basis according to the U.S. Office of Management and Budget and other organizations; 80% at the state and local level. Montana's geographic information systems (GIS) professionals recognized this as far back as the late 1980s and pioneered the adoption of geospatial data and applications. Montana's geographic architectural blueprint has 13 framework layers, with the cadastral layer being one of the most mature. The cadastral framework layer is based on the cadastre; a legal repository of land records that identifies the owner, location, boundaries, description, and property rights associated with a parcel of land.

This report focuses on the value and costs associated with Montana's cadastral framework layer. There are four primary objectives:

- Evaluation of the IT investment in the cadastral layer
- Identification of business processes, users, and beneficiaries that depend on the cadastral layer
- Identification of the linkages between the cadastral framework and the other 12 framework layers
- Develop a financial analysis that documents the current and ongoing costs and benefits of the cadastral layer
- Establish a potential frame work for analyzing non-cadastral layers

This report documents that the interrelationships between the cadastral layer and other layers are an essential business requirement. Independent studies have documented that GIS systems that automate all commonly used data sets return benefits 4 times higher than costs. The business usage of Montana's cadastral layer reinforces this finding. Business processes that rely on the cadastral data also require additional Montana Spatial Data Infrastructure (MSDI) layers to complete the business cycle.

Cadastral Framework Layer

Cadastral data is the information about rights and interest in land. Cadastral data may also be known as real estate data, parcel information, or tax parcel information. A multi-purpose cadastral map or database may contain deeded lots, lots aggregated into taxable property, easements, zoning, school districts, water rights, and many more features. All of this data convey rights and interests to real property. Collection of cadastral data can be and usually is multi-jurisdictional. In Montana the Department of Revenue (DOR) and eight counties collect the tax parcel data, arguably the most important and most used portion of the database. However other agencies and interests collect ancillary data on conservation easements, municipal and school district boundaries, special districts like water, sewer and mosquito, and other data that conveys rights and interests on the land. Presently it is the mission of the Montana Base Map Service Center (BMSC), a part of the Department of Administration, Information Technology Service Division (DOA/ITSD) to integrate the tax parcels and other related data into a statewide database monthly, and link the tax parcels to DOR's ORION database. Additionally the BMSC integrates the Bureau of Land Management's Geographic Coordinate Database (GCDB) as the digital representation of the Public Land Survey (PLS) in Montana, since the PLS is the foundation of land ownership in Montana The data is distributed as files (shapefiles and geodatabases) as well as map services that can be consumed by knowledgeable consumers and applications.

The annual support costs for maintaining the cadastral infrastructure are approximately $811,000 per year. BMSC's primary funding source has been annual grants through the Montana Land Information Act (MLIA). Several counties have applied for additional assistance with their cadastral operations through the MLIA as well. While no source of funding is completely secure, the greatest near term funding risk is to BMSC's cadastral stewardship. There is significant opinion that MLIAC funds are not an appropriate source for annual operational expenses related to cadastral or other MSDI framework layers.

Cadastral Layer Business Impact

The cadastral layer is most commonly associated with the property tax appraisal and tax assessment process in Montana, but use goes far beyond the Department of Revenue, local counties, and individual property owners. The state cadastral web sites are firmly entrenched in many Montana-centric to national business processes, from pipeline and road construction to finding a place to hunt.

Although cadastral data and maps are available from a variety of state and county web sites, two web pages receive a majority of the traffic. The first site provides access to individual parcel data; the second access to entire county files or statewide files. Usage statistics show that the private sector is the major user and beneficiary of the individual parcel data.

average monthly visits	average length of visit	estimated visitor distribution		
		state	private	federal
173,218	8.20 minutes	35%	62%	3%

The second site provides access for downloading entire counties and a state-wide cadastral file.

file	total downloads over 3.5 years	average annual downloads	average monthly downloads	estimated unique visitors
county files	72,268	24,180	2,015	unavailable
statewide files	3641	1040	24.8	75-100

Almost all of the examples of private and state usage point to the cadastral layer being used in conjunction with other GIS layers such as roads, governmental unit boundaries, imagery, etc. It is a rare business process that relies solely on the cadastral layer and finds no value in the other MSDI layers.

Net Financial Impact

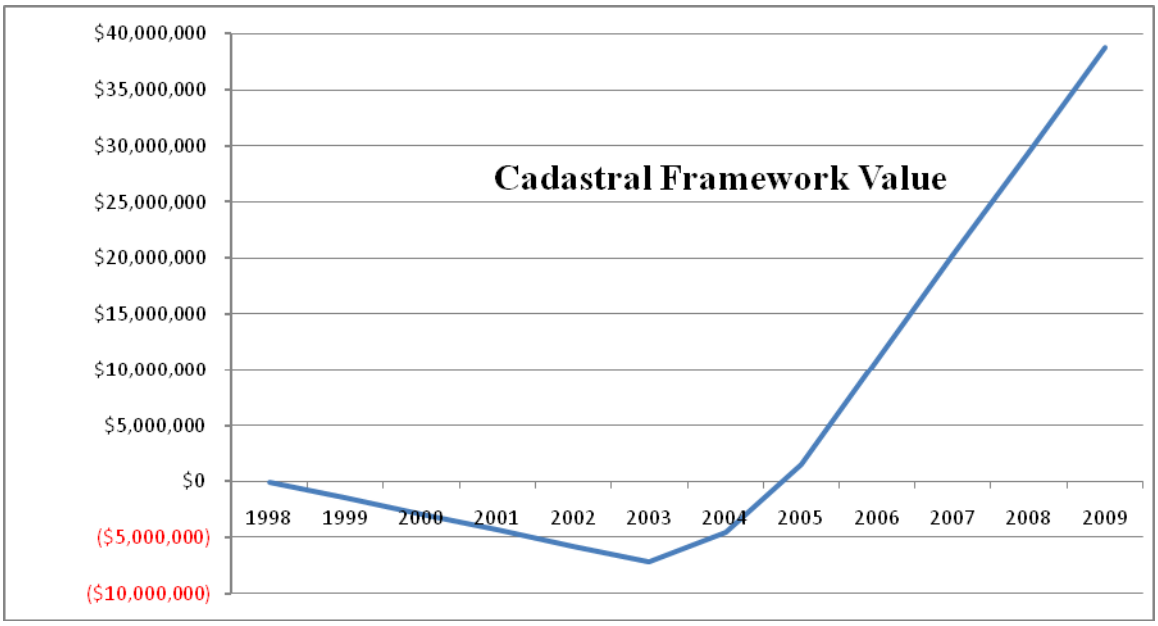
The estimate of the financial value of the cadastral infrastructure is based upon the actual usage of the State's interactive cadastral web site http://gis.mt.gov/ where cadastral files are downloaded and users can conduct interactive parcel query. By measuring the *actual current usage* (hours) of the cadastral web site, it was possible to conservatively estimate the price users are paying staff to acquire the information. ***If users are willing to invest $100 of their time working with the application, at a minimum the value of the information they received must be at least $100. The true value could be far more, but at a minimum the value is at least $100.***

ITSD's web monitoring programs recorded an average of 173,218 visits per month with an average length of 8.20 minutes per visit. The state, local, private, and federal visitors are

expending 24,250 hours per month to acquire cadastral data. The annual value of the time commitment is $6M if benefits are included at a conservative 16%. ***When cadastral system users are willing to expend $6M annually to collect cadastral data from the state's web site, the value of the data must be at least $6M.*** The true value of the cadastral layer is probably many times higher.

The second source of Montana cadastral data used for this study is the NRIS Data Access Page where users can download entire county files and the state-wide Shapefile. Due to library confidentiality laws, it is not possible to identify these users, but it is possible to estimate the value users receive by a comparison to a private source. First American Spatial Solutions (FASS) is one of the few firms marketing cadastral information. Their minimum fee is $300 per county for basic cadastral data. The fee is designed to cover only FASS data cleaning and standardization costs, the same functions that BMSC performs in Montana. FASS's customers are the same type of firms that are using Montana's cadastral data. ***Combining FASS's rates with Montana's download statistics produces $4.1 million of annual benefits. $4.1 million is also a minimal benefit value estimate.***

The initial investment in building the state cadastral infrastructure started in 1998 and finished in 2003. Converting the county data took 5 years, with contractors being used for non-aliquot parcels and state staff being used for aliquot parcels (see Appendix G: Glossary of Terms.) Total cost of building the cadastral database without maintenance, annotation or improvement costs is estimated at $3.3M. The annual support costs for maintaining the cadastral infrastructure are roughly $762,000. With more than $10M in benefits being generated each year for an annual expenditure of less than $.75M, it is no surprise that cumulative value of the framework is "off the chart".



Conclusions

A major objective of the analysis is to develop an understanding and insight into the business usage of the cadastral framework. Those major insights are:

- The private sector is the major beneficiary of the cadastral layer infrastructure. Private sector users are 62% of the visitors to the cadastral web site.
- Business usage extends far beyond the scope of the real estate industry. The real estate usage is most likely a small fraction of total usage and a minor proportion of all cadastral business value.
- Although there is significant intrinsic value to the cadastral data alone, that value is magnified many times when it is combined with other framework layers. Most business processes used multiple framework layers.
- Financial benefits to the private sector, state agencies, and private citizens far exceed the cost of the investment. At a minimum, the cadastral infrastructure has returned $46,000,000 in value over the last 10 years, with the real benefit total being probably far greater.
- The financial benefits realized from the cadastral infrastructure are at significant risk due to unstable funding of BMSC's operations. The MLIAC and GIS stakeholders must take action to mitigate the funding risks and ensure this outstanding IT investment continues to deliver economic benefits.

B. Introduction

The math is simple. Almost all government data has a geographic basis. According to the U.S. Office of Management and Budget's Federal Enterprise Architecture framework, 74% of government data is location based. At the state and local level, the number is even higher: 80%, according to several organizations and publications. Montana's geographic information systems (GIS) professionals recognized this as far back as the late 1980s and pioneered the adoption of geospatial data and applications.

Montana's investment in geospatial systems and activities has been founded predominately on faith and judgment rather than on formal business criteria and expected return on investment. Evidence of the value of geospatial systems was based more on common sense and anecdotes than on statistics and facts. This analysis will attempt to provide a more classic business evaluation of a subset of Montana's geospatial information technology applications; business processes that rely on cadastral information.

This document is a business analysis focusing on current cadastral business processes, and the costs and benefits cadastral framework layer. This report has four primary objectives:

- Evaluation of the IT investment in the cadastral layer
- Identification of business processes, users, and beneficiaries that depend on the cadastral layer
- Identification of the linkages between the cadastral framework and the other 12 framework layers
- Develop a financial analysis that documents the current and ongoing costs and benefits of the cadastral layer
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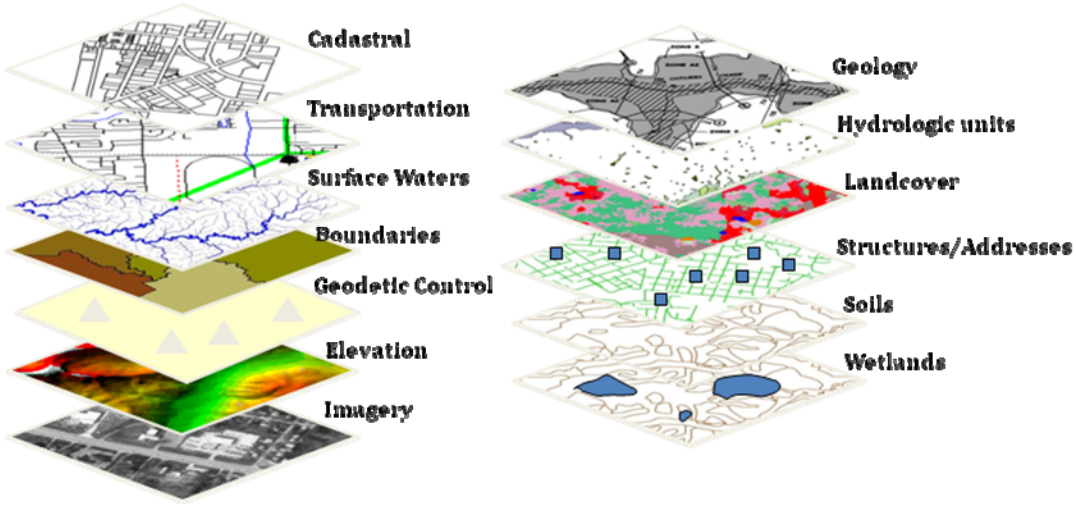
To understand the cadastral business processes and value it is first necessary to understand the legal constraints, funding, architectural design, and strategic plans surrounding the state's GIS information systems.

The Montana Spatial Data Infrastructure (MSDI) is the architectural blueprint for the state's GIS infrastructure. MSDI contains 13 Framework layers. The federal government has identified seven of these geospatial "framework data layers" for the nation. In addition to these seven, the State of Montana added six more layers to make up the MSDI. These data layers are in various states of development. The completion, dissemination and ongoing maintenance of the MSDI has been identified as a top priority by the entire Montana GIS community.

All MSDI layers have some interdependency with one or more layers. This report documents that the interrelationships between the cadastral layer and other layers are an essential business requirement. The value of multiple layers was probably best documented in the Joint Nordic Project Report. This report presented information on costs, benefits, and applications of 16 mature GIS projects. The findings were if a GIS system was used only for computer-aided mapping and updating, it produced a full return on investment (benefits = costs); but benefits exceeded costs by a factor of 4 when all commonly used data sets were automated. The business usage of Montana's cadastral layer reinforces this finding. Business processes that rely on the cadastral data also required additional MSDI layers to complete the business process.



In 2005 the Montana Land Information Act (MLIA) was passed for the purpose of developing a standardized, sustainable method to collect, maintain, and disseminate information in digital formats about the natural and artificial land characteristics of Montana. MLIA established the Montana Land Information Advisory Council (MLIAC) and defined the duties of the Council and the Department of Administration (DOA). DOA is responsible working with all federal, state, local, private and tribal entities to develop and maintain land information. The Act also established a special revenue account to support the development of GIS in Montana. Revenues are generated from a $1.00 per page recording fee assessed on most common documents at county Clerk and Recorder offices. 25% of the MLIA fee is retained by the county and 75% of the MLIA fee is deposited in the state special revenue account. The funds are distributed via an annual grant process established in administrative rule and administered by DOA.

C. Cadastral Framework Layer

Background

The Montana Cadastral Framework is one of the oldest MSDI efforts. In 1996 the state initiated the effort by allocating a project manager to explore the concept of statewide cadastre, build a project plan, and obtain funding to collect and maintain tax parcel data in a standardized manner. Converting paper records to digital format commenced in 1998 and the tax parcel framework was initially completed in 2003. Initial funding for the project was through a public/private partnership. Major contributors were the USDI Bureau of Land Management, Montana Power, Burlington Northern, and Montana Dakota Utilities. This funding was used for digital conversion; however no long-term funding commitments were ever obtained. Upon completion in 2003 the cadastre was the only statewide cadastral database in the nation. It still remains one of the few that is standardized across the state. It is this standardization that allows cadastral dependent applications to function statewide.

In the strictest context a cadastre is the legal repository of land records that identifies the owner, location, boundaries, description, and property rights associated with a parcel of land. A cadastral map locates the parcel relative to other parcels and points of reference. Since cadastres were first developed to enable land valuation and taxation, information associated with valuation and taxation (existing structures, unique identifying numbers for parcels, certificate of title numbers, etc.) is commonly considered part of the cadastre. A modern digital cadastral system provides the ability to search, map, and report on cadastral data

More broadly interpreted, cadastral data is information about rights and interest in land. Cadastral data may also be known as real estate data, parcel information, or tax parcel information. Many laymen simply describe a cadastral framework as parcels but unfortunately this is a vast simplification. A multi-purpose cadastral may contain deeded lots, lots aggregated into taxable property, easements, zoning, school districts, water rights, and many more features. All of this data convey rights and interests to real property.

In most states the responsibility for valuation lies solely with the counties. Montana is one of the few states where responsibility for property appraisal is centralized at the state level. This allows Montana to apply a minimum set of standardization to the tabular appraisal data associated with a taxable parcel. By nature, cadastral mapping can never be considered complete because rights and interests on the land change over time.

Cadastral Database and Operations

The State's Geographic Information Officer (GIO) and MLIAC require all MSDI framework databases to have a Steward. Like several other multi-jurisdictional framework layers, the Steward of the Montana cadastral framework is the BMSC. The Montana Base Map Service Center (BMSC) resides within the Information Technology Services Division (ITSD) of the Montana Department of Administration (DOA). Organizational oversight is provided by the State's GIO. BMSC staff consists of a Bureau Chief, five GIS computer programmer/analysts and three interns. The mission of the BMSC is composed of three core interest areas: the Montana Spatial Data Infrastructure (MSDI), support of the Enterprise GIS Federation, and web services.

The BMSC relies on several partners for cadastral operations, data, expertise and ideas on how a statewide cadastre can best meet customer needs. Daily maintenance of tax parcels is conducted

by DOR and eight counties with mature GIS shops. DOR has six cartographers working in a desktop environment to perform maintenance on the cadastral layer, including splits, combos and checking for data quality. The eight primarily urban counties perform similar functions. DOR also extracts commercial and residential data from their ORION appraisal database on a monthly basis and provides it to the BMSC, in flat files, for download and integration in the cadastral layer.

BMSC integrates the tax parcels from the DOR and counties into a statewide database each month. On a regular basis it also integrates ancillary information such as conservation easements as well as improved digital representations of the Public Land Survey System from BLM. The geography (parcel lines) is stored in an ESRI SDE database while DOR's tabular data is moved to an Oracle database linked to the parcels. All data is housed at the ITSD data center which supports enterprise GIS architecture with development, test and production environments.

The BMSC distributes cadastral information through the Montana Cadastral Mapping Application at http://gis.mt.gov/ and through map services available at http://testgisservice.mt.gov/arcgis/services. The Montana State Library's GIS portal http://gisportal.msl.mt.gov/GPT9/catalog/main/home.page is the distribution point for metadata describing the Montana Cadastral Database. The BMSC also provides hundreds of hours of assistance annually to the local governments maintaining their own cadastral databases, as well as holding educations workshops and seminars to expand cadastral knowledge.

The tax parcels in the cadastral framework become a digital representation of the written legal description and appraised attributes of taxable parcels when the parcel data is linked with DOR ORION database. The non-taxable parcels may include public lands (federal, state, local governments, etc.), tribal lands in USA or tribal trust, and other exempt property such as church owned property, but these parcels do not have all the appraisal information of the taxable parcels. The cadastral framework also carries an increasing amount of related information such as stewardship data, county and state boundaries, and state trust lands. Even with these additions, there is a vast amount of cadastral related data such as water rights and easements that is not integrated into the framework at this time

Expenditures and Funding

The annual support costs for maintaining the cadastral infrastructure are approximately $811,000 per year. Most of the county costs are for maintenance and minor enhancements, while BMSC's expenditures are for integrating the county data, standardization, quality control and distribution. ITSD hosts the application and database. The DOR costs are for maintaining data in the more rural counties without the capabilities or funding to maintain their own cadastre.

Annual Cadastral Infrastructure Costs	
Base Map Service Center	$105,000
ITSD hosting charges	$16,300
Department of Revenue	$314,000
Counties	$311,000
Grants	$65,000
	$811,300

BMSC's funding source since 2006 has been annual grants through the Montana Land Information Act (MLIA). From 2003 to 2006 it was a "pass the hat" process to obtain funding from state agencies. DOR funding is provided through the state general fund. Counties that

maintain their own cadastral databases and supply them to the state usually rely on local general funds as well. Several counties including Butte-Silver Bow, Gallatin, Ravalli and Yellowstone have applied for additional assistance with their cadastral operations through the MLIA as well. While no source of funding is completely secure, the greatest near term funding risk is to BMSC's cadastral stewardship. Although MLIA funds have supported BMSC's cadastral stewardship for the last four years, there is significant opinion that MLIA funds are not an appropriate source for annual operational expenses related to cadastral or other MSDI framework layers. There may be several options that would provide stable core cadastral funding while redirecting the focus of MLIA funds, however all options have political and institutional ramifications that will need to be debated

D. Cadastral Layer Business Impact

Business Process Usage

The cadastral layer is most commonly associated with the property tax appraisal and tax assessment process in Montana, but use goes far beyond the Department of Revenue, local counties, and individual property owners. Individuals and organizations use the cadastral information in a wide variety of ways. The state cadastral web sites are firmly entrenched in many business processes, from pipeline construction to finding a place to hunt. Below is a short summary of many, but not all, of the major users and the business processes that rely on the cadastral database.

a. Property Tax Revenue - The state property appraisal and tax assessment process, in particular forest and agricultural appraisals, was the fundamental reason for the construction of the ORION cadastral system.

b. Property Rights and Land Market Operations - Property and real estate transactions are heavy users of the cadastral data. Banks, mortgage lenders, title companies, insurance firms, brokers, realtors, lawyers, developers, buyers and sellers all use the data.

c. Conservation & Environmental Protection

Water Rights Adjudication - The State is in the midst of a massive program to establish water rights across Montana. Montana cannot defend its water use from other states' demands until it has completed the adjudication of all the water rights in Montana and knows how much of our water is currently being claimed and used. Economic development is only possible if developers and planners know how much water is available in a basin. The Department of Natural Resources and Conservation (DNRC) is linking its water rights database directly to DOR's ORION database.

DNRC Trust Land Management - DNRC manages about 5.2 million acres of state school trust land (state land), forests and agricultural, grazing and commercial properties that earn revenue to help fund public schools and universities. DNRC sells or exchanges out lands that are isolated or ineffective to manage and acquires replacement trust lands with higher long-term income potential. DNRC's Real Estate Management Bureau appraisers use the cadastral web site on a daily basis. It is also used to notify adjacent landowners of nearby projects

Environmental Assessment (EA) and Environmental Impact Statement (EIS)
The Department of Environmental Quality (DEQ) administers a variety of environmental laws, 19 of which have an enforcement component. EAs and EISs are required for many air quality permits, mining permits, major facility sitings, subdivisions reviews, waste permits, and water discharge permits. The proposing firm must submit a detailed application and maps that cover cadastral and most other GIS layers. DEQ uses the cadastral information to notify adjacent landowners and conduct public comment sessions.

d. Local Government - City and county planning departments use cadastral data for land use planning, zoning, plat review and sending constituents notifications of zoning change requests, and public hearings.

e. Public Safety and Emergency Response - Cadastral data is central to public safety operations. "Tax parcels and other local-source content produced at similar scales (water, sewer, power distribution, facilities information, telecommunications, etc.) are perhaps the most important geospatial assets for disaster response. Although other data are no less useful, parcels establish the critical link between who, what, and where that can help guide many forms of response and recovery." *Homeland Security Grant Program; Supplemental Resource Geospatial Guidance; February 2008; U.S. Department of Homeland Security*

Examples of cadastral data being used for public safety purposes are common. "With the aid of an assistant, he (Jack Dangermond, President of ESRI) pulled up a map of a massive fire in progress in Southern California and then proceeded to add layers of parcel data as well as information about health and emergency services to create a detailed map of potential danger zones for residents, as well as the nearest locations for disaster services. It was a powerful statement about the potential for open government geospatial information." *Gov 2.0 Summit: GIS the Big Winner in Push for Open Government, September 11, 2009 Govtech.com*

f. Transportation - Although the Department of Transportation (MDT) has many areas (hydraulics, maintenance, bridges, survey, environmental, planning) that use the cadastral information, MDT's Right of Way Bureau is the heaviest user of the cadastral web site. They use it on 100-150 projects annually to establish ownership on proposed road routes.

g. Private Right of Way - Utilities, communication companies, and gas transmission firms use cadastral data for planning, building and maintaining transmission right of way.

h. Recreation - Fish, Wildlife and Parks has web sites that assists hunters in identifying landowners for that are participating in the Block Management Program. Hunters can identify land and landowners where they can request permission to hunt.

i. Private Individual - Private citizens often use the cadastral system for their personal, non-business use. For example, the author used the cadastral web site to locate the owner of vacant land adjacent to his home in Clancy. The author had met the neighbor many years earlier, but had long since forgotten the name. The neighbor's name and phone number were found within 3 minutes on the cadastral site.

j. Federal Federal agencies often use the cadastral web sites to identify parcel owners adjacent to proposed federal projects. Last year the author received a letter from the BLM about a proposed easement for a road across BLM land. The BLM had used the state's cadastral site to identify parcel owners in close proximity to the proposed road.

Access to the Cadastral Framework

Users can access the cadastral framework from many different State and county web sites. The State sites offer the advantage of a statewide view but the counties often increase the value of the cadastral information by combining it with other data such as zoning, election districts, and fire districts. Links to the county cadastral web sites can be found in the Appendix. The most common points of access to the cadastral framework are:

1. Montana GIS Portal at the Montana State Library
Montana GIS Portal
http://gisportal.msl.mt.gov
The discovery hub for access to metadata for geospatial data including the cadastral layer. MSL also includes cadastral data in their Digital Atlas application.

2. The Montana Base Map Service Center – Montana Cadastral Mapping Program
Montana Cadastral Mapping Program
http://gis.mt.gov/
The authoritative source for cadastral data including geodatabase and shapefile download as well as web based query.

3. Land Ownership Maps
Montana Public and Private Land Ownership Maps of parcels over 40 acres in size
Montana Public and Private Land Ownership Maps – Resource Information System
http://nris.state.mt.us/gis/ownmaps.asp

For the purposes of this study cadastral data and maps were available from a variety of state and county web sites; however two web pages receive a large portion of the traffic. The BMSC site provided the main access to individual parcel data through web based query. The MSL site at the time of this study provided the primary source of shapefile download. Users and business processes that rely on the first source, individual parcel information, are referred to here as parcel users. Users and business processes that rely on the second source, entire county or statewide files, are referred to here as download users since the files must be downloaded for use.

Parcel Users

It is impossible to know the exact identity of the 1.39 million visitors who visited the cadastral web site during the 6 months of 2008 that were studied. Web site statistics do not identify individual users and the application does not request any personally identifiable information. It is possible to determine if the visitor is within the state network or from the outside, and occasionally the web records list the visitor's domain.

Although state employees and agencies were large users of the cadastral data, the private sector is the overwhelming visitor user group.

- state and local government - 35%
- private sector – 62%
- federal - 3%

The private sector is the major beneficiary of the cadastral layer infrastructure.

Predictably many of the cadastral users were associated with real estate transactions. Companies in the following industries used the cadastral information repeatedly.

- mortgage
- law
- title services
- insurance
- real estate
- banking
- risk management
- flood zone services

Firms with an interest in property ownership/rights were also found to be heavy users.

- oil and gas exploration
- engineering
- construction
- utilities
- lumber
- mining

Some very unusual industries were also found to be using the cadastral data. These types of private firms have no intuitively obvious reasons for accessing the cadastral data, but they obviously have a need for the data.

- Pharmaceuticals
- Accounting services
- Human services and resources
- Boat building
- Mail processing
- Lodging
- Heavy equipment
- Health care

Federal users comprise 3% of overall traffic volume to the cadastral site. Federal visitors came from the following departments and agencies.

- Environmental Protection Agency
- Bureau of Land Management
- Air Force
- Army
- Navy
- Western Area Power Administration
- US Courts
- National Park Service
- Bonneville Power Administration
- Department of Transportation
- Internal Revenue Service
- Department of the Interior- Bureau of Reclamation
- US Geological Survey
- Department of Agriculture
- Department of Justice
- National Institutes of Health
- Indian Health Service
- US Fish and Wildlife Service
- US Postal Service
- Department of Homeland Security
- Federal Emergency Management Agency
- Department of Energy – Princeton Plasma Physics Laboratory

Case Studies of Cadastral Usage

The following case studies provide details on a few selected business processes that rely on the cadastral framework.

1. Private Right of Way

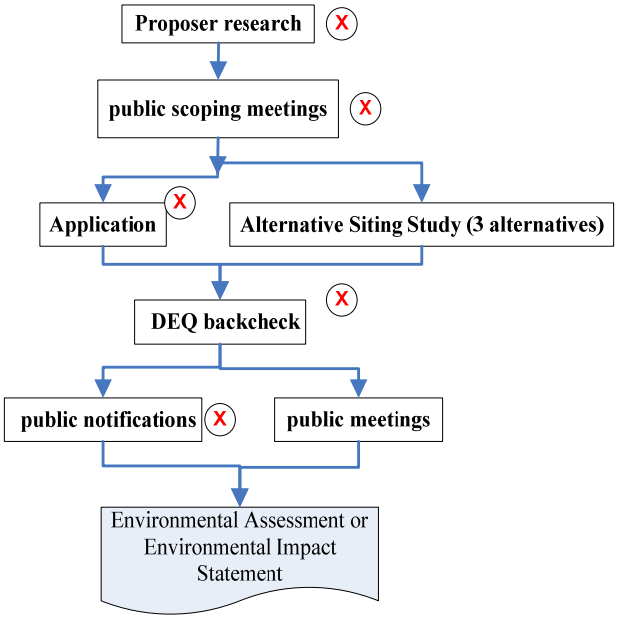
Private right of way is essential for power transmission lines, fiber cable for communications, and gas pipelines. Before the transmission lines can be built, engineering and design firms must identify and negotiate the right of way. The firms' planning engineers start by identifying the best possible route. The best route will depends on property ownership, land use, elevation changes, locations of roads, and other factors. Private right of way is a classic case where a business process is dependent on multiple MSDI layers. Although the cadastral layer is essential, the best route cannot be chosen without understanding the other layers.

The next step is identification and contacting the land owners. Prior to the construction of the cadastral web site, the firms would spend many weeks in county courthouses identifying the affected parcels, geocodes and land owners. Today the firms start their research on the cadastral web site and only visit county offices to verify they have the most current data. The following project is a specific example from August and September 2009.

Midstate Construction is currently planning to lay 1600 miles of fiber optic cable for 3 Rivers Communications. The cost of the project is $25,000 per mile or $40,000,000. Midstate's staff is spending 2 weeks of continuous effort on the Montana cadastral system to identify all the landowners on the proposed route. The 80 hours of cadastral work is saving them many man-weeks of research in county offices. Although they still visit county offices to ensure the cadastral data is current (10% of the time it is out of date) they no longer waste time identifying the correct parcels and finding geocodes. In their words the cadastral web site saves them "millions".

Midstate Construction is a Utah firm and the cost of travel to Montana county courthouses is probably as much as the cost of the staff time. Consultants charge $80-$200 per hour for field work so every hour that can be trimmed from field work is a large savings for the owner of the transmission line.

Establishing a private right of way is a long and expensive process, and Montana cadastral information is used extensively in the initial stages. The following flow chart illustrates when cadastral data is used.



a. <u>proposer research</u> The firm proposing the project must develop a proposed route for the transmission line by balancing the cost, environmental disruption, time, and other factors. This is a classic example where multiple GIS layer s (cadastral, elevation, orthoimagry, wetlands, etc.) are essential.

b. <u>public scope meetings</u> The proposing firm must arrange one or more public meetings where public is offered a chance to comment on the proposed project. Preparation for the meetings used to mean preparing and printing detailed maps showing the location of the transmission line or pipeline, and the parcels adjacent to or affected by the project. DEQ estimated the staff time preparing maps as up to 3-4 days for a project covering 450 miles. Today the meeting organizers only have to bring a laptop, large monitor, or projector to the meeting. Online maps are built with the cadastral web data.

c. application and alternative sitings DEQ requires the proposing firm to submit a detailed application and maps that cover all the GIS layers except for geodetic control, hydrologic units, and geology. Cadastral information is a key factor in evaluating the preferred alternative route.

d. DEQ backcheck - DEQ staff check the application for completeness and errors.

e. public notifications and public meetings - DEQ uses the cadastral web site to identify property owners so that they may be alerted to the project proposals and receive an invitation to public comment meetings. The cadastral site is also used to respond to written requests for information. At the public meetings department staff overlay the proposed right of way on to the parcel maps to demonstrate the location of the transmission line. Hardcopy maps are not used. Prior to the cadastral application, preparation for a public meeting could take 4-32 hours just to print maps.

Montana has several large scale private right of way projects in progress.

> The Keystone XL Project - A $5.2 billion crude oil pipeline project extending approximately 282 miles across Montana. Power line and associated facility upgrades will be required in multiple locations along the route.
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> Bison Pipeline Project - An interstate natural gas pipeline covering roughly 100 miles in Montana's southeast corner.
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> Mountain States Transmission Intertie - NorthWestern proposed a 500 kV electric transmission line from a new substation approximately 5 miles south of Townsend, through the Whitehall and Butte areas to an enlarged Mill Creek substation east of Anaconda and then south along the Interstate 15 corridor in Montana to the Midpoint Substation in south central Idaho.
>
> Montanore Transmission Line A new 230 kV transmission line from Pleasant Valley, approximately 26 miles southeast of Libby, to the proposed Montanore mine site on the east side of the Cabinet Mountains

2. Public Right of Way

The Department of Transportation's Right of Way Bureau is responsible for:

- Right-of-way plan development
- Ongoing research on property rights (wells, easements, etc.)
- Acquisition
- Appraisals

The pre-cadastral business processes for developing a right-of-way plan involved state staff driving to a county court house from one of 5 state district offices. The travel time and travel expenses (hotels, meals, fuel, etc.) were incremental expenses in addition to the time spent in the court houses. The state cadastral web site has not completely eliminated court house visits, but it has reduced the staff time consumed. For example, right-of-way plan development project time was reduced from 5-10 days to 2-3 days for an average of 125 projects annually. That is a savings of over 80% of an FTE. Staff spends the first day performing research in the cadastral web site before heading to the court house. Court house visits are still required at times because

court houses have the most recent information on ownership, and ownership changes are constant. Time within the court house is cut dramatically. The 100 bureau staff average roughly 10 hours per week working with the cadastral web site. Several other functional areas of MDT also use the cadastral data:

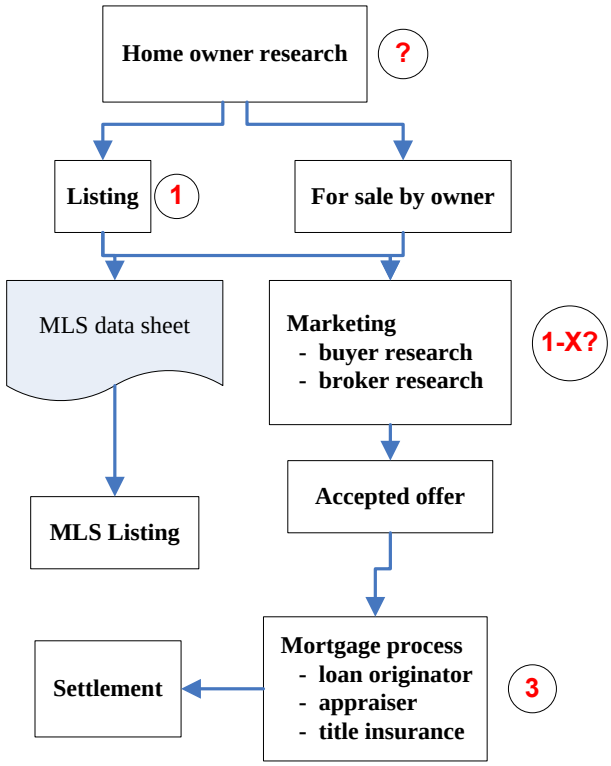
- Hydraulics
- Bridges
- Environmental
- Maintenance
- Survey
- Planning

3. Land Management

The J. R. Simplot Company is a private global food and agribusiness conglomerate with annual sales of about $4.5 billion. Simplot recently initiated a project to update their records and build an accurate inventory of all lands they owned. They looked at 23 states and 123 counties, but only 3 counties were in MT. Simplot was interested in the whole county as well as the individual parcel they owned. Simplot found the Montana data the "best out there" and the easiest to use. Some counties wanted a 20 page form filled out before they would release data. Other counties charged up to $20,000 for their cadastral data, although Simplot never paid more than $5600. One firm offered to sell Simplot data on half of its counties for $175,000 annually.

4. Real Estate Transactions

Montana's real estate market is a large user of cadastral data. Research by Scott Rickard Ph.D. at the request of the Department of Revenue estimated that 8500 homes were sold in Montana in 2008. Home sales peaked in 2006 but have declined since then. Each transaction results in several visits to the state's cadastral web site even if the home never is entered into the Multiple Listing Service database. The process is documented below along with the points of contact with the state's web site.



Many knowledgeable sellers start the sale process by researching comparable homes. It's an excellent way to develop an initial sale price. Before a real estate agent will list a property, they visit the state cadastral web site to obtain the data that will go into the MLS. They never trust the home owner to supply accurate information. The cadastral data that is collected gets entered on a MLS sheet and is entered into the MLS database. While the property is on the market, buyers, brokers and any other interested party may access the state's web site to get more information on the property or nearby properties. Once an offer has been accepted, there are 3 separate visits to the web site by the loan originator, appraiser, and title insurance company.

Cadastral Usage Statistics

At the state level there are two primary means of accessing the cadastral data;

http://nris.state.mt.us/nsdi/cadastral/ Montana Cadastral/CAMA Project – Data Access Page

http://gis.doa.mt.gov/ Montana Cadastral Mapping

The first page provides access to individual parcels if the user knows something about the parcel. The web site provides an efficient method for querying one or several parcels. The usage is surprisingly high, with the private sector making up the vast majority of users.

Individual Parcel Queries

average monthly visits	average length of visit	estimated visitor distribution		
		state	private	federal
173,218	8.20 minutes	35%	62%	3%

The second page provides access for downloading entire counties and a state-wide cadastral file.

Cadastral Batch File Downloads – County

file	total downloads over 3.5 years	average annual downloads	average monthly downloads
ESRI Shapefile	33,166	11,867	989
CAMA residential	24,194	7,117	593
CAMA commercial	14,908	5,196	433
total	72,268	24,180	2,015

Cadastral Batch File Download – Entire State

file	total downloads	average annual downloads	estimated unique visitors
ESRI Shapefile	3641	1040	75-150

It is impossible to estimate the number of unique county visitors to the web site because it is unknown how many repeat visits are made and how many counties a visitor downloads. Complete statistics for downloads can be found in the Appendix.

Business Value Interdependencies

Almost all of the examples of private and state usage point to the cadastral layer being used in conjunction with other GIS layers. It is a rare business process that relies solely on the cadastral layer and finds no value in the other MSDI layers. Probably the most obvious example of layer interdependency is private right of way for pipelines, gas lines and telecommunication lines. Before a right of way is granted the firm must prove through extensive research and documentation that all factors were considered, and the proposed route is optimum for all parties. Property location and ownership is critical, but cadastral data is just one of the GIS layers. The Environmental Assessment and Environmental Impact Statements must ensure that all factors are considered. Failure to consider all the MSDI layers may force a very expensive re-write of the EA and EIS or even kill the entire project.

To illustrate the magnitude of the layer interdependencies, business processes that used the cadastral layer were mapped against 13 MSDI layers. Checks indicate a business function that requires or benefits from integrating the corresponding MSDI layer.

MSDI Layers

business process	Cadastral	Elevation	Geodetic control	Government units	Hydrography	Orthoimagry	Transportation	structures	Geology	Hydrologic units	Land use / land cover	Soils	Wetlands
property tax revenue	√	√		√	√	√	√	√			√	√	√
property rights and land market operations	√		√	√	√	√	√	√		√	√	√	√
conservation and environmental protection	√	√		√	√	√	√	√	√	√	√	√	√
public safety and emergency response	√	√		√	√	√	√	√	√	√	√	√	√
transportation	√	√	√	√	√	√	√	√	√	√	√	√	√
recreation	√	√		√	√	√	√	√	√	√	√	√	√
private right of way	√	√	√	√	√	√	√	√	√	√	√	√	√
private individual	√	√		√	√	√	√	√			√		√

The value of multiple layers was probably best documented in the Joint Nordic Project Report. This report presented information on costs and benefits of 16 well established GIS projects in North America and two in Italy. The report concluded that if a GIS system was used only for computer-aided mapping and updating, it produced a full return on investment (benefits = costs). But if the GIS system used all commonly available data, benefits exceeded cost by a factor of 4. Montana's cadastral layer return on investment replicated those financial returns.

E. Net Financial Impact

Minimum Value of Parcel Information

Most business cases for a new system estimate the future benefits from implementing the recommended system. Benefits are estimated by indentifying system users and tracing the financial impact of the business processes based on the system. Users are interviewed or asked to fill out a questionnaire on how they would use the system. For example, if a new state cadastral web site could deliver information in 10 minutes, and it currently takes 50 minutes to gather the information, the potential incremental value to the end user is 40 minutes of time. Additional benefits could come from the elimination of transportation costs for a trip to the county court house to collect the data. This classic methodology is always very time consuming and subject to criticism of the estimates of time savings, transaction volumes, and value to the end user. The criticism is valid if the financial estimates are not extremely conservative.

Fortunately the cadastral infrastructure exists today. It is not necessary to estimate *potential future* benefits. It is only necessary to measure *actual current* usage. The classic business case methodology of interviews and surveys will measure these benefits, but there is another approach available. It is far faster and simpler, but it has the limitation of only measuring the absolute minimum value of the system. It is not an estimation technique; it is a measurement technique. This approach measures the amount of time users actually spend using the application. If users are willing to invest $100 of their time working with the application, at a minimum the value of the information they received must be at least $100. The true value could be far more, but at a minimum the value is at least $100.

During a 6 month period from April 2008 through September 2008 ITSD's web monitoring programs recorded an average of 173,218 visits per month with an average length of 8.20 minutes per visit.

visitors	percentage	2008 average compensation
State	35%	$20.55/hour [1]
Private	62%	$15.35/hour [2]
Federal	3%	$37.09/hour

[1] *Average 2008 state compensation from the State Research and Analysis Bureau, DoLI*

[2] *Average 2008 Montana private sector compensation from the State Research and Analysis Bureau, DoLI*

The state, private, and federal visitors are expending 24,250 hours per month to acquire cadastral data. The annual value of the time commitment is $5,186,371, excluding benefits. If benefits included at a conservative 16%, the total time investment would be $6M. When cadastral system users are willing to expend $6M annually to collect cadastral data from the state's web site, the value of the data must be *at least* $6M.

Some critics will argue that a visitor's average time may be exaggerated since the visitor could step away from their workstation in the middle of a cadastral visit, or interrupt cadastral work to focus on something else. This is true, but the program that measures the duration of a visit also undercounts the length of a visit because the program doesn't know when the visitor exits for another web site's page. The visitor time spent on the final page is not counted at all.

This minimal benefit measurement does not provide any information on the beneficiaries (state staff, real estate agents, homeowners, etc.) nor does it illustrate how the users are using the data. It is simply a very conservative lower bound on the value of the cadastral information. The true value of the cadastral layer is probably many times higher.

Minimum Value of Downloaded Cadastral Files

The second source of Montana cadastral data for users is the NRIS Data Access Page (http://nris.state.mt.us/nsdi/cadastral/) that provides access to the county files and the state-wide Shapefile. More than 50% of the counties across the nation charge for downloading their cadastral files, where Montana does not. The charges range from a nominal $5 in Los Angeles to as much as $380,000 for Orange County. County fees do not correspond to the value that users place on the data; the fees are based on the business philosophy of the county. Do counties see their cadastral infrastructure as a significant source of revenue or are they providing it as a public service?

In isolated cases such as Simplot and Midstate Construction it is possible to identify the users who download cadastral files. Calculating the value they receive is extremely difficult and subject to large errors. For one, the firms do not disclose their internal project costs or profit margins. For two, the handful of firms that are identified may not be representative of the whole population of users.

An alternative method was used to estimate the value of the cadastral file downloads. First American Spatial Solutions (FASS) is one of the few firms marketing cadastral information. Some regional players exist, but FASS is the only company that advertises a national database of cadastral information. They have data on 122 million parcels out of an estimated 140-150 million parcels across the nation. FASS fees vary by county depending on their cost of data acquisition, the proprietary data they add, and their costs to clean and standardize the data. FASS adds various levels of proprietary information to the basic cadastral data they assemble from the local counties. Their minimum fee is $300 per county for basic cadastral data. That fee is designed to cover only their data cleaning and standardization costs.

FASS's customers are the same type of firms that are using Montana's cadastral data. That implies the annual value of Montana's cadastral files is roughly $4.1 million.

County downloads
24,180 downloads / 3 files per county x $300/download = $2,418,000 annually

State downloads
100 estimated customers x ($300/county x 56 counties) = $1,680,000 annually

$4.1 million is also a minimal value estimate. If firms are willing to pay $300 per county to acquire data, the value of the data to their project must be at least $300 per county. For example, the fiber optic cable project in Montana will cost $40,000,000. Is it worth $16,800 ($300/county x 56 counties) to know all the parcel owners, the exact location and size of the property? The value to the firm laying the fiber cable probably far exceeds $300 per county.

Net Business Value – Annual and Cumulative

The initial investment in building the state cadastral infrastructure started in 1998 with assigning a project manager to lay out a multi-year project plan for standardizing, integrating, and publishing the county cadastral data.

Converting the county data took 5 years, with contractors being used for non-aliquot parcels and state staff being used for aliquot parcels. Approximately 387,500 non-aliquot parcels were converted at a cost of $8.00 per parcel. Approximately 512,500 aliquot parcels were converted at a cost of $.50 per parcel. Total cost of building the cadastral database without maintenance, annotation or improvement costs is conservatively estimated at $3,356,250

The annual support costs for maintaining the cadastral infrastructure are approximately $762,000 per year. Most of the county costs are for maintenance and minor enhancements, while BMSC's expenditures are for integrating the county data, standardization, quality control and distribution. ITSD hosts the application and database.

Annual Cadastral Infrastructure Costs	
Base Map Service Center	$105,000
ITSD hosting charges	
- storage	$7,000
- server and software hosting	$8,000
- backup	$1,300
Department of Revenue	$314,000
Counties	$311,000
Grants	$65,000
	$811,300

Grants for the cadastral framework total roughly $200,000 for the last three years. The grants were awarded for unique, one-time projects and not for daily operations of the cadastral infrastructure. It is a debatable point whether the grants should be counted as part of annual cadastral operational costs.

A close observer will note that the DOR costs for supporting the cadastral layer are very modest even though the state is responsible for state-wide tax property tax appraisals and the ORION system. Why aren't ORION costs part of the total annual expenditures for the cadastral infrastructure? This apparent exclusion is intentional, and logical. DOR's ORION system was developed as a means to assist DOR in fulfilling its statutory obligations on tax assessment. ORION existed prior to the development of the GIS cadastral infrastructure, and it will continue to exist even if the cadastral infrastructure is eliminated. Although the value of the cadastral layer is enhanced by incorporating ORION data, ORION costs are independent of the cadastral infrastructure.

The annual return on investment is the difference between the annual costs and benefits.

minimum annual value of parcel information	$6,000,000
minimum annual value of cadastral files	$4,098,000
	$10,098,000
annual cadastral infrastructure costs	-$762,300
annual return on investment	$9,335,700

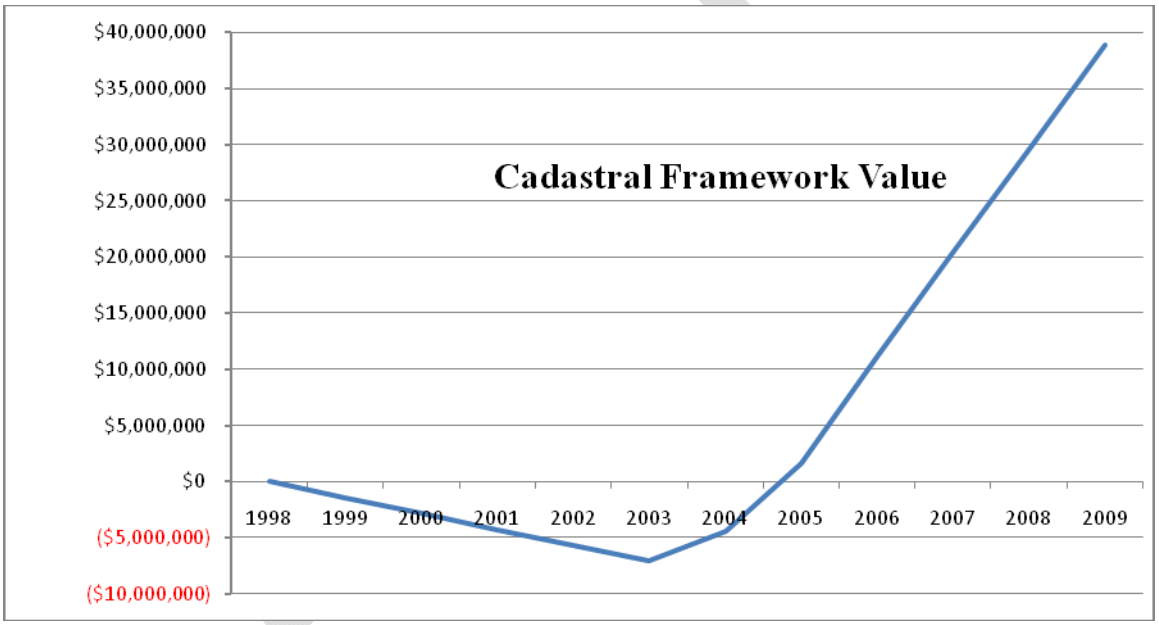
Cumulative Value

Developing an estimated return on investment over the life of the cadastral infrastructure is more difficult and less precise than assembling current costs. Neither the counties nor the state have kept detailed records of all expenditures since 1998, and usage was not monitored. But it is possible to make an estimate of the costs and benefits over the years provided conservative assumptions are made where detailed information is not available. Conservative in the sense that the assumptions and estimates over-estimate costs and under-estimate benefits.

The financial model was built on the following assumptions:

- No benefits were realized by users until all data was converted in 2003. The first data was actually available in 1999.
- Full user benefits were not realized until 2 years after the entire state's cadastral data was available in 2003.
- ITSD and county costs to maintain and support the system started in 1999, the first year data was converted. Costs were estimated at current levels and not lower levels due to a small proportion of data migrated.

The cumulative value of the cadastral frame work is exceptional. The chart below is based on the spreadsheet found on page 26.



The GIS cadastral framework is an outstanding example an IT system that delivers benefits far beyond its costs of implementation and ongoing maintetance. The eight years to a positive return on investment appears to be an exceptionally long time, but it is the result of two very fiscally conservative assumptions that didn't recognize any benefits until *all* county data was available (2003), and full benefits were not recognized until two years after that point (2005).

Cadastral Layer Costs/Benefits

		conversion period										
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Costs												
Project Manager	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000						
Conversion												
- aliquot parcels		$51,250	$51,250	$51,250	$51,250	$51,250						
- non-aliquot parcels		$620,000	$620,000	$620,000	$620,000	$620,000						
BMSC		$105,000	$105,000	$105,000	$105,000	$105,000	$105,000	$105,000	$105,000	$105,000	$105,000	$105,000
ITSD hosting charges		$16,300	$16,300	$16,300	$16,300	$16,300	$16,300	$16,300	$16,300	$16,300	$16,300	$16,300
DOR		$265,000	$265,000	$265,000	$265,000	$265,000	$265,000	$265,000	$265,000	$265,000	$265,000	$265,000
Counties		$311,000	$311,000	$311,000	$311,000	$311,000	$311,000	$311,000	$311,000	$311,000	$311,000	$311,000
ITPRs		$64,000	$64,000	$64,000	$89,282		$18,000	$3,450		$143,387	$151,987	$105,029
annotation												
	$25,000	$1,457,550	$1,457,550	$1,457,550	$1,482,832	$1,393,550	$715,300	$700,750	$697,300	$840,687	$849,287	$802,329
Benefits												
parcel web site							$2,000,000	$4,000,000	$6,000,000	$6,000,000	$6,000,000	$6,000,000
file downloads							$1,366,000	$2,732,000	$4,098,000	$4,098,000	$4,098,000	$4,098,000
	$0	$0	$0	$0	$0	$0	$3,366,000	$6,732,000	$10,098,000	$10,098,000	$10,098,000	$10,098,000
Annual Return	($25,000)	($1,457,550)	($1,457,550)	($1,457,550)	($1,482,832)	($1,393,550)	$2,650,700	$6,031,250	$9,400,700	$9,257,313	$9,248,713	$9,295,671
Cumulative Return	($25,000)	($1,482,550)	($2,940,100)	($4,397,650)	($5,880,482)	($7,274,032)	($4,623,332)	$1,407,918	$10,808,618	$20,065,931	$29,314,644	$38,610,315

F. Conclusions

This report contains extensive information on Montana's GIS IT infrastructure, history, programs, and operations. But that was not the goal of the report. The background information was assembled strictly to provide the reader with a foundation for understanding the state's cadastral framework. The real goal is to develop an understanding and insight into the business usage of the cadastral framework. Those major insights are:

- The private sector is the major beneficiary of the cadastral layer infrastructure. Private sector users are 62% of the visitors to the cadastral web site.

- Montana's centralized web access to the cadastral framework is greatly appreciated by the user community. Multiple comments about the "best system in the nation" were received.

- The cadastral data is very heavily used. Users spend more than 24,000 hours per month viewing individual parcel records and they download entire county files more than 1000 times per year.

- Business usage extends far beyond the scope of the real estate industry. The real estate usage is most likely a small fraction of total usage and a minor proportion of all cadastral business value.

- Although there is significant intrinsic value to the cadastral data alone, that value is magnified many times when it is combined with other framework layers. Most business processes used multiple framework layers.

- Although detailed records on all cadastral implementation costs are not available, constructing the infrastructure probably cost roughly $8,000,000. Funding came from both counties and the state.

- Financial benefits to the private sector, state agencies, and private citizens far exceed the cost of investment. At a minimum, the cadastral infrastructure has returned $46,000,000 of value. The real total on benefits is probably far higher.

- The financial benefits produced by the cadastral IT infrastructure are at significant risk due to unstable grant funding.

- The MLIAC and GIS stakeholders must take action to mitigate the funding risks and ensure this outstanding IT investment continues to deliver economic benefits.

Whether the MLIAC takes steps to address the funding risks is a strategic and political decision. The debate on specific actions should consider:

- Evaluate whether users should be required to identify themselves prior to downloading cadastral files. Registration is a common requirement in the private sector and almost all users provide valid contact information.

- Evaluate whether the state should charge a fee for downloading county and state-wide files. Fees should not be based on the value of the information ($10M+ annually), but on the cost to create, aggregate, and deliver the information ($1M annually).

One final observation on the report itself. This report relies heavily upon the cadastral web statistics to build the business case around the value of the cadastral layer. That approach will not be possible with the other GIS framework layers since the applications and web sites for those layers don't exist today. Building the business value for other framework layers will be more difficult.

G. Appendix: Web Site Links

Montana Land Information Act
http://giscoordination.mt.gov/mlia.asp

Montana Land Information Administrative Rules
http://giscoordination.mt.gov/2_2_362pro_final_3.doc

Montana Land Information Council
http://itsd.mt.gov/policy/councils/mliac/default.mcpx

Montana Land Information Plans
http://giscoordination.mt.gov/mlia.asp

Montana Cadastral/CAMA Project – Data Access Page
http://nris.state.mt.us/nsdi/cadastral/

Montana Cadastral Mapping
http://gis.doa.mt.gov/

Montana State Library GIS Portal
http://gisportal.msl.mt.gov/GPT9/catalog/main/home.page

Flathead County GIS
http://flathead.mt.gov/gis/

Gallatin County GIS
http://www.gallatin.mt.gov/public_documents/gallatincomt_gis/gis%20home%20page

Lake County
Lake County Montana Courthouse in Polson Montana

Missoula County GIS
http://www.co.missoula.mt.us/gis/

Ravalli County GIS
Ravalli County - GIS

Silver Bow County GIS
City and County of Butte-Silver Bow | GIS

Stillwater County GIS
Stillwater County, Montana

Yellowstone County GIS
http://www.co.yellowstone.mt.gov/mapping

G. Appendix: Glossary of Terms

aliquot
The regular (mathematical) division of a parcel land defined by the Public Land Survey System (PLSS). The basic unit of land in the PLSS is the section, a parcel of land 1 mile square in extent (640 acres).

The NORTH HALF of Section 1 (N1/2, 320 acres) is an aliquot part, as is the SOUTH EAST QUARTER (SE1/4, 160 acres), or the NORTH EAST QUARTER OF THE NORTH WEST QUARTER (NE1/4 NW1/4, 40 acres).

cadastral
Commonly, land ownership information. Formally, of or relating to an official register of the quantity, value, and ownership of real property used in apportioning taxes; showing or recording property boundaries, subdivision lines, buildings, and related details.

CAMA
(Computer Assisted Mass Appraisal) System for recording and determining valuation of real property, and improvements on the property, for purposes of taxation. Various characteristics describing the property and improvements are maintained for this purpose.

CSS
Cascading Style Sheets, or styles, is a Web formatting convention which allows assignment of several properties at once to all the elements on Web pages marked with a particular tag. Formatting properties not available using standard HTML tags are possible using styles (line spacing, background colors).

FGDC
Federal Geographic Data Committee, an interagency committee, organized in 1990 under OMB Circular A-16 that promotes the coordinated use, sharing, and dissemination of geospatial data on a national basis. The FGDC is composed of representatives from sixteen Cabinet level and independent federal agencies. The Steering Committee sets high-level strategic direction for the FGDC as a whole. The Coordination Group advises on the day-to-day business of the FGDC. Staff support for FGDC committees is provided by the FGDC Secretariat staff.

The FGDC subcommittees are organized by data themes. Working groups play a crosscutting role, dealing with issues that span many subcommittees.

FTP
File Transfer Protocol, an Internet protocol and service providing network file transfer between any two network nodes. User must have file access rights to transfer files to or from node. Typically used between remote host and local host (computers).

geocode
a key descriptor which identifies a parcel of land by its unique location (county, township, section, quarter section, quarter section block, quarter section lot, and unit number).

Geographic Coordinate Database (GCDB)
The GCDB is a database (digital) of the most dependable coordinates available for the US Public Land Survey System (PLSS) corners. It is produce by the US Bureau of Land Management. The data contained in the GCDB has been collected with a 98% level of accuracy. For details see the BLM website.

GIS
Geographic Information System: a combination of computer hardware and software used to collect, maintain, analyze, and display geographic (map) information.

JavaScript
a scripting language embedded within standard HTML pages which makes Web pages more interactive (forms, dynamic page creation, window control). JavaScript can be run in Web pages either client-side (local machine) or server-side (remote host machine). JavaScript was developed by Netscape Communications and is supported by most browsers.

MGIC
(Montana Geographic Information Council) Fourteen members, appointed by the Governor, to provide policy level direction and promote efficiency and effective use of resources for matters related to geographic information. Executive Order No. 17-97

PLSS
Public Land Survey System, adopted in 1785 as a method to demarcate and legally subdivide public domain lands using a rectangular system of surveying.
The basic unit of land in the PLSS is the township, 6 miles square, containing 36 sections, each measuring 1 mile square (640 acres). Sections can be subdivided into aliquot parts or by a certificate of survey (COS).

Appendix: Cadastral File Downloads

This data is a record of the web traffic to http://nris.state.mt.us/nsdi/cadastral/ during the period from February 8, 2006 to August 31, 2009. http://nris.state.mt.us/nsdi/cadastral/ provides access to the county cadastral files: ESRI shapefile, CAMA residential, and CAMA commercial. In addition to individual county downloads, the ESRI Shapefile for the entire state was downloaded 3641 times since March 1, 2006. The spreadsheets describing the layout of the CAMA text files were downloaded 1204 times since March 1, 2006.

	ESRI Shapefile			CAMA Commercial			CAMA Residential			Total	
County	Downloads (hits)	Visits	First Download	Downloads (hits)	Visits	First Download	Downloads (hits)	Visits	First Download	Downloads (hits)	Visits
Missoula	1,520	1,301	2/28/2006	438	207	2/28/2006	667	354	3/13/2006	2625	1862
Lewis & Clark	1,476	1,202	3/2/2006	400	183	3/22/2006	713	407	3/6/2006	2589	1792
Gallatin	1,398	1,158	3/2/2006	434	198	3/22/2006	669	358	3/2/2006	2501	1714
Beaverhead	1,381	933	3/1/2006	406	206	3/22/2006	650	346	3/15/2006	2437	1485
Yellowstone	1,177	920	3/1/2006	448	213	3/20/2006	678	342	3/2/2006	2303	1475
Flathead	1,085	901	2/28/2006	409	188	3/10/2006	599	288	3/2/2006	2093	1377
Big Horn	1,132	848	3/1/2006	365	175	3/4/2006	508	220	3/3/2006	2005	1243
Cascade	959	791	3/2/2006	427	174	3/28/2006	534	239	3/15/2006	1920	1204
Madison	1,072	905	2/28/2006	339	165	3/23/2006	480	224	3/7/2006	1891	1294
Silverbow	917	725	3/6/2006	365	160	3/11/2006	526	242	3/11/2006	1808	1127
Ravalli	876	722	2/28/2006	345	156	3/16/2006	526	237	3/16/2006	1747	1115
Lake	797	686	3/1/2006	344	159	3/28/2006	572	273	3/26/2006	1713	1118
Lincoln	746	615	3/1/2006	375	171	3/28/2006	507	244	3/28/2006	1628	1030
Park	820	704	3/2/2006	334	141	3/28/2006	473	220	3/15/2006	1627	1065
Powell	894	750	3/1/2006	275	137	3/28/2006	441	185	3/28/2006	1610	1072
Jefferson	868	729	3/5/2006	240	152	3/27/2006	481	237	3/2/2006	1589	1118
Fergus	830	675	3/1/2006	314	143	3/28/2006	443	183	3/28/2006	1587	1001
Carbon	709	595	3/1/2006	324	152	3/28/2006	470	207	3/28/2006	1503	954
Deer Lodge	774	656	3/1/2006	292	141	3/28/2006	423	194	3/15/2006	1489	991
Stllwater	705	588	2/28/2006	294	136	3/28/2006	465	201	3/20/2006	1464	925
Broadwater	696	574	3/1/2006	297	145	3/15/2006	417	180	3/1/2006	1410	899
Sanders	644	525	3/6/2006	323	133	3/28/2006	433	167	3/28/2006	1400	825
Choteau	651	523	3/2/2006	309	144	3/28/2006	429	170	3/28/2006	1389	837
Granite	705	582	2/28/2006	267	141	3/23/2006	391	170	3/16/2006	1363	893
Teton	563	483	3/6/2006	291	131	3/23/2006	395	153	3/3/2006	1249	767
Custer	511	420	3/6/2006	306	144	3/22/2006	424	161	3/22/2006	1241	725
Blaine	494	409	3/1/2006	301	140	3/28/2006	446	169	3/1/2006	1241	718
Hill	497	402	3/3/2006	332	139	3/28/2006	403	155	3/28/2006	1232	696

Sweet Grass	596	513	3/2/2006	263	129	3/28/2006	364	150	3/28/2006	1223	792
Phillips	533	450	3/1/2006	295	141	3/28/2006	374	153	3/28/2006	1202	744
Valley	445	358	3/6/2006	318	127	3/28/2006	413	154	3/28/2006	1176	639
Mussellshell	524	434	3/4/2006	255	126	3/28/2006	392	156	2/28/2006	1171	716
Glacier	479	400	3/6/2006	305	138	3/28/2006	380	152	3/28/2006	1164	690
Richland	422	349	3/6/2006	310	131	3/28/2006	407	156	3/28/2006	1139	636
Pondera	476	412	4/11/2006	276	123	3/28/2006	374	140	3/22/2006	1126	675
Roosevelt	418	348	3/3/2006	294	131	3/28/2006	379	140	3/28/2006	1091	619
Mineral	443	381	3/1/2006	264	133	3/28/2006	376	151	3/28/2006	1083	665
Rosebud	574	488	3/6/2006	215	118	3/28/2006	283	139	3/28/2006	1072	745
Toole	410	340	4/19/2006	291	130	3/28/2006	371	132	3/28/2006	1072	602
Wheatland	438	368	3/6/2006	225	120	3/28/2006	350	132	3/28/2006	1013	620
Meagher	513	440	3/6/2006	22	21	7/3/2009	346	141	3/28/2006	881	602
Carter	475	384	3/4/2006	21	20	7/3/2009	385	157	3/28/2006	881	561
Judith basin	375	320	4/19/2006	232	126	3/28/2006	274	139	3/28/2006	881	585
Powder River	455	373	3/5/2006	22	21	7/3/2009	366	140	3/28/2006	843	534
Petroleum	368	321	3/6/2006	21	20	7/3/2009	356	129	3/13/2006	745	470
Dawson	31	28	7/3/2009	300	141	3/15/2006	379	146	3/15/2006	710	315
Sheridan	28	26	7/3/2009	277	118	3/28/2006	357	130	3/28/2006	662	274
Fallon	29	28	7/2/2009	278	136	3/24/2006	352	140	3/28/2006	659	304
Daniels	30	28	7/3/2009	255	131	3/28/2006	355	137	3/28/2006	640	296
Liberty	33	32	7/3/2009	237	127	3/28/2006	346	138	3/27/2006	616	297
McCone	30	27	7/2/2009	225	133	3/28/2006	357	139	3/28/2006	612	299
Garfield	30	27	7/3/2009	22	20	7/3/2009	375	156	3/28/2006	427	203
Golden Valley	29	28	7/3/2009	21	20	7/3/2009	335	142	3/28/2006	385	190
Prairie	25	24	7/3/2009	21	20	7/3/2009	337	127	3/28/2006	383	171
Wibaux	28	27	7/3/2009	24	22	7/3/2009	330	132	3/26/2006	382	181
Treasure	32	31	7/3/2009	25	24	7/3/2009	318	129	3/28/2006	375	184
	33,166	27,307		14,908	7,121		24,194	10,503		72,268	44,931