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March 6, 2014

CLIENT CONTACT: Mr. Matt Edmonson
UIUC Facilities & Services, Planning Division
Physical Plant Service Building
1501 S Oak Street
Champaign, IL 61820

RE: PSSU14R19 Photogrammetry and LiDAR Services – Retainer Agreement 2014-0446

Quantum Spatial Preliminary Project Number _____ Processing of Airborne LiDAR Data for Madison County in Illinois

Dear Mr. Edmonson:

The following responds to the request for Retainer Services from Quantum Spatial, Inc. for the Illinois Height Modernization Program (ILHMP), which is managed by the Illinois State Geological Survey (ISGS). The Photogrammetry service activities response has been broken down into two separate project proposals. This submittal is for;

2) Madison Data Processing: for all data processing to create contract deliverables including las classification, generation of data derivative products, creation of metadata and reports, and final delivery of all data.

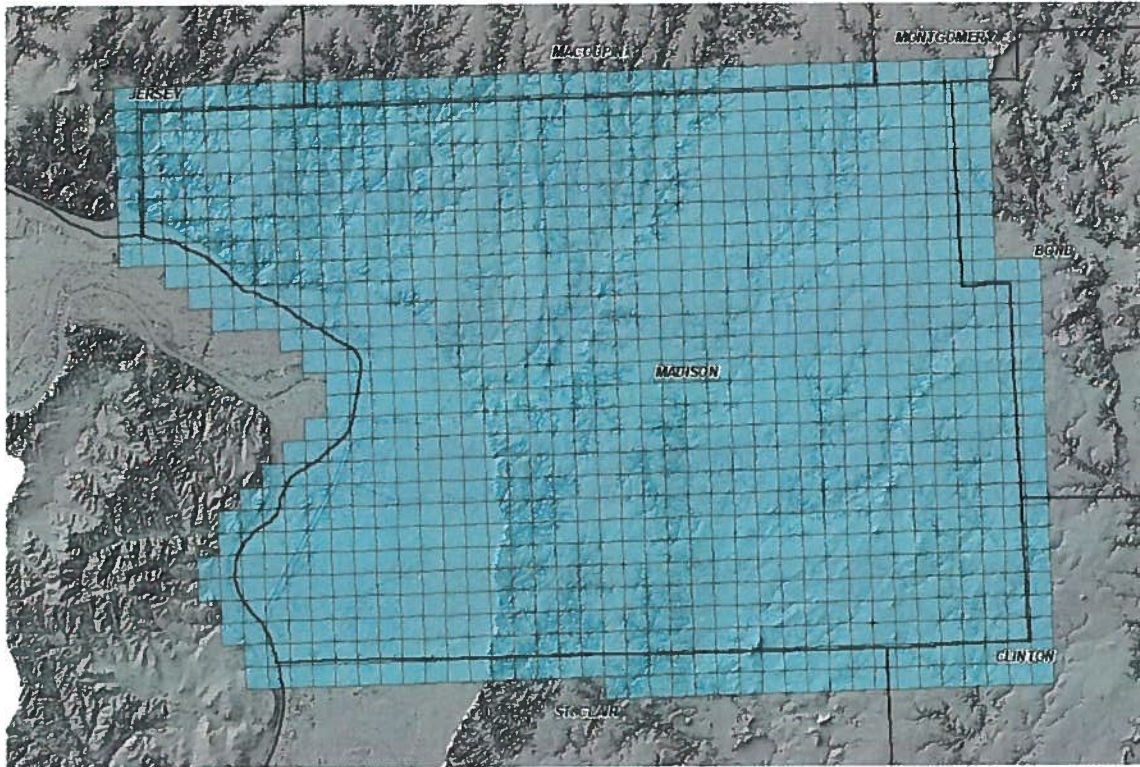
This proposal includes a detailed scope of work for the services required for acquisition, timeline for acquisition project completion, proposed staff breakdown, and proposed service fee with detailed pricing justification.

STATEMENT OF WORK:

Project Area Description

LiDAR data will be processed for Madison County in Illinois. Approximately 966 square miles of LiDAR will be processed; this total includes a 1 tile buffer around the project area. Project data will be collected at a nominal pulse spacing (NPS) of 0.70 meters, or 2 point per square meter. The data will be accurate to 9.25 RMSEz and meet USGS QL2.

*Process
173.14*



The approximate project boundary was defined by the GIS data layer provided by Janet Holden of ISGS. The intention for this project is to extend beyond the county boundary by a single index tile. The project has been designed to acquire LiDAR coverage to provide complete tile coverage of the 966 square mile AOI.

Quantum Spatial will perform all tasks related to the processing of Airborne Light Detection and Ranging (LiDAR) data for a project area encompassing approximately 966 square miles of Madison County in Illinois. The task list includes, but will not be limited to: complete LiDAR data point cloud classification and data processing to generate hydro-flattened digital elevation models, perform data QA/QC, and compile related metadata, FOCUS report, and GIS tile index data.

Processing of LiDAR data deliverables will be in conformance with the project scope of work defined by ISGS for Madison County. The ISGS requested data and derivative data deliverables will be compliant with U.S. Geological Survey National Geospatial Program LiDAR Base Specification, Version 1.0. Data deliverables will be in conformance with recent IDOT data deliveries in las, dgn, dat, and tin formats from previous Quantum Spatial contracts for airborne LiDAR for IDOT District 4 and IDOT District 5. Data will meet USGS QL 2.

LiDAR PROCESSING SCOPE OF WORK:

The LiDAR data will be processed following the steps outlined in our original Statement of Qualifications. All processing will be compliant with U.S. Geological Survey National Geospatial Program LiDAR Base Specification, Version 1.0 (see <http://pubs.er.usgs.gov/publication/tm11B3>). LiDAR data will be processed once data has been verified after data collection.

Data Classification

The LiDAR filtering process encompasses a series of automated and manual steps to classify the point cloud data set. Our team works closely with USGS and uses the USGS NGP LiDAR Base Specifications v1.0-based LiDAR data classification scheme requested by ISGS. LAS data will be provided in ASPRS version 1.2 per USGS specifications.

The LiDAR classification process encompasses a series of automated and manual steps to classify the point cloud data set. Every Illinois County will be reviewed separately due to unique land cover and cultural features. Madison County is located northeast of St. Louis and is part of the Metro-East region of St. Louis Metro Area. This county is semi-rural. These characteristics were thoroughly evaluated by Quantum Spatial at the onset of the project to ensure that the cost estimation is correct and appropriate automated filters are applied and that subsequent manual filtering yields correctly classified data. Our filtering process uses finely tuned algorithms to automatically identify and classify features that have an extremely high probability of being non-ground features such as vegetation or structures. Feature classification codes are listed below.

Classified Point Cloud

Code:	Description:	
0	Created, never classified	
1	Unclassified1	
2	Ground	
3	Low Vegetation	[numeric cutoff values to be provided by INHS]
4	Medium Vegetation	[numeric cutoff values to be provided by INHS]
5	High Vegetation	[numeric cutoff values to be provided by INHS]
6	Building	
7	Low Point (noise)	
8	Model Key-point (mass point)	

Breaklines

All breaklines developed for use in hydro-flattening will be delivered as an ESRI feature class, Polyline Z or Polygon Z format, as appropriate to the type of feature represented. ESRI file geodatabase format is required. Breaklines should be as a continuous layer and must use the same horizontal and vertical coordinate reference system and units as the LiDAR point delivery. Hydroflattening will be in conformance with USGS version 1.0.

Metadata

Project-level metadata shall be delivered that fully comply with Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata (CSDGM) format standard in XML format. Metadata will describe the project, data acquisition methods, system calibration, processing methods, and statistical validation process and results. Project documentation will include control point and flight diagram information from the LiDAR acquisition flight. All metadata will run through the USGS validation services website (<http://geo-nsdi.er.usgs.gov/validation>) prior to delivery.

QA/QC and FOCUS Reporting

Quality Assurance (QA) and Quality Control (QC) steps are incorporated throughout the entire LiDAR process to ensure that project requirements and industry standards are met. The LiDAR FOCUS report is a quality assurance solution that reports on a comprehensive set of testing and

reporting tools. A number of the tests provided in these reports are required in Version 1.0 of the USGS Base LiDAR Specifications and FEMA PM 61. The project summary within FOCUS includes a detailed accounting of LAS versioning, projection, datum, units, point formats, return information, point classification, the location of high and low points, and other useful project information on a tile-by-tile basis. There is also a detailed accounting and intuitive graphic for the final calibration of the elevation surface.

LiDAR Mapping Accuracy

The LiDAR mapping provided under this proposal will meet or exceed accuracies stated below: The vertical accuracy will be less than or equal to 9.25 cm RMSEz and meet USGS QL2 requirements. The surface will be suitable for 2-foot contour generation. Digital elevation data will be suitable for digital mapping, planning studies, and the development of precise topographic maps and digital elevation models. Data will be compliant with U.S Geological Survey National Geospatial Program LiDAR Base Specification, Version 1.0.

Due to the inherent nature of LiDAR technology success of vegetation removal may decrease in leaf-on environments. LIDAR pulses may be naturally absorbed by water bodies or areas recently covered with asphalt or tar. These areas may result in small data voids in the DEM data.

PROJECT TEAM

The Quantum Spatial, Inc. project team will consist of any number of qualified personnel from our pool of corporate wide personnel to fulfill the specialized requirements of the project requirements. The disciplines required to fulfill the Scope of Work are varied, thus a specific listing of personnel other than the project managers will not be known until the process is begun. Key administration, project management and production managers shall be as follows:

Jeffrey B. Stroub, Vice-President – Contract Administration
Jennifer Whitacre – Assistant Contract Administrator
James Young – Wide Area Project Manager
Chris Guy – Assistant Wide Area Project Manager
Rob Merry – Geomatics Project Manager

BUDGET

We have established a budget of \$167,262 to complete all LiDAR final data processing and QA/QC review, for the 966 square miles of proposed project area in accordance with the Scope of Work set forth by the Work Order assignment.

SCHEDULE, REPORTING, MILESTONE DESCRIPTION, and COMPLETION DATE

Schedule

The intention is to complete data acquisition during the Spring of 2014 during leaf-off vegetative conditions, followed by initial data processing and review by the vendor sufficient to ensure high-quality data have been acquired.

Seasonal and weather conditions dictate when acceptable acquisition can occur. Assuming acceptable weather, and timely acquisition of LiDAR data, all final data and documentation will be submitted to the IGS no later than September 29, 2014, if feasible.

Project Reporting

Every 2 weeks Quantum Spatial will report the project progress as milestones and show the percentages of each milestone complete. ISGS will provide a 1-page form for reporting once project requirements have been agreed upon.

We will coordinate with ISGS to provide a 15-day opportunity for data quality assurance (QA) and quality control (QC) review of a pilot project area within the Madison project area.

*966 sq. mile
QL2*

Milestone Description and Completion Date

<i>Approximate Schedule</i>			
Milestone	Start Date	Finish Date	FEE
Data Classification	5/30/14	7/30/14	\$ 110,800
Breakline Generation	7/30/14	8/15/14	\$ 28,128
DEM Generation	8/5/14	8/15/14	\$ 7,234
Final Deliverables / FOCUS Report	8/15/14	9/29/14	\$ 21,100

DELIVERY ITEMS

All products for Madison will be delivered as a stand-alone County delivery. It will include a 1 tile buffer around the county. All deliverables will be delivered in the tile index provided by ISGS. Deliverable formats will be verified prior to data delivery.

1. **Pilot Data for Madison County**
2. **Classified LiDAR Point Cloud in LAS v1.2, and .DAT file formats**
 - a. LiDAR will be calibrated and georeferenced to NAVD-88, Geoid 12A, and NAD-83/2011, Illinois State Plane West, US Survey feet
 - b. Data will be provided in American Society for Photogrammetry and Remote Sensing (ASPRS) Standards for LAS version 1.2
 - c. Data will be provided in the tiling index provided by Madison County.
 - d. Classifications as defined in processing write up above.
3. **Breaklines Provided in .DGN format**
 - a. Continuous layer
 - b. Same coordinate system as LiDAR delivery
4. **TIN Surface Provided in .TIN formats**
5. **Hydroflattened DEM in .DEM format**
 - a. In compliance with USGS version 1.0
6. **Geodatabase of Deliverables in ESRI file format**
7. **FGDC Compliant Metadata in XML format**
8. **FOCUS Report Provided in PDF and HTML format**

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Quantum Spatial Project Number:

March 4, 2014

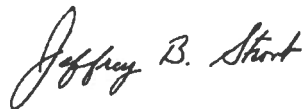
PRICING:

The fee consists of data processing to create contract deliverables including .las classification, generation of data derivative products, creation of metadata and reports, and final delivery of all data for the approximate 966 square miles of Madison County, Illinois. Neither additional fees nor reimbursable costs are expected. Fees are payable to contract terms and conditions.

TOTAL FEE not to exceed:

\$167,262

Respectfully Submitted,



Jeffrey B. Stroub, CP, RLS, PPS, SP
Vice President Business Development

C: Jennifer Whitacre, GISP – Assistant Contract Administrator

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