

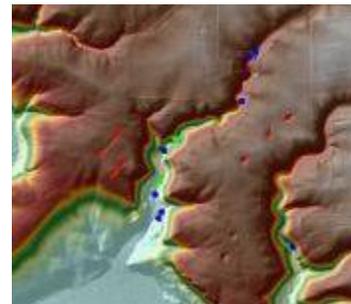
Nomination for a Governor's Commendation Award for the Minnesota Elevation Mapping Project

June 30, 2014

Introduction

The [Minnesota Elevation Mapping Project](#) developed and delivered a seamless high-accuracy digital elevation dataset of the State of Minnesota using data collected with LiDAR technology. The data was acquired and compiled using a consistent set of specifications and was made possible by a partnership of organizations from all levels of government as well as from the academic and private sectors.

Accurate topographic information is greatly enhancing the ability of decision makers and resource managers to understand Minnesota's landscape and is providing the foundation for developing innovative, effective, and defensible resource management strategies. The project has enabled the flow of accurate topographic information between all organizations and the general public.



The benefits-driven motivation of this project utilized the contributions of staff, expertise and money across all levels of government including federal, state, county and municipal entities. This level of collaboration is rarely seen on such large and complex projects. Project staff leveraged the myriad resources and expertise available to them through these partnerships to produce a high quality dataset on time and under budget. Minnesota is now one of very few states to have complete LiDAR coverage that is viewable and downloadable through common gateways of access.

Problems Addressed and Solutions

The Minnesota Elevation Mapping Project fulfilled a long-term vision for statewide LiDAR-derived elevation data that is publicly available and usable by citizens and technicians alike through various avenues of data viewing, data-downloading portals and custom tools supported by user training. Prior to the establishment of this project there were many barriers to accessing existing data. Proprietary restrictions, high cost, inconsistent data specifications, cumbersome delivery methods, and little help to understand or use the data all hindered widespread use of LiDAR data.

Unmet data need. High accuracy elevation data has been a long-recognized high-priority need for a wide variety of business purposes across Minnesota, particularly those associated with water resource management. The first statewide, agency-based proposal¹ was written in 2002 by the former DNR Waters Division with support from 24 additional sponsors. The Minnesota Elevation Mapping Project brought those early plans to fruition.

¹ [A White Paper on Developing a High-Resolution Digital Elevation Model \(DEM\) and Floodplain Mapping Program](#), MN DNR Water and Partners, June 2002.

Piecemeal data coverage. To start meeting this established data need, entities began moving forward independently with their own LiDAR acquisition projects. This approach led to scattered geographic coverage, inconsistent specifications, higher production costs and data access restrictions. This project used and standardized existing data where feasible and collected data for remaining areas in several phases (see [map of project phases](#)).



Data dissemination. Due to its size and complexity, LiDAR data has been difficult to distribute. Current computing power, internet services and storage capacities used under the coordinated approach of this project have brought efficiencies into the design and implementation of the data and tools established early on by the project visionaries. As a result, users of LiDAR data now have consistent data available to them statewide.

Data use. LiDAR data and its derived products are an emerging and exciting technology that is making its way into the inner workings of planning and GIS analysis worldwide. However, other than a few skilled high end users, few technicians possessed the skills to readily use the technology to meet their business needs. Project partners recognized early on that a training program would be an important contributor to the overall success of data users. Several training courses have been developed and conducted at locations across the state, and educational materials are available online.

Partners

A project of this scope required the cooperation of many organizations to bring skills and resources together to accomplish the full vision.

- **Minnesota Legacy Amendment – Clean Water Fund:** Provided the base funding to ensure that this project could be completed.
- **Minnesota Department of Natural Resources:** Served as the lead agency on the project. Staff managed the project, provided contract oversight, coordinated with the vendors, performed quality control and validation of the data, delivered the data to the stakeholders, and developed support materials and tools.
- **Digital Elevation Committee:** Coordinated the project, defined the products to be delivered and the data collection, processing and accuracy standards to be followed. Members include state and federal agencies, local and regional government, academic, and private sector.
- **LiDAR Research and Education Subcommittee:** This subcommittee of the Minnesota Digital Elevation Committee, comprised primarily of LiDAR technicians, worked to establish best practices for this LiDAR data. Their work during this project has brought consistency in data development, nomenclature, dissemination, training and application for all users.
- **Minnesota Geospatial Information Office:** Performed additional quality-checking and data processing, developed data delivery infrastructure, and maintained information webpages.
- **Minnesota Department of Transportation and county partners:** MnDOT developed the validation point collection methodology, coordinated the collection of validation points with county partners and provided valuable survey consultation and direction.
- **University of Minnesota:** Water Resources Center staff led the request for legislative support from the Clean Water Fund for this project and for support from the Legislative-Citizen

Commission on Minnesota Resources for training GIS professionals to use the data. They developed and managed the training program.

- **U.S. Geological Survey, Natural Resources Conservation Service and National Park Service:** Provided additional funding to improve data resolution and expand geographic coverage.

Award Criteria

This project meets the following five of seven possible award criteria:

1. Promote effective investments in geospatial information

The project has promoted efficient investments both in terms of collaborative funding, economies of scale and use of existing data:

Collaborative Funding: The largest source has been the Minnesota Legacy Amendment – Clean Water Fund, with additional investment by several federal agencies, counties and cities:

Clean Water Fund of the Clean Water, Land and Legacy Amendment: The Minnesota Legislature appropriated \$8.3 million for this project (\$2.8 million each in fiscal years 2010 and 2011; \$1.35 million each in fiscal years 2012 and 2013) from the Fund, thereby making statewide coverage possible.

U.S. Geological Survey: Funding from USGS enabled increases in point density in the Twin Cities metropolitan area and facilitated acquisition in areas outside the state. Since Legacy Amendment funding could not be used outside Minnesota, USGS funding supported the collection and processing of the South Dakota portion of the Minnesota River Basin; this ensured that modeling can be done for the entire watershed using data collected with consistent specifications.

Natural Resources Conservation Service: Funding supported acquisition in the Arrowhead region for soil surveys currently in-progress for Lake and Cook counties.

Lake County and the **City of Duluth** provided funds to increase accuracy in the coastal zone management area along Lake Superior's North Shore and in the Duluth area.

Dakota County contributed funds to increase resolution to 2 points per square meter to increase accuracy and support the development of 1-foot contours.

The cities of St. Paul and Maple Grove contributed funds to increase resolution of their data to 8 points per square meter to support infrastructure inventory and 1-foot contours.

Economies of scale: Collaborative funding helped the project come in \$1 million under budget. This allowed updating information in Blue Earth County and in areas around the City of Duluth that had seen landscape change due to significant precipitation events.

Use of Existing Data:

Counties: Project staff negotiated agreements with the following counties to make their data publicly available: Blue Earth (2005 version), Chisago, Crow Wing, McLeod, Rice, Stearns and Wright, and with NRCS to include data collected in Pine County. In addition, DNR staff processed the data for these counties to make it as consistent as possible with the specifications used for the Minnesota Elevation Mapping Project.

Red River Basin: DNR staff processed this publicly available data to convert the coordinates to UTM Zone 15 and to standardize the tiling to be consistent with the project.

2. Promote geospatial information as a shared public resource

All of the data and tools from this project are publicly available online at no charge. The data can be either viewed online or downloaded in commonly used and open formats.

Online Map for General Public

[MnTOPO](#) provides access to derived LiDAR information with just a browser on a variety of devices including personal computers, tablets, and smartphones. MnTOPO opens the information to a far wider audience who does not have GIS software and expertise. They can:

- View contour lines and floodplain boundaries over a choice of backgrounds: imagery, terrain or road map.
- Create, save and print a map.
- Click on a location to see its elevation or draw a line to create an elevation profile graph.



Data Downloads

The data are available for download in commonly used and open formats ensuring that they are usable in a wide variety of GIS software. Two applications provide map interfaces for the user to outline their area of interest for data download:

1. [MnTOPO](#): People can outline their area of interest and then download just the layers that they need (e.g., contours, digital elevation model, or the original LiDAR points), choosing from several formats². Individual tiles of data are merged together before the data is delivered.
2. [ArcGIS Toolbox](#): People who have Esri's ArcMap software can use this toolbox along with a polygon outlining their area of interest to streamline downloading and merging all the LiDAR data for that polygon.

LiDAR data is voluminous – the data holdings for existing Minnesota LiDAR data and its current derived products total about 10 terabytes uncompressed (3 terabytes compressed), making for many managerial and downloading challenges. The coordinated approach established by this project has greatly increased the efficiency of data management and user download.

² From October 2013 – June 2014, MnTOPO received nearly 3,800 download requests, detailed in this [graph](#). The majority of the requests were for contour lines and digital elevation models. Although file geodatabase format (for use with Esri software) was the most popular, a sizable number of requests were for open formats (shapefile and binary floating point raster) that can be used in a number of other software packages.

FTP site downloads: During the period July 2013 – June 2014, just over 4,000 different users made data requests of MnGeo’s FTP site totaling about 39 terabytes of data transferred, which included:

- 370,000 files in LAZ format
- 202,000 files in geodatabase format (smaller tiles)
- 1,661 mosaicked county or project geodatabases (ranging from 3 to 58 gigabytes apiece)

As recognition and applicability of these data resources increase, so will the download demands.

Reusable Services (for website developers)

DNR is making the data available in formats that allow other website developers to incorporate the data, for example contour lines or hillshades, into their applications and online maps. For example, the [Red River Basin Decision Information Network](#) site uses these services and thus does not have to store the data.

Data Integration

Minnesota’s LiDAR data and derived products are intended to be added to the [National Elevation Dataset](#), a national seamless dataset derived from the best available raster elevation data.

3. Support the establishment and use of geospatial standards and guidelines

This project meets the criteria in two areas:

1. Used specifications to ensure consistent, quality data products within this project.

The Digital Elevation Committee established specifications based on those developed by the USGS; these were consistent for all data collected as part of the project. MnDNR staff quality-checked all data delivered and worked with the vendors to ensure that the data met the standards. To verify that the data met positional accuracy standards, MnDOT and county surveyor staff cooperated to collect validation points, and DNR staff produced detailed accuracy assessment reports. These combined efforts allow individual users, who usually do not have the expertise and resources to fully assess data accuracy, to have confidence in the data.

2. Provides a model (master agreement, specifications and collaborative approach) that other organizations, including those outside Minnesota, can use for other projects.

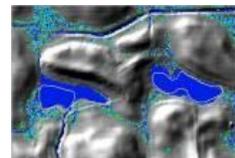
The State of Minnesota created a Master Contract for LiDAR Services that was in effect for three years. The contract provided a way to pre-qualify LiDAR vendors and then keep them on a retainer for future work orders. The Master Contract was also available for other units of government to use for special projects.

4. Educate and inform policymakers related to the value and use of geospatial technology

LiDAR-derived elevation data is being used in a wide and growing range of applications, many of which are documented in the letters of support (attached). Increasingly, examples show ways in which the use of LiDAR data has saved money and time or has allowed people to accomplish tasks they could not have done without the data. Examples such as protecting against flooding, reducing water pollution, or analyzing a home's suitability for solar energy resonate with policymakers and citizens alike, helping to demonstrate the value and use of geospatial technology.

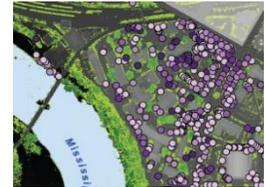
Water resources and hydrology: To date, the best-documented examples are in the area of water resources and hydrology (see the [water quality examples webpage](#)):

- Flooding
 - Assist property owners, at greatly reduced cost, to prove that the elevation of their structure is above flood elevation in order to waive FEMA flood insurance requirements.
 - Better estimate coastal flood hazards to St. Louis, Lake and Cook counties as part of FEMA's [Great Lakes Coastal Flood Study](#); one of the study's products will be updated Digital Flood Insurance Rate Maps (DFIRMS) for St. Louis County (the only county of the three that participates in the flood insurance program). The results will assist community planning to reduce flood-related losses and the need for taxpayer-supported flood disaster relief.
 - Help NOAA's Digital Coast Program estimate the economic impacts of different flooding frequencies. The Chester Creek watershed in the Duluth area was one of two pilot studies done for the [Economic Assessment of Green Infrastructure Strategies for Climate Change Adaptation: Pilot Studies in the Great Lakes Region](#) project.
 - Assist local officials, surveyors and engineers to quickly identify potential flood risks, plan flood control and map inundation areas.
- Use LiDAR-derived hillshade layers in the statewide [Altered Waters](#) project to find watercourse channels not otherwise visible on aerial photography, such as those obscured by grass or trees (*see graphic to right*), and to help distinguish altered (channelized) waters from natural streams.
- Develop a high resolution classification of the Saint Louis River estuary shoreline and wetland areas to support efforts to delist the river as an EPA [Great Lakes Area of Concern](#).
- Demonstrate the impacts of land use changes on increasing peak flows in streams along the North Shore of Lake Superior. Higher peak flows increase the likelihood of stream erosion and sedimentation. In the past, this analysis was not conducted because it required dedicated funding; now it can easily be done in-house.
- Find depressional areas for water storage to reduce runoff, flooding and sediment loads. Prioritize projects and target best management practices to areas that will benefit the most.
 - From 2011-2014, 27 projects receiving grants totaling over \$4 million from the Board of Water and Soil Resources used LiDAR data to analyze terrain, target best management practices and improve water quality – see Appendix A (separate spreadsheet attachment).
- Help to identify and map wetlands for the [National Wetlands Inventory update](#), a statewide, multi-year project.



A sampling of other known uses for the data:

- **Air Photos**
 - Provide ground elevations used to orthorectify and quality-check imagery collected for the State's [Spring Aerial Imagery Program](#) (central and northwest phases).
 - Create elevation models used to orthorectify detailed photos that MnDOT uses along transportation corridors for planning. Processes that used to take weeks now can now be done in days.
- **Archaeology**
 - Provide significant predictors of the locations of archaeological sites for the statewide [MnModel](#) project.
 - Assess the potential existence of historic burial mounds to determine the need for site visits by the State Archaeologist (see [pilot project](#) and attached support letter)
- **Farming**
 - Support field-level planning of precision agriculture.
- **Forestry**
 - Estimate forest metrics such as canopy cover and height, tree diameter and basal area, stem density and volume in order to simplify annual forest inventory efforts at Camp Ripley.
 - Estimate tree height, canopy density and canopy coverage of trees on the University of Minnesota campus to support urban forestry decisions that promote tree health and reduce management costs.
- **Geology and Mining**
 - Map the properties and origin of soil parent materials statewide, primarily to support drinking water management.
 - More accurately locate sinkholes and springs in karst topography.
 - Use LiDAR throughout the life cycle of a mine to explore feasibility, measure ore extraction and landscape restoration, capture stockpile, waste rock and tailing volumes and accurately contour shadowed slopes of steep pit walls.
 - Map hundreds of historic mining features at the new Lake Vermilion State Park.
- **Landcover**
 - Map land cover for the Twin Cities metro area with unprecedented accuracy. Surface information provided by the LiDAR data allows discrimination between land cover types that are difficult to distinguish using satellite imagery alone. These include shrubs vs. trees, asphalt roads vs. dark rooftops, and certain crop species such as corn vs. soybeans.
 - Map native plant communities using contour lines and hillshades to better define cover types.
- **Planning**
 - Create viewsheds from points along the Mississippi National River and Recreation Area and the Great River Road as part of a Visual Protection Plan project. LiDAR data captured the mix of buildings and vegetation that plays a key role in what is seen and unseen.
 - Target outreach material related to bluff restoration projects to owners of parcels containing LiDAR-identified shoreline bluffs.
- **Solar Energy**
 - Map statewide solar radiation for solar panel suitability. The [Minnesota Solar Suitability Analysis](#) project has been submitted to the [Esri Climate Resilience App Challenge](#) competition.
 - Analyze total rooftop solar capacity for residential and commercial properties within the City of Stillwater. The research could not have



- been done without the high-resolution elevation data which was used to calculate roof slope and aspect and to take into account the shadows from trees and buildings.
- Allow individual property owners in a Minneapolis neighborhood to use the [Kingfield Solar Energy Potential webmap](#) to understand if their rooftop is suitable for solar photovoltaics, and to get an estimate of system size, output and cost.
 - **Transportation**
 - Fill in areas under tree canopy where MnDOT photogrammatrists cannot see, thus eliminating or reducing the need to send survey crews to gather elevation data in those areas.
 - Keep survey crews out of potentially hazardous situations along busy highways, eliminating a work zone that would cause congestion and saving the driving public time and fuel costs.

This data will have a long shelf-life, useful for generations to come as a snapshot in time capturing Minnesota's landscape. Uses for the data will continue to grow, particularly as new tools and viewing options make the information accessible to wider audiences.

5. Encourage geospatial education at all levels

LiDAR data and technology is so new that it is not enough to just provide raw LiDAR data for download. The datasets are levels of magnitude larger than most spatial datasets and many users are unfamiliar with procedures and best practices for using the data. Many users have no experience with the native LiDAR data format (LAS). Information about applying LiDAR data to natural resource management was not widely available.

- Using a grant from the Environment and Natural Resources Trust Fund, training modules on the basics of LiDAR data and five natural resource management application areas were developed and delivered in 34 hands-on workshop sessions at eight locations across the state. Application areas addressed were terrain analysis, hydrology, engineering, forestry, and wetland mapping. 226 GIS professionals attended an average of two modules each.
- Webinars addressed applications in forestry and hydrology, as well as LiDAR for non-technical managers and staff. 437 individuals participated in the live webinars.
- The Conservation Applications of LiDAR [training webpage](#) maintains all of the training materials and webinar recordings openly available for self-paced learning. The training modules have been augmented with lecture videos as well as the original slides and GIS exercises.
- An [online LiDAR Forum](#) is actively answering questions regarding the data and its applications.
- Eleven presentations and one workshop were conducted at the 2013 GIS/LIS consortium annual conference and Spring Workshops; many posters at the annual conference referenced use of the LiDAR data.

Conclusion

The Minnesota Elevation Mapping Project is worthy of a Governor's Geospatial Commendation Award because it overwhelmingly met the award criteria. It has:

- Optimized resources by utilizing prior investments and aggregating multiple funding sources
- Made project products freely and publicly available thus ensuring extensive use
- Developed detailed acquisition and quality assurance specifications that were carefully adhered to, producing a consistent high quality product
- Identified community needs through two online public surveys ([data needs](#) and [education needs](#)) which informed project activities
- Promoted and provided training and educational opportunities, and
- Promoted the benefits of geospatial information by providing a number of different data products in multiple formats to make the data useful to policy makers and resource managers

Letters of Support (attached)

Letters written to support this nomination:

- Scott Anfinson, Office of the State Archaeologist
- Matthew Baltes, Natural Resources Conservation Service
- Patrick Belmont, Utah State University
- Les Everett, University of Minnesota – Twin Cities
- William Glesener, Minnesota Department of Natural Resources
- Elizabeth Hobbs, Minnesota Department of Transportation
- Dennis Honsa, Minnesota Society of Professional Surveyors
- George Host, University of Minnesota – Duluth
- Jared Hovi, Carlton County
- Suzanne Jiwani and Ceil Strauss, Minnesota Department of Natural Resources
- Alan Kean, Board of Water and Soil Resources
- Joseph Knight, University of Minnesota – Twin Cities
- Benjamin Lundeen, Minnesota Pollution Control Agency
- Rick Moore, Minnesota State University – Mankato
- Harvey Thorleifson, Minnesota Geological Survey

June 23, 2014

Commissioner Parnell
MN.IT Services
State of Minnesota
658 Cedar Street
St. Paul, MN 55155



Re: Governor's Geospatial Commendation Award - Statewide LiDAR acquisition and distribution project

Dear Commissioner Parnell:

In 2006, soon after I was appointed Minnesota State Archaeologist, I attended a conference on geospatial information and heard a presentation on LiDAR by Tim Loesch of MnDNR. I immediately thought what a wonderful tool this could be to help me map burial mounds. Minnesota Statutes 307.08 puts the State Archaeologist in charge of all unrecorded burial grounds in the state, which includes over 12,000 burial mounds. Most of these mounds were mapped in the late 1800s and most have not been visited by archaeologists in over 100 years. At the time of Tim's presentation, we had no idea how many of the mounds were even still present on the landscape.

Using early LiDAR data privately acquired by Crow Wing and Scott counties, we undertook a demonstration project in 2009 that clearly indicated the value of LiDAR for mapping burial mounds. There were problems with the data from both counties, however, and you needed a GIS specialist to access the data. I imagined a time when I personally could have direct access to accurate LiDAR data in Minnesota so I could assess burial mound potential at any location at any time of the year.

My dream recently became a reality when Legacy funds were used to acquire statewide LiDAR data and this data became readily accessible through the MnTOPO website. I use the MnTOPO website every day and it has become an invaluable tool for doing my job in an efficient and accurate manner. Just today, I looked at a location on Lake Mille Lacs where a possible burial mound disturbance may occur and also examined a location in Crow Wing County where a historic family burial plot was thought to be located on the edge of a field. In both cases, LiDAR analysis using the MnTOPO website helped me assess burial site potentials and indicated that I will need to field visit both locations.

I strongly recommend that a Governor's Geospatial Commendation Award be given to the statewide LiDAR acquisition and distribution project led by Tim Loesch and others.

Sincerely,

Scott Anfinson
State Archaeologist



Letter of Support for the Governor's Geospatial Commendation Award

June 24th, 2014

Commissioner Parnell
MN.IT Services
State of Minnesota
658 Cedar Street
St. Paul, MN 55155

Dear Commissioner Parnell,

I am writing this letter to show my support for the Minnesota Elevation Mapping Project and the extraordinary service it is providing to Minnesota as well as the Natural Resources Conservation Service (NRCS).

LiDAR data has become an integral part of the decision making process at NRCS in Minnesota. It has taken the place of the previous generation of elevation mapping, and is being used daily by our conservation planners to work with Minnesota land owners in implementing conservation practices. This entire project, along with the data delivery methods of FTP and MNTPOPO, has made this data set easily available to NRCS and other federal government agencies. The use of this data has allowed us to better understand the lands we protect, develop tools to streamline our decision making process, and enhance the quality of the products we deliver like SSURGO Soils and farm bill programs.

The Minnesota Elevation Mapping Project has successfully accomplished a daunting task of collecting, standardizing, organizing, producing and delivering LiDAR and LiDAR related products to suit the elevation needs of Minnesota users. I fully support the nomination of this project for the Governor's award.

Thank you for your time.

Sincerely,

Matthew J. Baltes
MN State GIS Coordinator
United States Department of Agriculture
Natural Resources Conservation Service



Patrick Belmont
Assistant Professor
Department of Watershed Sciences
Utah State University
Logan, Utah 84332
Phone (435) 881-7697

Commissioner Parnell
MN.IT Services
State of Minnesota
658 Cedar Street
St. Paul, MN 55155

Commissioner Parnell,

I am writing this letter to offer my full support for a Governor's Commendation Award to the Minnesota Elevation Mapping Project, coordinated by the State Digital Elevation Committee and led by the Minnesota Department of Natural Resources in collaboration with many other entities.

While I live in Utah and conduct research in many different parts of the country, I continue to work extensively in Minnesota, in part due to the extraordinary data resources that are available. I can say with confidence that the data and services provided by the Minnesota Elevation Mapping Project are exceptional and worthy of the highest recognition. Such high quality datasets, complemented by efficient tools for data distribution and analysis, have greatly enhanced our ability to understand topographic patterns and processes occurring throughout the state. This understanding has led to demonstrably improved decision-making at local and state levels. I suspect that the improved land and water management decision-making has already offset the cost of the lidar mapping project and will continue to pay dividends well into the future.

My research group has used the Minnesota lidar data extensively to identify significant sources and sinks for sediment, map features of interest that can be explored further from air photos or field work, measure and model landscape change over time, and communicate the beauty, novelty, and vulnerability of the Minnesota landscape to other scientists and the public. In addition, we have used the Minnesota lidar as a case study to develop innovative new tools for landscape analysis.

In a time when respect and appreciation for the hard work of state and federal employees is so lacking, those who have contributed to the Minnesota Elevation Mapping Project have gone well above and beyond expectations to provide an incredibly valuable resource. They should be commended for their exceptional contributions.

Please feel free to contact me (patrick.belmont@usu.edu) if you have additional questions.

Patrick Belmont

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June 10, 2014

Commissioner Parnell
MN.IT Services
State of Minnesota
658 Cedar Street
St. Paul, MN 55155

Subject: Support of Digital Elevation Project

The University of Minnesota's Water Resources Center strongly supports a Governor's Commendation Award to the Statewide Elevation Mapping Project. This project was a team effort of state and federal agencies and the University of Minnesota, coordinated through the State Digital Elevation Committee and led by staff of the MN Department of Natural Resources and the Minnesota Geospatial Information Office. This will prove to have been a landmark project both for current needs and as a benchmark for measuring future change.

The need for high resolution digital elevation data in Minnesota for research and management in many sectors, including natural resources, transportation, agriculture, urban planning and others, has been recognized for more than fifteen years. University of Minnesota research faculty had used LiDAR derived elevation data from small projects to test and develop applications in soil and water management, but they could not be applied in most of Minnesota because of limited LiDAR coverage. The advancement of water quality and quantity management projects depends on accurate water quality modeling and the ability to target management practices, both of which are greatly enhanced by high resolution digital elevation data.

The State Digital Elevation Committee and members had been coordinating development of standards for elevation data and had assisted local government entities and others in watershed and county data collects for more than a decade. They had also explored opportunities for statewide coverage. When the Legacy Amendment Clean Water Fund became available, members of the Committee presented to the Legislature the need for statewide LiDAR coverage to increase the effectiveness and efficiency of the water projects that would be carried out in the 25 year life of the Clean Water Fund. The Legislature recognized this need, and funded the completion of statewide data coverage over a four year period.

The Statewide Elevation Mapping Project has been completed on schedule and comprehensively. It required multiple collaborators for technical planning and implementation and multiple vendors for the data collect. The project included preparation of data collection specifications, ground survey validation, quality control of massive data sets, and development of data products, a distribution system, and an extensive training program for natural resource managers on use of the data. In

addition to the Clean Water Fund, contributions were obtained for elements of the project from the Environment and Natural Resources Trust Fund (training), USGS, local units of government, and others.

The data and data products are now being used at all levels of government, universities, and the private sector in applications and research including soil and water management (water quality and quantity modeling, sediment source determination, and targeting of practices), forestry, archeology, transportation, urban planning, energy, and many others. Many of the applications for Clean Water Fund projects now include use of LiDAR data for targeting of practices, as predicted in the original justification to the Legislature. The data, in addition to current uses, serve as a permanent and accurate benchmark for elevation of the land and the natural vegetation and man-made structures on it. This is proving very valuable in accurately measuring change brought as a result of floods, fires, construction and other natural events and human activities on the landscape.

The University of Minnesota Water Resources Center is pleased to have been part of this landmark project.

Sincerely,

A handwritten signature in black ink, appearing to read "Leslie A. Everett". The signature is fluid and cursive, with a large initial "L" and "E".

Leslie A. Everett
Agronomist and Program Coordinator

Minnesota Department of Natural Resources

Northwest Region Forestry, Firewise Program
2115 Birchmont Beach Road NE
Bemidji, MN 56601
(218)308-2364



Letter of Support for the Governor's Geospatial Commendation Award

June 26, 2014

Commissioner Parnell
MN.IT Services
State of Minnesota
658 Cedar Street
St. Paul, MN 55155

Dear Commissioner Parnell,

I am writing this letter to show my support for the Minnesota Elevation Mapping Project and the exemplary service it is providing to Minnesota's residents through the use of LiDAR data to improve processes that are cost effective and efficient.

The Minnesota Firewise Program has a risk rating system for residential structures to identify areas that are at a higher risk for loss during a wildland fire incident. Manually rating structures through the use of aerial photo interpretation was the initial method that was used in the system. After the Minnesota Elevation Mapping Project was able to provide LiDAR data for entire counties in the state, I worked with MN.IT services to institute a process by which manual interpretation of risk was automated using LiDAR data.

Costs associated with manual interpretation were 25 times greater than the cost of processing the LiDAR data to achieve the same result. The savings will allow our budgets to be extended to other projects and planning efforts that help to mitigate the hazard of wildfires to homeowners.

I fully support the nomination of this project for the Governor's award.

Sincerely,

A handwritten signature in blue ink that reads "William J. Glesener, II".

William J. Glesener, II
Northwest Region Firewise Communities Specialist
Minnesota Department of Natural Resources, Forestry Division



Minnesota Department of Transportation

395 John Ireland Boulevard MS 620
Saint Paul, MN 55155

June 18, 2014

Commissioner Parnell
MN.IT Services
State of Minnesota
658 Cedar Street
St. Paul, MN 55155

RE: Governor's Geospatial Commendation for the LiDAR Project

Dear Commissioner Parnell:

I am writing this letter to support the nomination of the Minnesota Elevation Data Project, coordinated by the Minnesota Digital Elevation Committee and managed by the Department of Natural Resources, for a Governor's Geospatial Commendation.

The high resolution elevation data produced by this project has many, many benefits. Among these, it is providing a high quality base for Phase 4 of MnModel, Minnesota's statewide archaeological predictive model. Terrain variables (slope, aspect, height above surroundings) are significant predictors of the locations of archaeological sites. With this higher resolution elevation data, we expect to produce more refined and better articulated models than were possible in the past. The LiDAR data have also been used for our MnModel geomorphic mapping projects, allowing for the detection of landforms and interpretation of geomorphic processes that were not previously visible from available data.

Having a statewide, high resolution elevation data of consistent quality will be of great benefit to MnModel and many other projects in Minnesota. I applaud this effort and encourage you to consider this project favorably for the Governor's Geospatial Commendation.

Sincerely,

Elizabeth Hobbs, Ph.D.
State Program Administrator Coordinator, Cultural Resources
Office of Environmental Stewardship

An Equal Opportunity Employer



June 26, 2014

Commissioner Parnell
MN.IT Services
State of Minnesota
658 Cedar Street
St. Paul, MN 55155

Subject: Support of the Digital Elevation Project

Commissioner Parnell,

I am writing this letter on behalf of the Minnesota Society of Professional Surveyors who strongly supports the nomination for a Governor's Commendation Award to the Statewide Elevation Mapping Project team. This team made strong efforts to include a variety of interests and backgrounds ranging from all levels of government, academia and the private sector. This project was needed many years ago but lacked a number of vital components such as funding, technology and leadership.

The basis of this high resolution data set is a technology called Light Detection And Ranging or LiDAR and is a measuring tool that is familiar to the majority of our members. It is satisfying to see that a positive and valued project can be appreciated by the general public. The acceptance of this data and its use in the decision making process will have an enormous impact on this state. As a dataset, elevation data has one of the highest cost benefit ratios you will find and therefore its impact cannot be overstated.

The Minnesota Society of Professional Surveyors is pleased to have many of its members connected to such an important project. Please give serious consideration for a Governor's Commendation Award for this project.

Sincerely,



Dennis Honsa, LS
President MSPS 2014

June 30, 2014

Minnesota Geospatial Information Office
658 Cedar Street, Room 300
St. Paul, MN 55155

Subject: Support of Digital Elevation Project

I would like to express my support for a Governor's Commendation Award to the Elevation Mapping Project recently completed through initiatives of the MN Department of Natural Resources and many collaborating state, federal, university and other land management agencies.

Within weeks of its release, the 2011 LiDAR data was being used for creating more accurate watershed maps, identifying hot spots of erosion on streams of Lake Superior's North Shore, and developing more accurate maps of land covers related to stormwater management, such as impervious surfaces.

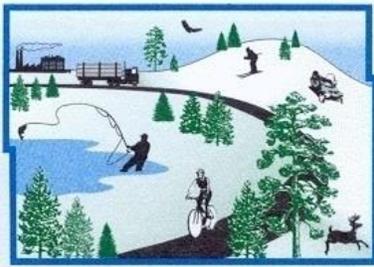
The new availability of post-flood imagery from Duluth will help assess damages and guide possible remediation techniques. At UMD's Natural Resources Research Institute, we have three projects in the Geographic Information System lab working directly with this data, and are incorporating it into future proposals.

We appreciate the leadership of the Digital Elevation Committee and I strongly encourage a Governor's Commendation for this project. It will prove invaluable for understanding and making wise decisions on Minnesota's natural resources.

Sincerely,



George Host
Senior Research Associate
Director NRRI GIS Laboratory



Carlton County

INFORMATION TECHNOLOGY

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PETER J. GOULD • IT DIRECTOR

218.384.9137

June 27, 2014

Commissioner Parnell
MN.IT Services
State of Minnesota
658 Cedar Street
St. Paul, MN 55155

Subject: Support of Digital Elevation Project

I would like to voice my support for a Governor's Commendation Award to the Digital Elevation Project.

At Carlton County several departments use LiDAR data on a daily basis to improve their workflow and obtain a higher degree of accuracy within their work. Users have repeatedly praised the usefulness of the data and have found it be part of their daily work while improving communications with the public. While it would be wonderful to list every department that uses LiDAR and all that they've accomplished with it, a couple stand out the most.

The Zoning Department has found the highly accurate data allows them to visualize slopes and bluffs in the office before visiting the site, giving them a feel for the land before setting foot on it. It has created better communications with the public to be able to provide a visual aid to them. Site planners can see how the land lays and better understand zoning setback regulations. Staff has also found the data useful in implementing the Wetlands Conservation Act.

The Land Department uses the data daily in managing county lands. Whether it's for delineating management areas to protect water quality and riparian areas or utilizing the information when constructing management access roads and temporary access trails it's a powerful aid. In the southeastern portion of the county where there are large amounts of topography, the LiDAR data has been noted to cut back staff time by 15 percent.

As noted by several departments it adds a third dimension to project plans and assists in emphasizes the need to protect resources. Reports to the County Board, various Departments of the State, and subdivisions of the US Federal Government have been submitted with LiDAR information to have a visual impact.

Carlton County greatly appreciates the data that has been generated and provided publicly. As the GIS Specialist, the LiDAR data has been one of the most valuable datasets to my line of work, the work of county employees, and the public. A Governor's Commendations for the project is greatly encouraged.

Sincerely,

Jared Hovi
GIS Specialist
Carlton County, MN

Minnesota Department of Natural Resources

Division of Ecological and Water Resources
Box 25, 500 Lafayette Road • St. Paul, MN • 55155-4025



June 23, 2014

Minnesota Geospatial Information Office
658 Cedar Street, Room 300
St. Paul, MN 55155

Subject: Kudos for Minnesota Digital Elevation Project

We would like to express our support for a Governor's Commendation Award to the Minnesota Digital Elevation Mapping Project completed last year. This project collected and processed data so that Minnesota has digital elevation and two foot contour data throughout the state.

The Minnesota Department of Natural Resources collaborated with many state and federal agencies in developing the specifications for this data. Because the specifications meet federal standards, the contour data can be certified as an acceptable topographic resource for FEMA's Letter of Map Amendments (LOMA). Property owners need a LOMA to waive a mandatory flood insurance requirement for federally-backed mortgages of structures mapped in the floodplain. To waive the insurance requirement, the property owner needs to prove the elevation of the structure is above the flood elevation. Usually, this requires a land survey, but FEMA accepts maps based on Minnesota's contour data if the map is created by the county/city, a registered land surveyor, or registered engineer.

Sometimes the local government prepares the map for free or a nominal charge. Sometimes registered land surveyors prepare the map, but the charge is about half the cost of a land survey. FEMA has not approved this method in other states because their digital elevation data wasn't processed in a certifiable manner.

Since 2013 nearly a hundred Minnesotans have used this method to get LOMAs. We feel the number will increase as more local government staff, surveyors, and property owners learn about the data. Recent changes in flood insurance rates will also increase the number of property owners wanting LOMAs and therefore using this procedure.

We also appreciate the MnTOPO website, where the contour and floodplain data are available on Personal Digital Assistants (PDA) devices. We have demonstrated this website to many local government staff. This is becoming a go-to site for local officials, surveyors and engineers to quickly identify potential flood risks among other uses.

We want to thank all of the people who have worked hard to make Minnesota's Digital Elevation Mapping Project a success. Their foresight developed products that are very useful to us and Minnesota citizens. We benefit by being able to develop applications that help Minnesotans make better decisions in a cost-effective manner.

A handwritten signature in blue ink, appearing to read "Suzanne Jiwani".

Suzanne Jiwani
Floodplain Mapping Engineer

A handwritten signature in blue ink, appearing to read "Ceil Strauss".

Ceil Strauss
MN National Flood Insurance Program Coordinator





June 27, 2014

Nancy Rader
GIS Data Coordinator
MnGeo
658 Cedar St., Room 300
St. Paul, MN 55155

Re: Support for Nomination of Statewide LiDAR Acquisition and Distribution Project for Governor's Geospatial Commendation Award

Nancy,

I'm writing in support of the nomination of the statewide LiDAR Acquisition and Distribution Project for the Governor's Geospatial Commendation Award. As you may know, BWSR administers the Reinvest in Minnesota (RIM) conservation easement program and associated partnerships, which involve many wetland restorations for conservation each year. BWSR also administers the Local Road Wetland Replacement Program and has a partnership with MnDOT, which also involves several wetland restorations per year for mitigation bank credits for state and local road authorities. Ten of my current staff are engineers and technicians who use topographic information for wetland restoration projects. The LiDAR project has been a huge asset, particularly for feasibility and concept planning, substantially reducing the amount of surveying that we need to do for these engineering investigation and design functions.

My staff has worked with Tim Loesch and others involved in the LiDAR Acquisition and Distribution Project, as state agency users of topographic data, to help with preliminary testing of MNTPO and earlier data distribution methods. MNTPO is the way that my staff now access LiDAR topographic data for RIM and wetland banking projects. Statewide LiDAR topography is a great asset for the substantial wetland restoration work done by BWSR and program partners.

I'm also aware that Soil and Water Conservation Districts (SWCDs) are users of LiDAR topography, particularly the shared engineers and technicians that serve joint powers groups of SWCDs through the Nonpoint Engineering Assistance Program administered by BWSR. LiDAR topography is used by SWCD staff for a wide variety of conservation practices statewide.

Having served on the State Digital Elevation Committee during the development and implementation of the LiDAR Acquisition and Distribution Project, I am very gratified that this project has been extremely successful at providing a powerful and efficient statewide digital elevation data set for use by both public and private entities for conservation in Minnesota! The subject project involved a collaboration of proponents, and very effective partnerships to achieve a great outcome for Minnesota that will continue to pay dividends for some time!

Sincerely,

Al Kean, PE
Chief Engineer
Minnesota Board of Water and Soil Resources

<i>Bemidji</i>	<i>Brainerd</i>	<i>Duluth</i>	<i>Fergus Falls</i>	<i>Mankato</i>	<i>Marshall</i>	<i>New Ulm</i>	<i>Rochester</i>
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29 July 2014

Commissioner Parnell
MN.IT Services
State of Minnesota
658 Cedar Street
St. Paul, MN 55155

Commissioner Parnell:

I write to express my enthusiastic support for the nomination of the Minnesota Elevation Mapping Project for a 2014 Governor's Commendation Award. I represent the University of Minnesota's Remote Sensing and Geospatial Analysis Laboratory (RSGAL). Our primary mission is to conduct cutting-edge research in geospatial science and technology, though we also engage in outreach and extension efforts to Minnesota stakeholders and occasionally perform contract work for state and federal agencies. It is difficult to overstate the importance of the Minnesota Elevation Mapping Project's statewide lidar product in our work.

In a project funded by the Metropolitan Council, we recently produced the latest in our series of detailed land cover map for the Twin Cities Metro Area. Such maps are used to assist with various infrastructure and natural resources management and policy decisions. For the first time in these efforts, we included lidar data in our workflow. This addition resulted in a TCMA map that has unprecedented accuracy – far greater than previous efforts. Surface information provided by the lidar data allowed us to discriminate between land cover types that often look similar from a satellite's perspective, and so are difficult to distinguish using imagery alone. These included shrubs vs. trees, asphalt roads vs. dark rooftops, and certain crop species such as corn vs. soybeans. Lidar was essential to creating such a high quality product. The Metropolitan Council and our other stakeholders are very pleased with this result.

The Minnesota Elevation Mapping Project is a wonderful example of a broad partnership of statewide governmental and non-governmental groups coming together to accomplish a goal that could not have been achieved by any one of them alone, and that has resulted in a truly significant benefit to the a wide range of Minnesota stakeholders. The project is a model for future efforts, and is highly deserving of a Governor's Commendation Award. Please do not hesitate to contact me if I can be of further assistance in this matter.

Sincerely,



Joseph F. Knight
Associate Professor



Minnesota Pollution Control Agency

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800-657-3864 | 651-282-5332 TTY | www.pca.state.mn.us | Equal Opportunity Employer

June 30th, 2014

Commissioner Parnell
MN.IT Services
State of Minnesota
658 Cedar Street
St. Paul, MN 55155

Re: Governor's Geospatial Commendation Award – Statewide LiDAR acquisition and distribution project

Dear Commissioner Parnell,

I am writing this letter to show my support for the Minnesota Elevation Mapping Project and the great service it is providing to Minnesota, as well as the Minnesota Pollution Control Agency's Altered Watercourse project.

LiDAR-derived hillshade layers provided an invaluable resource during the altered watercourse project method development and statewide analysis. The project completion schedule was aligned with the release of the LiDAR-derived data, as they provided an accurate "bare-earth" depiction of the landscapes throughout Minnesota. Many of the streams in Minnesota have heavy canopy cover and satellite imagery (even those taken in the fall following leaf abscission) often did not provide enough evidence to make a determination on whether or not a stream had been altered. In many cases LiDAR-derived hillshade layer provided indisputable evidence as to whether a stream had been channelized. The state's first attempt at categorizing altered stream channels would not be as accurate as it is today without the data generated by the LiDAR acquisition project.

I strongly recommend that a Governor's Geospatial Commendation Award be given to the statewide LiDAR acquisition and distribution project.

Thank you for your time and consideration of this nomination.

Sincerely,

A handwritten signature in black ink, appearing to read "Benjamin J. Lundeen".

Benjamin J. Lundeen
Research Scientist II | North Biological Monitoring Unit
Environmental Analysis and Outcomes
Minnesota Pollution Control Agency
Brainerd, MN 56401



June 26, 2014

Commissioner Parnell
MN.IT Services
State of Minnesota
658 Cedar Street
St. Paul, MN 55155

RE: Support of Digital Elevation Project

Dear Commissioner Parnell:

The Minnesota State University Mankato's Water Resources Center strongly supports a Governor's Commendation Award to the Statewide Elevation Mapping Project. This project was recently completed through initiatives of the MN Department of Natural Resources and many collaborating state, federal, university and other land management agencies.

The Statewide Elevation Mapping Project has been instrumental in many projects that the Water Resources Center has been involved over the last few years. It has allowed us to target conservation practices on the landscape as well as work with landowners who are interested in their ravines. We recently held a Ravine Workshop and utilized the MNTPOPO mapping site as a reference in discussing ravine issues. The availability of the aerial imagery as well as the hillshade of the LiDAR data was instrumental in visualizing the locations of ravines around the landowner's property. We could turn on the different contour layers and visually see the flow of water across the landscape and see where the water is concentrating or where steep slopes may cause erosion. This site has a plethora of data available to the public as well as GIS users, which we use on a regular basis.

The data coming directly from the Elevation Mapping Project has been instrumental in over four of our projects that we have worked on at the Water Resources Center. We are currently using the data from the project to complete Terrain Analysis in the Lac qui Parle Yellow Bank Watershed District as well as the Yellow Medicine Watershed District. Through the MNTPOPO site, we can seamlessly download data for a large area without downloading multiple counties and then mosaicking them together. The data is ready to use from the site once downloaded. This has sped up the process and removed a lengthy task from our workflow.

As the GIS Watershed Research Scientist at the Water Resources Center, I fully support the Elevation Mapping Project and the continued collaborations to make Minnesota the leader in elevation data as well as the ability to make that data available to the practitioners as well as the citizens of Minnesota.

Sincerely,

A handwritten signature in black ink that reads "Rick Moore".

Rick Moore. GIS Watershed Research Scientist, Water Resources Center, MSU - Mankato

WATER RESOURCES CENTER
184 TRAFTON SCIENCE CENTER S · MANKATO, MN 56001
PHONE 507-389-5492 · FAX 507-389-5493

An affirmative action/equal opportunity university.

16 June 2014

Commissioner Parnell, MN.IT Services,
State of Minnesota, 658 Cedar Street
St. Paul, MN 55155

Dear Commissioner Parnell:

As Minnesota State Geologist, and as a longstanding supporter of statewide LiDAR data acquisition, it gives me great pleasure to provide my strong endorsement for the Minnesota Elevation Mapping Project to receive the Governor's Geospatial Commendation Award.

Since 1872, we have been responsible for ensuring availability of the regional geological information that the people of the State need to ensure wise stewardship of their water, land, and mineral resources, and to realize benefits related to economic prosperity, public health, natural hazards, as well as preservation of our natural heritage. The Minnesota Elevation Mapping Project has enabled us to be much more efficient and effective in our roles.

One of our roles is to map the properties and origin of soil parent materials, primarily to support drinking water management. LiDAR data is now giving us enormously powerful insights into of what lies below the soils, thus significantly improving our work in this field.

Similarly, LiDAR data has proven to be extremely useful for locating sinkholes and springs, and for updating coordinates for previously located karst features. The ability to "see" features through vegetative cover has not only greatly increased the number of mapped features, but is resulting in a more accurate spatial distribution of sinkhole and spring occurrence. LiDAR data has also proven extremely useful for establishing elevations of hydrologic features, and by extension hydraulic head with accuracy not previously available without survey equipment.

LiDAR also is giving us powerful insights into underlying rocks. In areas of limited exposure, we are now empowered with greatly improved information that indicates whether we need to trek through swamp, to see the rocks! Where rocks are better exposed, we can see their structure, thus providing powerful insights into their composition, properties, and extension into the subsurface. For some regions, LiDAR is as important as any comparable survey in history, allowing geologic interpretations that are much more detailed, accurate, and reliable.

It therefore will please me tremendously if the Minnesota Elevation Mapping Project receives the Governor's Geospatial Commendation Award.

Sincerely,



Harvey Thorleifson Ph.D., P.Geo., D.Sc., Director, Minnesota Geological Survey, State Geologist of Minnesota, Professor, Department of Earth Sciences, University of Minnesota