MSDI Cadastral Theme Plan - DRAFT

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Executive Summary

Following completion of the GIS Coordination Strategic Plan in 2022, Montana Spatial Data Infrastructure (MSDI) Theme Leads were tasked with developing data improvement plans for their respective themes. This business plan formalized the process the Montana State Library (MSL) uses to develop data quality improvement strategies.

The plan identifies eleven goals to achieve over the next 3-5 years. These include develop a prioritization evaluation mode; acquire 25% of the township corners of the state; investigate improvements to the Cadastral API; publish parcels semi-monthly; complete metadata for all theme datasets; incorporate missing GLO surveys into the CadNSDI; identify topology errors in public lands data; develop a better mechanism to detect public land changes; facilitate a seamless parcel data initiative with parcel providers; provide additional resources for SQL database users and streamline routing to ensure timely GIS entry of new conservation easements.

Through the Cadastral Improvement Plan, subtheme assessments establish a baseline for measuring future progress. The near-term goals reflect the current state of each Cadastral

Framework subtheme through different data quality measures. The plan provides a structure for improving the data quality and enhancing the practical use of the data.

Theme Definition and Description

Cadastral Framework is the authoritative statewide GIS framework for tax parcels and related land-information records, providing standardized parcel geography and selected property, ownership, valuation, and jurisdictional attributes for mapping, analysis, and public access. The use of the framework's datasets is quickly on the rise by private entities, incorporating the data into heavily used applications. The framework is designed to support public and private sector using including (but not limited to) land use/zoning planning, asset management, disaster emergency planning, environmental management, 911 call routing, health/human services, demographic analysis and engineering design.

The Cadastral Framework Theme consists of four subthemes (Owner Parcels, Public Lands, Conservation Easements & Public Land Survey System (PLSS)). The subthemes are maintained statewide and are mapped to align with other MSDI data themes where appropriate.

The Cadastral National Spatial Data Infrastructure (CadNSDI) is the digital representation of the Public Land Survey System (PLSS). The core components of the PLSS framework (township, first division, second division, etc.) are the foundation for all legal descriptions of private property and public land boundaries in Montana.

Individual Theme Testimonials

"As an MSDI framework theme, cadastral provides the spatial framework on which most other authoritative data is created and maintained. Cadastral data is invaluable and will continue to be a crucial component for local governments, state agencies, and the public."

Eric Spangenberg & Jason Danielson, Lewis & Clark County/City of Helena

For our local government GIS management, the MSDI cadastral theme serves as the foundation for our GIS. As a small local government office, we rely on MSL/MT Department of Revenue (DOR) to maintain parcels for our county. Rather than spending time on cadastral maintenance, we can focus on supporting our enterprise GIS users and refining our online web map and application services.

Using the monthly cadastral download and a weekly DOR Orion CAMA (computer assisted mass appraisal) download, we create custom features and services to support users and visitors. The underlying data includes extensive information used for analysis, inquiries,

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and projects. Cadastral data is also referenced as web services for additional third-party applications, which support building permits, utility asset management, and public safety.

Cadastral data provides a base for many of our administrative features and interactive mapping applications. The statewide cadastral theme includes data for neighboring counties, which supports cross boundary analysis, addressing, and public safety response. The cadastral theme also provides additional derivatives, including public lands, conservation easements, and CadNSDI. This data is referenced within our GIS and applications and serves as authoritative data for our users and public inquiries.

As an MSDI framework theme, cadastral provides the spatial framework on which most other authoritative data is created and maintained. Cadastral data is invaluable and will continue to be a crucial component for local governments, state agencies, and the public.

"BLM fully endorses this plan and the Montana State Library's continued leadership in coordinating the Cadastral Framework Theme. We look forward to continuing our collaboration on GLO survey integration and public lands data maintenance, and we encourage decision-makers to provide the support needed to carry this plan forward over the next five years."

Allen Armstrong, U.S. Bureau of Land Management, Montana/Dakotas GIS Program Manager

On behalf of the Bureau of Land Management (BLM), I am writing to express our strong support for the MSDI Cadastral Theme Plan. As a core partner in maintaining the CadNSDI, BLM relies on this framework daily to support efforts such as land management decisions, oil and gas lease sales, land exchanges, public easements and rights of way, and public land boundary integrity across Montana. The plan's goal of incorporating all currently missing General Land Office (GLO) surveys into the CadNSDI is one we are particularly invested in, as this work will significantly contribute to the overall spatial accuracy of the cadastral framework.

The BLM is committed to our continued partnership with the Montana State Library, collaborating on the input of historic survey control and prioritization of the remaining survey gaps. Support from our staff is available to increase overall capacity and share the responsibilities of producing authoritative data for all users.

We also recognize the value of the plan's broader goals, particularly improving topology accuracy between public lands and parcel data and developing a better mechanism to detect public land ownership changes. These efforts directly support BLM's responsibility for accurate, up-to-date public land records, and a more consistent, timely dataset that benefits both our internal operations and the many external stakeholders who rely on this framework for land use planning, emergency response, and resource management.

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BLM fully endorses this plan and the Montana State Library's continued leadership in coordinating the Cadastral Framework Theme. We look forward to continuing our collaboration on GLO survey integration and public lands data maintenance, and we encourage decision-makers to provide the support needed to carry this plan forward over the next five years.

Private Sector Support

Name, Agency

TO BE ADDED

The Plan (3-5 years)

Through the Data Quality Assessment Matrix and Data Improvement Plan, the below set of objectives were identified as near-term data improvement goals. These objectives will be prioritized for completion within the next three to five years. Progress on these items will be quantified within the Data Improvement Plan and reported back through the Working Group.

These goals are listed in no order of priority (numbers are provided for identification purposes within the Data Quality Measures section):

1. Develop a prioritization evaluation model
2. Acquire 25% of the township corners of the state
3. Investigate improvements to the Cadastral Application Programming Interface (API)
4. Publish parcels semi-monthly
5. Complete metadata for all subtheme datasets
6. Incorporate missing GLO surveys into the CadNSDI
7. Identify and fix topology errors in public lands data
8. Develop a better mechanism to detect public land changes
9. Facilitate a seamless parcel data initiative with parcel providers
10. Provide additional resources for SQL database users
11. Streamline routing to ensure timely GIS entry of new Conservation Easements

Develop a prioritization evaluation model

The Cadastral Framework currently lacks an evaluation model for identifying and prioritizing areas that would benefit most from adjustment or acquiring additional survey control. Developing such a model could help the Montana Geospatial Information Act (MGIA) grant program target funding toward locations where collecting PLSS control data would have the greatest impact, improving the accuracy and positional alignment of the datasets tied to the PLSS.

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Acquire 25% of the township corners of the state

A near-term goal identified was to acquire survey control for 25% of township corners in the state. The state currently has roughly 18% of the state's township corners, much of which was funded through the MGIA grant program dating back to 2007 when the grant program began prioritizing the collection of PLSS mapping control to improve both the Mapping Control and Cadastral Framework Themes. To acquire an additional 7% of the state's township corners, two avenues will need to be utilized over the next five years: the MGIA grant program and contributions from the surveying community. Additional existing staff time may need to be prioritized to perform PLSS adjustments in the GIS.

Investigate improvements to the Cadastral API

A more thorough investigation is needed to determine why some property queries in the Montana Cadastral application return incorrect ownership information. MSL is aware of several erroneous result types, most notably cases in which beneficiaries named in beneficiary deeds are incorrectly displayed as current property owners.

Correcting these issues in the Cadastral API will possibly be complex. Additional research is necessary to identify the underlying cause, determine how ownership records are being interpreted and returned by the service, and develop an appropriate solution.

Publish parcels semi-monthly

Parcel users have expressed a need for more frequent and timely parcel data updates. With the transition to a cloud environment and more flexible web-service administration, a near-term goal is to publish parcel updates twice each month. Parcels have the capacity to be updated more frequently because of the streamlined process and several parcel providers that already have automated parcel data availability.

Complete metadata for all subtheme datasets

A near-term goal is to conduct a comprehensive review of metadata for all subtheme datasets. This review will evaluate each dataset's metadata for completeness, consistency, and alignment with MSL metadata standards. This effort will help ensure that ArcGIS users can more easily discover, interpret, evaluate, and appropriately use each dataset, while supporting consistent documentation and long-term stewardship across the subthemes.

Incorporate missing GLO surveys into the CadNSDI

A near-term priority is to improve the completeness of the CadNSDI by incorporating all currently missing GLO survey data. In partnership, MSL and the Bureau of Land Management (BLM) will identify, inventory, and collectively prioritize missing surveys for

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entry into the CadNSDI. This effort will focus on ensuring that all GLO surveys are represented in the dataset and establish a timely maintenance workflow.

BLM's hiring of a GIS Specialist in 2024 has increased the capacity to advance this work and share CadNSDI maintenance responsibilities between partner agencies. Coordinated priorities will help address the most significant survey data gaps, reduce duplicated effort, and support more complete and efficient long-term maintenance of the CadNSDI.

Identify topology errors in public lands data

Analyzing public lands datasets for topology errors will help identify alignment issues with parcel data. Since the public lands and parcel datasets are maintained independently, by multiple agencies and updated on different schedules, their boundaries can become misaligned over time.

A near-term goal is to implement an improved ArcGIS topology and editing workflow that identifies and resolves these discrepancies more consistently, helping maintain data integrity and improve alignment between the two datasets.

Develop a better mechanism to detect public land changes

In addition to improving the topology workflow, a need was identified for a more effective method to detect ownership changes that affect public lands. Public lands data can lag several months behind current parcel ownership changes. This goal focuses on implementing more efficient workflows to identify public lands ownership changes properly and reduce the risk that changes are missed.

Facilitate a seamless parcel data initiative with parcel providers

Parcel data providers maintain topology and spatial integrity within their individual county boundaries; however, this maintenance does not typically extend across county lines. As a result, the statewide parcel dataset contains noticeable areas where adjacent county parcel boundaries are not seamless, resulting in persistent gaps, overlaps, or misaligned parcel edges. MSL will facilitate the conversation for parcel providers collectively agreeing to use the MSDI County Boundary dataset and on a scheduled basis, a topology report will be generated for all parties to resolve.

Provide additional resources for SQL database users

A near-term goal identified from common information requests is to offer additional resources to assist users work more efficiently with SQL databases. The resources MSL currently offers regarding SQL databases do not meet the needs of how cadastral users can use the data more efficiently. This goal addresses the need to improve those resources

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by providing more training opportunities, tutorial “how to” videos and better documentation.

Streamline routing to ensure timely GIS entry of new conservation easements

A near-term priority is investigating ways to improve the routing process of new conservation easement documents when they are filed with the county. Currently, not all new conservation easements are shared with DOR to add to the GIS database.

Data Quality Measures

The data quality for subthemes of the Cadastral Framework were assessed based on the measures below. Data quality is a component of the value of data. Because data quality directly affects usefulness, improving the quality improves the value of the data.

Spatial Accuracy and Precision

Precision refers to how data values are stored and expressed. Spatial accuracy describes how well the data values represent the actual observed phenomenon, based on usage needs and measurement technologies.

MSDI Cadastral subthemes (parcels, public lands and conservation easements) align with the CadNSDI. The spatial accuracy with these datasets varies greatly across the state. MSL has performed annual adjustments to the CadNSDI and associated Cadastral and Administrative Boundaries themes using newly acquired survey control, largely funded by MGIA grants.

Goal 1 and 2 focus on improving the spatial accuracy and precision of cadastral framework data in areas that are in of adjustment the most.

Consistency

Consistency highlights the similarities and differences between data that are stored in multiple datasets or databases.

The public lands data has not been consistently maintained, and ownership updates have not occurred at or near the same time that corresponding changes are reflected in the parcel data.

Goal 8 focuses on improving the consistency of maintaining a more up to date dataset and ensuring that changes are not missed.

Completeness

Completeness describes the extent to which the dataset includes all observations needed for its intended purpose.

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All cadastral subtheme datasets have statewide coverage; however, some components remain incomplete. For example, the CadNSDI parcel fabric is missing survey parcel lines in some areas. The need to complete this linework before adjustments can be made slows the progress of adjustment projects. Metadata is also missing complete feature characteristics and description information for both the CadNSDI and Parcels.

Goals 5, 6 and 7 aim towards improving upon the completeness of the subtheme data.

Timeliness

Timeliness is an assessment of the data's update cycles and temporality to internal and external deadlines and reporting needs.

Cadastral Framework datasets experience challenges with current timeliness outlined in update frequency. Parcels have the capacity to be updated more frequently because of the streamlined process and several parcel providers that already have automated parcel data availability. Both the public lands and conservation easements experience timeliness issues due to current workflows by respective agencies.

Goals 4, 8 and 11 targets improving timeliness of the data.

Update Frequency

Update Frequency, an aspect of Timeliness, is defined by how often the data are updated.

The goal is to update Parcels, Conservation Easements, and Public Lands datasets every month. Conservation Easements, maintained by the DOR, and Public Lands receive fewer updates because of higher priority work tasks. Similar challenges exist with the ability to increase the update frequency of the PLSS CadNSDI. Parcels have the capacity to be updated more frequently because of the streamlined process and several parcel providers that have automated parcel data availability.

Goals 4 and 8 aim to increase the update frequency of the parcels and public lands.

Archive Frequency

Archive Frequency is defined as how often the data are archived or how often a snapshot of the data is taken. Archive Frequency is another aspect of Timeliness.

Cadastral Framework datasets are archived in accordance defined within Update Frequency. The quality assessment did not identify any priority for Achieve Frequency.

Integrity

Integrity is an assessment of the data's structure, schema, and maintenance workflows for accuracy, precision, consistency, completeness to meet user needs and interoperability.

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Integrity is one of the more complicated data measures to assess as multiple objectives were identified in the data improvement matrix for each cadastral subtheme.

Goals 3, 5, and 9 focus on improving the integrity of the framework data.

Relevance

Relevance refers to whether data are available, accessible, and meet the requirements for a given business use based on completeness, consistency, precision, accuracy, integrity, and timeliness.

Cadastral Framework data supports many industries beyond GIS professionals such as real estate, engineering, community development, emergency services, and natural resources. Improving the efficiency and user needs of the data will be the focus with this data measure.

Goals 3 and 10 focus on improving the relevance of the data.

In the Parking Lot

Parking-lot items are aspirational, longer-range efforts that may advance the cadastral theme when funding, staffing, and partnerships allow.

A long-term goal identified to obtain 35% of township corners of the state is a goal that will take longer than 5 years. A modified version of this goal is mentioned in near-term goals, that takes into account current staffing and funding. Additional existing staff members would need to be trained to assist with PLSS adjustments should there be a significant increase in the amount of new survey control acquired annually.

Lastly, issues related to incorrect Property Address information in the CAMA data were identified. A future goal may be to develop processes for DOR to verify the property address with authoritative address data.

These long-term goals and challenges form a list of items that require continued attention, but not immediate implementation.

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High Level Schedule

Objectives and Tasks	Timeline in Years				
Year	**1**	**2**	**3**	**4**	**5**
1. Develop a prioritization evaluation model	X	X	–	–	–
2. Acquire 25% of township corners of the state	X	X	X	X	X
3. Improvements to the Cadastral API	–	X	X	X	–
4. Publish parcels semi-monthly	–	X	X	X	X
5. Complete subtheme metadata	–	X	–	–	–
6. Incorporate missing GLO surveys	X	X	X	–	–
7. Identify topology errors	–	–	X	X	–
8. Detection of ownership changes	–	–	–	X	X
9. Seamless parcels data	–	–	–	X	X
10. Additional SQL database resources	–	–	–	–	X
11. Improvements to conservation easements routing process	–	–	–	–	X

X = Working on task

Theme Challenges

A challenge facing the MSDI Cadastral Framework Theme are adjustments made to the subthemes are largely driven by who applies for MGIA grant funding and not always by the areas most in need of an adjustment. With current resources, completing data acquisition for every township statewide would take more than 80 years. By establishing priority collection areas within the MGIA grant program, available resources can be directed to areas with the greatest need in a more timely and strategic manner. Goal 1 in the plan aims to address this challenge.

MSL does not maintain the parcels or conservation easements subthemes, they are maintained in partnership with other data providers, which creates challenges for theme stewardship. MSL will collaborate with its data partners to encourage and support progress toward these improvements, while promoting reliable, consistent, and well-stewarded statewide data.

Conclusion

The MSDI Cadastral Framework Theme Plan establishes an actionable path for improving subtheme datasets over the coming years. Through a comprehensive assessment of the data and working group collaboration, the plan highlights near-term goal priorities, including the development of an evaluation model, acquiring 25% of township corners of the state, completing metadata and incorporating missing GLO surveys.

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MSDI Cadastral faces several theme challenges including lack of resources devoted, the turnaround time to incorporate cadastral improvements funded by the MGIA grant program and the improvement rate that exceeds 80 years to obtain every township corners of the state. While challenges remain, the theme plan provides a realistic path forward for improvement over the next 5 years.

Appendix

Below are links to the theme's quality assessment matrix and improvement plan table.

MSDI Cadastral Framework Data Theme Quality Assessment Matrix

MSDI Cadastral Framework Data Improvement Plan Table

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