PROPOSAL

USGS Broad Agency Announcement for 3D Elevation Program

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Southeastern Wisconsin 2015 Regional Lidar and Elevation Data Project

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Executive Summary:

The team of SEWRPC and Quantum Spatial will partner with five counties to acquire lidar and elevation data for an area of 2,087 square miles covering the most urbanized region of Wisconsin. SEWRPC will provide administrative and liaison services for the project, while Quantum Spatial, an experienced Geospatial Products and Services Contract provider, will serve as the professional contractor in the collection and preparation of lidar and derived elevation data sets. The project will result in the preparation of all deliverable products as specified by the USGS *Lidar Base Specification Version 1.0* with incorporation of the changes in *Specification Version 1.1,* and to the current definition of USGS Quality Level 2 (QL2). Total cost for this project—at $335 per square mile—is $699,145. The five participating counties propose to provide a seventy-five percent (75%) cost-share—approximately $524,359—towards completion of this project. The Southeastern Wisconsin 2015 Regional Lidar and Elevation Data Project is scheduled to begin in January 2015, with all deliverable products to be completed by December 31, 2015.

1. Technical Proposal

The Southeastern Wisconsin Regional Planning Commission (SEWRPC) and Quantum Spatial, Inc. (QSI) propose to conduct a major lidar collection and elevation data preparation project in Southeastern Wisconsin.

Project Overview

The Southeastern Wisconsin 2015 Regional Lidar and Elevation Data Project will cover the five counties of Milwaukee, Ozaukee, Walworth, Washington, and Waukesha in the most populous and urbanized region of Wisconsin. Lidar data collection and preparation will be performed for a total area of approximately 2,087 square miles, including the 100-meter buffer surrounding the main project area (shown on Exhibit A and included in shapefile named *"SE_WI_2015_Lidar_Project_Area"*). The project is proposed to be completed under a Geospatial Products and Services Contract (GPSC) arrangement between QSI, an experienced GPSC contractor, and USGS staff. The project will result in the acquisition of lidar data meeting the USGS requirements for Quality Level 2 (QL2) elevation data. Flight acquisition of lidar data covering the project area will be conducted by QSI during the spring of 2015, with delivery of final products scheduled by December 2015. The deliverable products will include raw and classified lidar point cloud data sets, bare-earth surface or raster DEM data sets, hydro-flattening breaklines, and various supporting metadata documentation.

The team of SEWRPC and QSI will collaborate with the appointed Land Information Officers in each of the five counties to facilitate this project. SEWRPC is the Federally-recognized Metropolitan Planning Organization for the Southeastern Wisconsin Region, and has assisted its counties and local governments in the collection and preparation of conventional topographic mapping for over 50 years, and digital elevation mapping for more than 25 years. The SEWRPC staff will serve as liaison to the USGS staff and the County Land Information Officers. QSI (formerly AeroMetric, Inc.) is a leading geospatial products and services provider with a long history of successful completion of projects both in Southeastern Wisconsin and nationally. The firm has successfully completed a number of lidar-related projects under the GPSC program with the Federal government. The QSI staff will provide technical expertise in lidar

data collection and derived elevation data processing for this project. QSI will collect and process lidar data sets, prepare bare-earth DEMs and derived breaklines, perform quality control procedures on the deliverable digital products, and develop the required metadata.

Project Benefits

The lidar and derived elevation data acquired as a result of this project will benefit the five counties and 120 municipalities in the project area in a number of ways:

- Milwaukee County will utilize lidar and coincident 3-inch resolution orthophotography collected in 2015 to update planimetric mapping throughout the County. Lidar will be used to validate structure locations and configurations through a comparison of lidar-derived DEM and DSM. A previous structure inventory using DSM and orthophotography identified over 440,000 buildings. The new inventory will update structure features and quantify change over a five-year interval.
- A second mapping project in Milwaukee County will use the 2015 lidar in conjunction with 3-inch resolution orthophotography to detect impervious surfaces. The work effort will update a prior inventory that discovered approximately 93 square miles or about 38 percent of the County containing impervious surfaces. The 2015 lidar and elevation data will be used to identify impervious features such as structures, paved roads, sidewalks, and parking areas in the County. The updated inventory of these features will aid in floodplain modeling and mapping.
- SEWRPC will utilize the new lidar and derived elevation products to assist in a potential Coastal Bluff Recession analysis in Southeastern Wisconsin. The project would use the lidar data to locate the top of the Lake Michigan bluff in Kenosha, Milwaukee, Ozaukee, and Racine Counties in order to compare the present bluff location to historical bluff lines. The rate of recession of the bluff would be calculated and used to prepare criteria to establish proposed setbacks for development in the vicinity of the bluff.
- Waukesha County foresees application of the new lidar data for stormwater management. The County is charged with enforcing stormwater runoff regulations that are designed to enhance

water quality and minimize flooding. Much of Waukesha County has limited topographic relief, so that slight changes in slope may affect stormwater runoff. The more-precise lidar dataset will allow better watershed modeling and identification, resulting in improved stormwater management system design.

- The lidar and elevation data acquired for this project will be used by all five participating counties to update existing topographic base mapping. The counties intend to acquire one-foot contour interval topographic mapping derived from the lidar to update digital base maps and county websites. The lidar, DEM, and contour files will be distributed by the counties to requesting individuals and agencies for use in engineering, environmental, and planning projects throughout the Region. Milwaukee County, for example, provides digital topographic base mapping for approximately 200 site-specific requests annually.
- SEWRPC will use the 2015 lidar and elevation data in water resources planning activities, including floodplain mapping, watershed delineations, and evaluation of sources of stormwater runoff pollution and measures to abate such pollution. One example is the proposed Oak Creek Watershed Restoration Plan, which will utilize elevation data and topographic mapping in the analysis and plan recommendations for this important watershed covering approximately 12 percent of Milwaukee County.
- Washington County will use the new lidar and elevation data as part of their application for a Municipal Separate Storm Sewer System (MS4) permit from the Wisconsin Department of Natural Resources. One of the requirements for this permit is an accurate storm system map, including features such as open swales, culvert locations, and drainage ways. The 2015 lidar and elevation data will help the County and several cooperating municipalities model drainage patterns and prepare required materials in support of their MS4 permit applications.

2. Project Deliverables

The project will result in the collection and preparation of all deliverable products with acceptance criteria as specified in the USGS *Lidar Base Specification Version 1.0* with incorporation of the changes in *Specification Version 1.1*. The products to be delivered include four digital data sets: 1) raw point cloud; 2) classified point cloud; 3) bare-earth surface [raster DEM]; and 4) hydro-flattening breaklines. Complete metadata and reports will also be delivered. The lidar data and derived products will meet the current definition of Quality Level 2 (QL2) as specified by the USGS.

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3. Past Performance Information

Project contractor Quantum Spatial (formerly AeroMetric, Inc.) is a USGS GPSC partner and is documented in the Federal *Contractor Performance Assessment Rating System* (CPARS).

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4. Contractor Qualifications

Quantum Spatial, the preferred contractor for this project, has performed numerous lidar and elevation data projects in the U.S. and North America. QSI (formerly AeroMetric, Inc.) is an experienced GPSC contractor and has provided professional lidar preparation, photogrammetric mapping, and GIS services to the USGS since 1999.

Airborne Lidar Acquisition

QSI owns and operates a total of 17 high performance modern lidar sensors manufactured by industry leaders such as Leica, Optec, and Reigl. The firm's combined collection assets include a total of 24 aircraft configured with GPS, dual frequency GNSS antennas, and inertial measurement unit (IMU) configurations. To ensure accurate determination of all positional and alignment parameters of sensors in the aircraft, QSI performs lidar boresighting and system testing to validate the calibration of equipment prior to lidar procurement. Acquisition quality control is achieved through detailed flight reporting that includes aircraft and sensor utilized, atmospheric and ground conditions, and sensor parameters.

Additionally, flight crews undertake a quality control review of the collected data prior to leaving the field. This ensures that the project area is sufficiently covered and that there are no data voids due to gaps between flight lines or system malfunctions.

Lidar Processing

Lidar datasets collected by QSI are provided to an accomplished and experienced processing team with over a decade of technical expertise in lidar data handling, with many team members having significant experience with USGS product deliverables. Quantum Spatial follows a number of post-processing workflow procedures that result in data products of superior quality. Post-processing is centered on the point cloud—point data go through multiple inspections throughout the workflow to ensure that the most representative models of the project area terrain and aboveground features are ultimately delivered.

The general workflow includes accurate calculations of laser point position using precise survey control and airborne GPS / IMU data, relative accuracy testing and tight line-to-line calibration, a combination of rigorous automated and manual point filtering procedures, and classification of the point cloud using in-house proprietary processing algorithms tailored for the particular study area or landscape.

Quantum Spatial's lidar production environment is built upon Terrasolid, GeoCue, and MicroStation software platforms, as well as proprietary tools developed for specific workflow steps. Cleanup functionality includes a full LAS validation suite for finding problem files, intensity normalization workflows for resolving intensity differences between flight lines, and complex duplicate point removal techniques to correct common processing and re-tiling blunders. One proprietary software tool is "FOCUS" (Final Observed and Calculated User Statistics) which provides a comprehensive collection of software tools used during all phases of the lidar post-processing and final validation prior to the shipment of data to USGS. Another tool is "LAS Monkey" to address an industry need for a user-friendly, expedient way to convert and clean non-conforming LAS files from any software package into standard LAS-compliant files in whatever format is required for the final delivered data package. Both FOCUS and LAS Monkey have become instrumental in ensuring products prepared by Quantum staff

meet USGS *Lidar Base Specification Version 1.0* with incorporation of the changes in *Specification Version 1.1* for product delivery.

5. Principal Staff Qualifications

Project contractor Quantum Spatial will assign the following principal staff to this lidar project. Mr. Jeff Stroub will serve as the Technical Project Manager and primary contact person for technical issues during the course of this project.

Staff Member	Title	Registration	Years of Experience
Jeff Stroub	Project Manager	ASPRS Certified Photogrammetrist, Professional Land Surveyor, Professional Photogrammetry Surveyor	40
Jon Wittman	Flight Department Manager	Airline Transport Pilot, Commercial Pilot	21
Paul Bishop	Project Manager	Advanced training in TerraScan, TerraModeler, and GeoCue software, Intergraph GeoMedia	21
Sonia Ellefson	QA / QC Manager	ASPRS Certified Photogrammetrist	10

6. Data Acquisition Specifications

The Southeastern Wisconsin 2015 Regional Lidar and Elevation Data Project, under the technical guidance of QSI and with the administrative assistance of SEWRPC, will result in the preparation of deliverable products that meet or exceed all minimum specifications as outlined in the USGS *Lidar Base Specification Version 1.0* with incorporation of the changes in *Specification Version 1.1*, and deliverable products that meet the current definition of Quality Level 2 (QL2) as specified by the USGS.

7. Unrestricted Data

The deliverable products for the Southeastern Wisconsin 2015 Regional Lidar and Elevation Data Project will be provided to the USGS without any restrictions whatsoever on use of the data.

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8. Detailed Project Costs and Cost-Sharing Contribution

The cost for this project, consisting of lidar data collection, lidar processing, preparation of bare-earth raster DEMs, hydro-flattening breaklines, and metadata for five counties, is $335 per square mile. The total cost for the 2,087 square-mile project area is $699,145. The five participating counties propose to pay a seventy-five percent (75%) cost-share—approximately $524,359—towards completion of this project.

The project cost estimates assume administration of this project by USGS staff under a Geospatial Product and Services Contract (GPSC) arrangement with project contractor Quantum Spatial. Itemized project costs are as follows:

Task	Cost per square mile	Total Cost
Lidar acquisition and elevation data preparation	$277	$578,099
Quality Assurance / Quality Control	$42	$87,654
USGS Administration	$16	$33,392
Totals	$335	$699,145

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9. Data Acquisition Approach

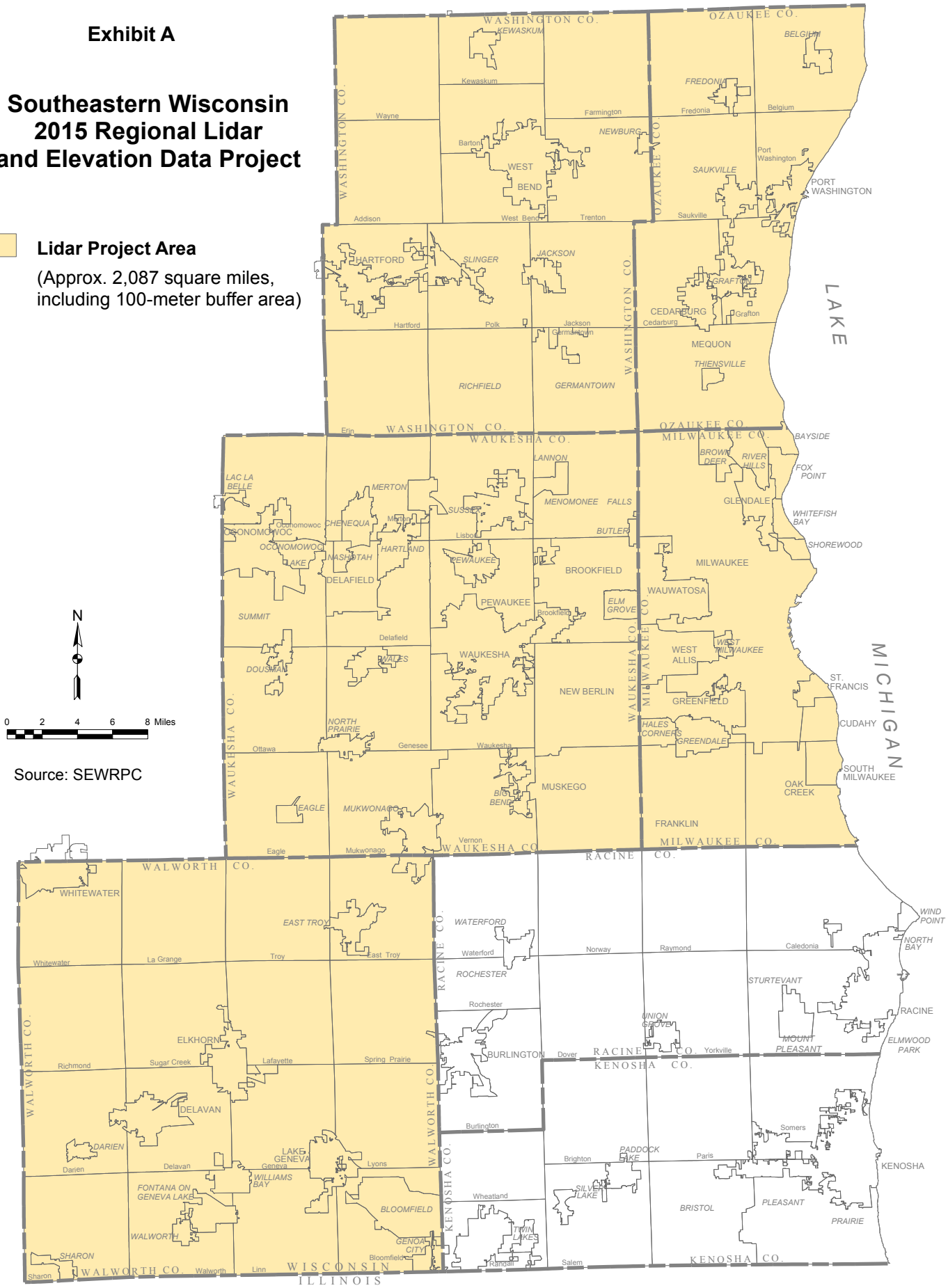
The project team of SEWRPC and QSI will utilize the Geospatial Products and Services Contract (GPSC) arrangement with USGS for acquisition and preparation of the data. QSI is the preferred contractor for data acquisition and is familiar with the project area and participants. SEWRPC will serve as liaison for the counties and USGS staff.

Exhibit A

Southeastern Wisconsin 2015 Regional Lidar and Elevation Data Project

Lidar Project Area

(Approx. 2,087 square miles, including 100-meter buffer area)



Source: SEWRPC

Map Document: (O:\Orthophoto_Statusmaps\2015OrthophotoStatusMaps\2015LIDAR_ElevationProjectArea.mxd)
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