STATE OF MICHIGAN
CENTRAL PROCUREMENT SERVICES
Department of Technology, Management, and Budget
320 S. WALNUT ST., LANSING, MICHIGAN 48933
P.O. BOX 30026 LANSING, MICHIGAN 48909

CONTRACT CHANGE NOTICE

Change Notice Number **7**

to

Contract Number **071B6600036**

CONTRACTOR	
	THE SANBORN MAP COMPANY, INC.
	1935 Jamboree Drive , Suite 100
	Colorado Springs, CO 80920
	Brad Arshat
	443-603-7725
	barshat@sanborn.com
	CV0002134

STATE			
	Program Manager	Everett Root	DTMB
		517-335-7180	
		RootE@Michigan.gov	
	Contract Administrator	Sean Regan	DTMB
		(517) 284-6993	
		regans@michigan.gov	

CONTRACT SUMMARY			
AERIAL IMAGING SERVICES			
INITIAL EFFECTIVE DATE	**INITIAL EXPIRATION DATE**	**INITIAL AVAILABLE OPTIONS**	**EXPIRATION DATE BEFORE**
February 10, 2016	February 9, 2019	5 - 1 Year	February 9, 2023
PAYMENT TERMS		**DELIVERY TIMEFRAME**	
Net 45		N/A	
ALTERNATE PAYMENT OPTIONS			**EXTENDED PURCHASING**
☐ P-Card	☐ PRC	☐ Other	☒ Yes ☐ No
MINIMUM DELIVERY REQUIREMENTS			
N/A			

DESCRIPTION OF CHANGE NOTICE				
OPTION	**LENGTH OF OPTION**	**EXTENSION**	**LENGTH OF EXTENSION**	**REVISED EXP. DATE**
☒	1 year	☐		February 9, 2024
CURRENT VALUE	**VALUE OF CHANGE NOTICE**		**ESTIMATED AGGREGATE CONTRACT VALUE**	
$6,564,190.00	$0.00		$6,564,190.00	

DESCRIPTION

Effective January 12th, 2023, the State is exercising the fifth option year. The revised contract expiration date is February 9th, 2024.

All other terms, conditions, specifications, and pricing remain the same. Per contractor and agency agreement, DTMB Central Procurement Services approval.

STATE OF MICHIGAN
CENTRAL PROCUREMENT SERVICES
Department of Technology, Management, and Budget
525 W. ALLEGAN ST., LANSING, MICHIGAN 48913
P.O. BOX 30026 LANSING, MICHIGAN 48909

CONTRACT CHANGE NOTICE

Change Notice Number **6**

to

Contract Number **071B6600036**

CONTRACTOR	
	THE SANBORN MAP COMPANY, INC.
	1935 Jamboree Drive , Suite 100
	Colorado Springs, CO 80920
	Brad Arshat
	443-603-7725
	barshat@sanborn.com
	CV0002134

STATE			
	Program Manager	Everett Root	DTMB
		517-335-7180	
		RootE@Michigan.gov	
	Contract Administrator	Sean Regan	DTMB
		(517) 284-6993	
		regans@michigan.gov	

CONTRACT SUMMARY

AERIAL IMAGING SERVICES

INITIAL EFFECTIVE DATE	INITIAL EXPIRATION DATE	INITIAL AVAILABLE OPTIONS	EXPIRATION DATE BEFORE
February 10, 2016	February 9, 2019	5 - 1 Year	February 9, 2022

PAYMENT TERMS	DELIVERY TIMEFRAME

ALTERNATE PAYMENT OPTIONS			EXTENDED PURCHASING	
☐ P-Card	☐ PRC	☐ Other	☒ Yes	☐ No

MINIMUM DELIVERY REQUIREMENTS

DESCRIPTION OF CHANGE NOTICE

OPTION	LENGTH OF OPTION	EXTENSION	LENGTH OF EXTENSION	REVISED EXP. DATE
☒	1 year	☐		February 9, 2023

CURRENT VALUE	VALUE OF CHANGE NOTICE	ESTIMATED AGGREGATE CONTRACT VALUE
$6,564,190.00	$0.00	$6,564,190.00

DESCRIPTION

Effective January 10th, 2022, this contract is exercising the third option year. The new expiration date is February 9, 2023.

All other terms, conditions, specifications, and pricing remain the same. Per contractor and agency agreement, and DTMB Central Procurement Services approval.

STATE OF MICHIGAN
CENTRAL PROCUREMENT SERVICES
Department of Technology, Management, and Budget

525 W. ALLEGAN ST., LANSING, MICHIGAN 48913
P.O. BOX 30026 LANSING, MICHIGAN 48909

CONTRACT CHANGE NOTICE

Change Notice Number **5**

to

Contract Number **071B6600036**

CONTRACTOR	
	THE SANBORN MAP COMPANY, INC.
	1935 Jamboree Drive , Suite 100
	Colorado Springs, CO 80920
	Brad Arshat
	443-603-7725
	barshat@sanborn.com
	CV0002134

STATE			
	Program Manager	Everett Root	DTMB
		517-335-7180	
		RootE@Michigan.gov	
	Contract Administrator	Sean Regan	DTMB
		(517) 243-8459	
		regans@michigan.gov	

CONTRACT SUMMARY

AERIAL IMAGING SERVICES

INITIAL EFFECTIVE DATE	INITIAL EXPIRATION DATE	INITIAL AVAILABLE OPTIONS	EXPIRATION DATE BEFORE
February 10, 2016	February 9, 2019	5 - 1 Year	February 9, 2021

PAYMENT TERMS	DELIVERY TIMEFRAME

ALTERNATE PAYMENT OPTIONS			EXTENDED PURCHASING	
☐ P-Card	☐ PRC	☐ Other	☒ Yes	☐ No

MINIMUM DELIVERY REQUIREMENTS

DESCRIPTION OF CHANGE NOTICE

OPTION	LENGTH OF OPTION	EXTENSION	LENGTH OF EXTENSION	REVISED EXP. DATE
☒	1 Year	☐		February 9, 2022

CURRENT VALUE	VALUE OF CHANGE NOTICE	ESTIMATED AGGREGATE CONTRACT VALUE
$6,564,190.00	$0.00	$6,564,190.00

DESCRIPTION

Effective February 1, 2021, this contract is exercising the thrid option year. The new expiration date is February 9, 2022.

All other terms, conditions, specifications, and pricing remain the same. Per contractor and agency agreement, and DTMB Central Procurement Services approval.

Program Managers
for
Multi-Agency and Statewide Contracts

AGENCY	NAME	PHONE	EMAIL

STATE OF MICHIGAN
CENTRAL PROCUREMENT SERVICES
Department of Technology, Management, and Budget

525 W. ALLEGAN ST., LANSING, MICHIGAN 48913
P.O. BOX 30026 LANSING, MICHIGAN 48909

CONTRACT CHANGE NOTICE

Change Notice Number **4**

to

Contract Number **071B6600036**

CONTRACTOR	
	THE SANBORN MAP COMPANY, INC.
	1935 Jamboree Drive , Suite 100
	Colorado Springs, CO 80920
	Brad Arshat
	443-603-7725
	barshat@sanborn.com
	CV0002134

STATE			
	Program Manager	Everett Root	DTMB
		517-335-7180	
		RootE@Michigan.gov	
	Contract Administrator	Mike Breen	DTMB
		(517) 249-0428	
		breenm@michigan.gov	

CONTRACT SUMMARY			
AERIAL IMAGING SERVICES			
INITIAL EFFECTIVE DATE	**INITIAL EXPIRATION DATE**	**INITIAL AVAILABLE OPTIONS**	**EXPIRATION DATE BEFORE**
February 10, 2016	February 9, 2019	5 - 1 Year	February 9, 2021
PAYMENT TERMS		**DELIVERY TIMEFRAME**	
ALTERNATE PAYMENT OPTIONS			**EXTENDED PURCHASING**
☐ P-Card	☐ PRC	☐ Other	☒ Yes ☐ No
MINIMUM DELIVERY REQUIREMENTS			

DESCRIPTION OF CHANGE NOTICE				
OPTION	**LENGTH OF OPTION**	**EXTENSION**	**LENGTH OF EXTENSION**	**REVISED EXP. DATE**
☐		☐		February 9, 2021
CURRENT VALUE	**VALUE OF CHANGE NOTICE**		**ESTIMATED AGGREGATE CONTRACT VALUE**	
$6,564,190.00	$0.00		$6,564,190.00	

DESCRIPTION

Effective with mutual signature and the approval of the State of Michigan Attorney General's Office Schedule C is amended to add Sanborn Software End-User License Agreement (attached). All other terms and conditions remain the same.

Program Managers
for
Multi-Agency and Statewide Contracts

AGENCY	NAME	PHONE	EMAIL

State of Michigan
Contract No. 071B6600036
LiDAR Services and Optional Hosting

Schedule C
Sanborn Software End-User License Agreement

THE STATE'S EXECUTION OF A CHANGE NOTICE INCORPORATING THIS **SCHEDULE C** INTO THE CONTRACT INDICATES THAT THE STATE HAS READ THIS LICENSE AGREEMENT AND ACCEPTSTHESE TERMS AND CONDITIONS.

THIS IS NOT FREE DATA, FREE PRODUCT OR FREE WARE. UNLICENSED USE OF THE SANBORN PRODUCTS IS A VIOLATION OF LAW, INCLUDING WITHOUT LIMITATION, THE U.S. AND INTERNATIONAL COPYRIGHT LAWS.

THE STATE IS GRANTED A LICENSE TO USE THE SANBORN PRODUCTS AS SET FORTH BELOW.

The Sanborn Map Company, Inc. ("Sanborn") grants a non-exclusive, non-transferable license (the "License") to the State to install, download, use, copy or transmit the Sanborn Software, including any services, documentation, data and information the State receives in connection therewith (the "Products"), on the express condition that the State agree to the terms and conditions of the license as set forth herein (the "License Agreement"):

1. License Granted

(a) The License to install, download, use, copy or transmit the Products granted by this License Agreement provides for the following use depending upon the fee the State pays to Sanborn, and as indicated by the box checked below:

☒ **Enterprise License**: Permits access to, or delivery or transmission of the Products to or from the State's computer system ("Computer") for an unlimited number of users within a designated geographic area or market segment as expressly defined and set forth in the State's corresponding purchase order or contract. Enterprise licenses to agencies of the United States Government are unrestricted. Such license may be accompanied, as appropriate, by a Reseller or Value-Added Reseller ("VAR") agreement, and will outline any exceptions to the permitted or prohibited uses if the Reseller or VAR agreement is exercised.

(b) This License Agreement is subject to Sanborn's agreements with its data suppliers, as may be imposed or modified from time to time. Any data available to the State under this License Agreement that is provided to Sanborn by third party data suppliers is expressly conditioned on Sanborn's agreements with such data suppliers. Sanborn shall cease delivery of such data to the State upon termination of the license granted by such data suppliers to Sanborn to distribute such data.

2. No Warranties

DISCLAIMER. SANBORN MAKES NO WARRANTIES AS TO THE PRODUCTS, WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR USE OR PURPOSE. IN NO EVENT SHALL SANBORN BE LIABLE TO THE STATE OR ANY OTHER PERSON OR ENTITY FOR SPECIAL, INCIDENTAL, PUNITIVE, EXEMPLARY OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, LOSS OF DATA OR LOSS OF USE DAMAGES) ARISING OUT OF OR IN CONNECTION WITH THIS LICENSE AGREEMENT OR THE MANUFACTURE, SALE OR SUPPLY OF THE PRODUCTS WHETHER OR NOT SANBORN HAS BEEN ADVISED OF OR OTHERWISE MIGHT HAVE ANTICIPATED THE POSSIBILITY OF SUCH DAMAGES.

3. Limitation on Liability

(a) The Products provided hereunder are obtained or derived by Sanborn from sources, in a manner that Sanborn, using commercially reasonable resources, has reason to believe are reliable. Sanborn and its suppliers shall have no liability to the State, or a third party, for errors, omissions or malfunctions in the Products, other than the obligation of Sanborn to use commercially reasonable efforts, upon receipt of notice from the State, to correct a malfunction, error, or omission in any Products. Sanborn, at its option and expense, may either (a) replace the Products, or (b) refund the purchase price the State paid upon receipt of the Products. Infringement claims made against the Products, to include without limitation copyright, patent, trademark, or trade secret infringement claims, the remedies applicable to which are set forth in Section 24 of the Standard Contract Terms will not be subject to the limitations of liability described in this Section 3(a).

4. Proprietary Information

The State acknowledges that the data and information contained in the Products constitute copyrighted, trade secret or proprietary information of substantial value to Sanborn or its suppliers (collectively "Proprietary Information"). The State shall treat Proprietary Information as proprietary and shall not divulge, nor permit any of the State's employees or agents to divulge, any Proprietary Information to any person or entity, except as expressly permitted under this License Agreement, or as otherwise provided by law.

5. Copyright

(a) The State understands and acknowledges that the Products are a copyright of Sanborn and the State agrees that it will insure that all copies of the Products will contain appropriate copyright notices and that all notices, reproductions or advertisements of any kind will also credit Sanborn as the source of the data.

(b) All Products and advertising must, minimally, be accompanied by the following copyright and credit statements: © The Sanborn Map Company, Inc. (insert year). All Rights Reserved.

6. Limitations on Use of Products

(a) The State agrees to obtain access to or receive deliveries of the Products solely from Sanborn and/or its authorized distributors or resellers.

(b) The State agrees to use the Products solely for the State's internal governmental use and benefit as expressly set forth in Section 1(a) of this License Agreement, and not for resale or

other transfer or disposition to, or use by or for the benefit of, any other person or entity, except as follows: Use of the Products is limited to use by the State, temporarily on another computer system while the State's Computer is inoperative, or on a replacement computer system, upon advance written consent by Sanborn. The information and data contained in the Products, or any portion thereof (also, the "Products"), may not be transferred to or used on any other computer system except as provided for in this Section 6(b).

(c) The State may disseminate reports and analyses that contain "insubstantial" portions of the Products by either hard copy or view only access; provided that such dissemination is for human cognition only and not for manipulation in machine readable form ("Hard Copy Redistribution"). "Insubstantial" means those portions of Products which in the aggregate do not form a significant part of the Products from which they were derived, combined or revised. The State may make an unlimited number of print and internet display copies of the Products for use by any other person or entity as expressly permitted under this License Agreement, provided that: (1) all copies include the copyright notice prominently displayed in or adjacent to the Products; (2) the State may not sell any copies made for such purposes; (3) with the exception provided by (4) below, the State will prohibit and prevent this data from being downloaded or screen captured by such other persons or entities; and (4) the State may display Products on the Internet in JPEG format that is non-geo-referenced and degraded from its original form. Other than Hard Copy Redistribution, no other redistribution of the Products is permitted unless expressly set forth in this License Agreement.

(d) The State shall not use the Products for any unlawful purpose.

(e) The State is specifically prohibited from charging, or requesting donations, for the Products or any copies of the Products, however made, and from charging, or requesting donations, for the Products or any copies of the Products, however made, which are combined or bundled with other data or products of any kind, commercial or otherwise.

(f) The State is specifically prohibited from the reverse engineering of any kind of, or the creation of derived applications or data of any kind from, the Products and/or the information and data contained in the Products, or any portion thereof (also, the "Products").

(g) The State is specifically prohibited from transmitting, sharing, or distributing the Products or posting the Products via the world wide web to any person or entity except as expressly permitted under this License Agreement.

7. Intellectual Property

Sanborn retains and will hold all ownership rights in all intellectual property embodied in the Products including without limitation all trademarks, trade names, copyrights, service marks, source code, object code, documentation or data contained in the Products, the Products themselves or any modifications of any kind thereto. Sanborn's ownership in the Products, as set forth herein, shall also apply to any derivative works of any kind thereto which are created in violation of this License Agreement. Nothing contained herein shall be deemed a transfer by Sanborn of any rights therein, nor a right to customize, manage or otherwise manipulate the Products.

8. Termination

Upon failure of a party to comply with any material provision of this License Agreement, the other party may terminate this License Agreement on thirty (30) days written notice thereof if such material breach is not cured within such thirty day period. Upon the termination or expiration of this License Agreement, the State will immediately return or destroy all the Products.

9. Reserved

10. General

(a) This License Agreement shall be governed by, and construed in accordance with, the laws of the State of Michigan without giving effect to any choice of law or conflict of law provision that would cause the application of the laws of any other jurisdiction other than the State of Michigan. Each of the parties agrees that any dispute relating to or arising from this License Agreement or the transactions contemplated hereby shall be resolved only in the state or federal courts located in Michigan and the appellate courts having jurisdiction of appeals from such courts. Each of the parties hereby irrevocably and unconditionally (i) submits for itself and its property in any legal action relating to this License Agreement or the transactions contemplated hereby, or for recognition and enforcement of any judgment in respect thereof, to the exclusive jurisdiction of the state and federal courts in Michigan and appellate courts having jurisdiction of appeals from any of the foregoing, and each of the parties hereto irrevocably and unconditionally agrees that all claims in respect of any such legal action shall be heard and determined in such courts; and (ii) consents that any such legal action may and shall be brought in such courts and waives any objection that it may now or hereafter have to the venue or jurisdiction of any such legal action in any such court or that such legal action was brought in an inconvenient court and agrees not to plead or claim the same.

(b) The State may only assign this License Agreement, or its rights or obligations contained herein, if required by law or Executive Order, to another State of Michigan agency or Department. If such an assignment occurs, the State will notify Sanborn of that assignment within thirty (30) days of its effective date. (c) The parties expressly exclude from this License Agreement the applications of the United Nations Convention on Contracts for the International Sale of Goods, and further exclude from this License Agreement the applications of the International Sale of Goods Contracts Convention Act, S.C. 1990-1991, c. 13, and the International Sale of Goods Act, R.S.O. 1990, C.I.10, as amended.

Signature:
Name:
Agency/Organization:
Date:

STATE OF MICHIGAN
CENTRAL PROCUREMENT SERVICES
Department of Technology, Management, and Budget
525 W. ALLEGAN ST., LANSING, MICHIGAN 48913
P.O. BOX 30026 LANSING, MICHIGAN 48909

CONTRACT CHANGE NOTICE

Change Notice Number **3**

to

Contract Number **071B6600036**

CONTRACTOR	
	THE SANBORN MAP COMPANY, INC.
	1935 Jamboree Drive , Suite 100
	Colorado Springs, CO 80920
	Brad Arshat
	443-603-7725
	barshat@sanborn.com
	CV0002134

STATE			
	Program Manager	Everett Root	DTMB
		517-335-7180	
		RootE@Michigan.gov	
	Contract Administrator	Mike Breen	DTMB
		(517) 249-0428	
		breenm@michigan.gov	

CONTRACT SUMMARY

AERIAL IMAGING SERVICES

INITIAL EFFECTIVE DATE	INITIAL EXPIRATION DATE	INITIAL AVAILABLE OPTIONS	EXPIRATION DATE BEFORE
February 10, 2016	February 9, 2019	5 - 1 Year	February 9, 2021

PAYMENT TERMS	DELIVERY TIMEFRAME

ALTERNATE PAYMENT OPTIONS			EXTENDED PURCHASING	
☐ P-Card	☐ PRC	☐ Other	☒ Yes	☐ No

MINIMUM DELIVERY REQUIREMENTS

DESCRIPTION OF CHANGE NOTICE

OPTION	LENGTH OF OPTION	EXTENSION	LENGTH OF EXTENSION	REVISED EXP. DATE
☒	12 months	☐		February 9, 2021

CURRENT VALUE	VALUE OF CHANGE NOTICE	ESTIMATED AGGREGATE CONTRACT VALUE
$5,164,190.00	$1,400,000.00	$6,564,190.00

DESCRIPTION

Effective with mutual signature and State Administrative Board approval od 1/14/2020 the contract is amended to add $1,400,000 plus exercising a one year option to 2/9/2021. All other terms and conditions remain the same.

Program Managers
for
Multi-Agency and Statewide Contracts

AGENCY	NAME	PHONE	EMAIL

STATE OF MICHIGAN
CENTRAL PROCUREMENT SERVICES
Department of Technology, Management, and Budget

525 W. ALLEGAN ST., LANSING, MICHIGAN 48913
P.O. BOX 30026 LANSING, MICHIGAN 48909

CONTRACT CHANGE NOTICE

Change Notice Number **2**

to

Contract Number **071B6600036**

CONTRACTOR	
	The Sanborn Map Company, Inc.
	1935 Jamboree Drive , Suite 100
	Colorado Springs, CO 80920
	Brad Arshat
	443-603-7725
	barshat@sanborn.com
	CV0002134

STATE		
	Everett Root	DTMB
	517-335-7180	
	RootE@Michigan.gov	
	Mike Breen	DTMB
	(517) 249-0428	
	breenm@michigan.gov	

CONTRACT SUMMARY			
AERIAL IMAGING SERVICES			
INITIAL EFFECTIVE DATE	INITIAL EXPIRATION DATE	INITIAL AVAILABLE OPTIONS	EXPIRATION DATE BEFORE
February 10, 2016	February 9, 2019	5 - 1 Year	February 9, 2019
PAYMENT TERMS		DELIVERY TIMEFRAME	
ALTERNATE PAYMENT OPTIONS			EXTENDED PURCHASING
☐ P-Card	☐ PRC	☒ Other	☒ Yes ☐ No
MINIMUM DELIVERY REQUIREMENTS			

DESCRIPTION OF CHANGE NOTICE				
OPTION	LENGTH OF OPTION	EXTENSION	LENGTH OF EXTENSION	REVISED EXP. DATE
☒	12 months	☐		February 9, 2020
CURRENT VALUE	VALUE OF CHANGE NOTICE	ESTIMATED AGGREGATE CONTRACT VALUE		
$4,689,190.00	$475,000.00	$5,164,190.00		

DESCRIPTION

Effective with mutual signature the contract is amended to add funds of $475,000, add SOW for pending project, and execute a one year option to 2/9/2020. All other terms and conditions remain the same.

Program Managers
for
Multi-Agency and Statewide Contracts

AGENCY	NAME	PHONE	EMAIL

sanborn

Corporate Headquarters
1935 Jamboree Drive
Suite 100
Colorado Springs, CO 80920

Phone: 719.593.0093
Toll-Free: 1.866.726.2676
Fax: 719.528.5093
www.sanborn.com

October 1, 2018

Mr. Everett Root
Outreach Specialist
Center for Shared Solutions & Technology Partnerships
Department of Technology, Management and Budget
State of Michigan
111 S. Capitol Ave., 10th Floor Romney
Lansing, MI 48933
Email: RootE@michigan.gov

Re: Quotation for Fall 2018 MISAIL LiDAR Collection, Contract# 071B6600036

Dear Mr. Root:

The Sanborn Map Company, Inc. (Sanborn) is pleased to continue our partnership with the State of Michigan in the MISAIL program. We are submitting our quotation for the requested Fall 2018 LiDAR collection, in keeping with all provisions of the contract governing this program. Tables with scope and fee summaries are provided below, and a project map is appended to this letter.

Scope and Fee Per Square Mile	
Task	**Fee/Mi²**
Raw Point Cloud - Calibrated-unclassified	$69.57
Classified Point Cloud	$23.26
Bare-Earth Surface	$1.16
Hydro-flattened Bare-Earth Surface, including Breaklines	$25.82
Lidar Intensity Images	-0-
Total Fee Per Square Mile	**$119.81**

Upper Peninsula Counties			
County	**Tiles**	**Square Miles**	**Extended Fee @ $119.81/mi²**
Keweenaw	3048	683	$81,869.17
Houghton	3346	750	$89,873.44
Ontonagon	1991	446	$53,478.19
Gogebic	1076	241	$28,901.32
Iron	3560	798	$95,621.47
Dickinson	3542	794	$95,137.99
Menominee	4949	1110	$132,929.96
Schoolcraft	4439	995	$119,231.38
Luce	4229	948	$113,590.79
Chippewa	2763	619	$74,214.08
Subtotal for Upper Peninsula Counties	**32,943**	**7385**	**$884,847.80**

Lower Peninsula Counties			
County	**Tiles**	**Square Miles**	**Extended Fee @ $119.81/mi²**
Cheboygan	3672	823	$98,629.79
Alpena	2812	630	$75,530.22
Montmorency	2516	564	$67,579.67
Otsego	2314	519	$62,153.96
Antrim	2372	532	$63,711.84
Alcona	3122	700	$83,856.81
Oscoda	2499	560	$67,123.05
Crawford	2494	559	$66,988.75
Kalkaska	2541	570	$68,251.17
Subtotal for Lower Peninsula Counties	**24,342**	**5457**	**$653,825.25**

Project Summary			
	Tiles	**Square Miles**	**Fee**
Project Total	**57,285**	**12,843**	**$1,538,673.05**

Fees

The total fee for all products and services quoted above is **$1,538,673.05.**

Terms

It is understood that payment will be made in accordance with the following terms:

- 50% - Upon acquisition of LiDAR data
- 25% - Upon successful completion of DTMB QA of the data and derivatives collected in accordance with USGS Base Lidar Specification Version 1.3, February, 2018 for Quality Level 2.
- Remaining - Upon Acceptance from USGS. If USGS acceptance exceeds 90 days from data receipt, an additional payment of 15% will be made

Schedule

Deliveries to begin 4 months from completion of acquisition.

We believe that this document has addressed all of your requirements. However, should you have questions or need clarification on any matter, please contact Mr. Brad Arshat, Director, Strategic Accounts, via phone: 443-603-7725, fax: 719-528-5093, or email: barshat@sanborn.com. We appreciate the opportunity to submit this quotation and look forward to hearing from you.

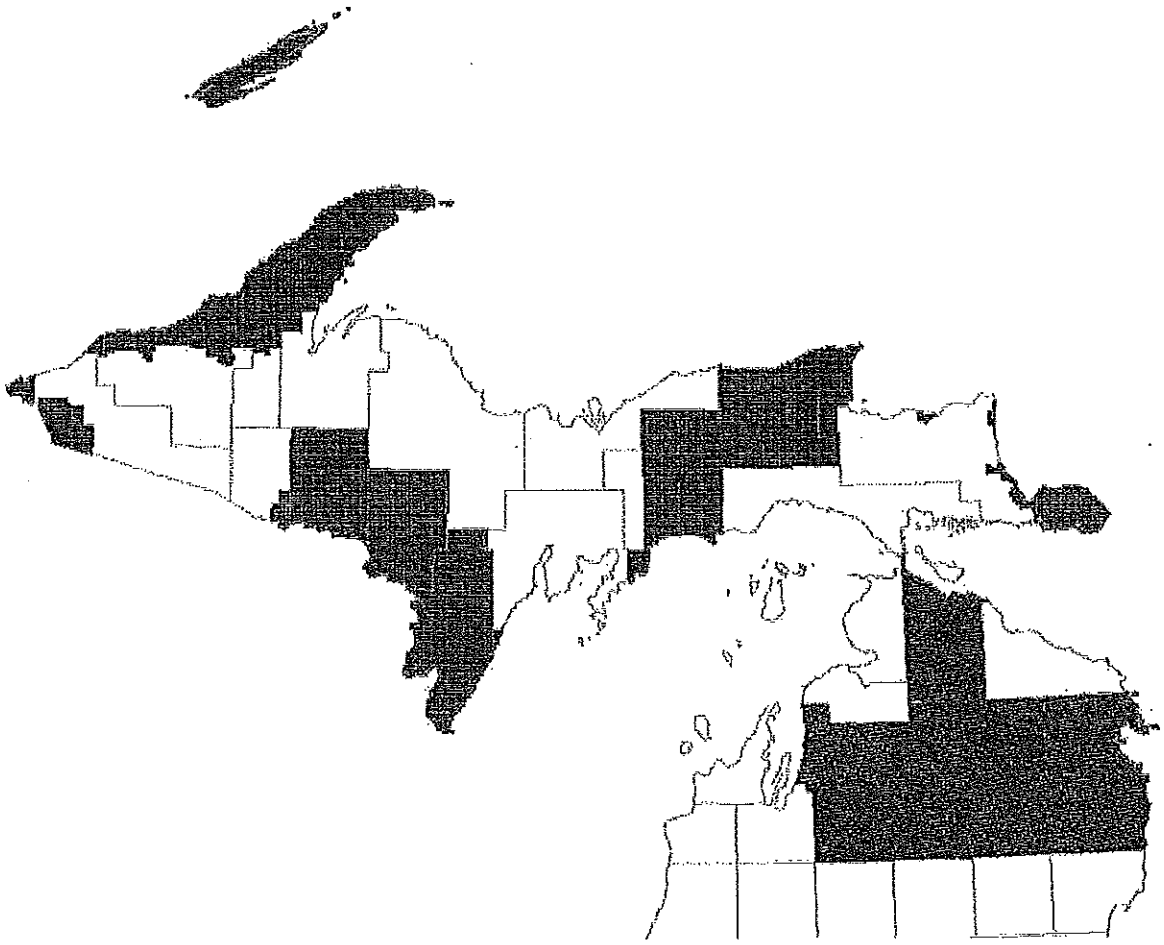
Sincerely,

John R. Copple

President/CEO

Area of Interest Map

MISAIL Fall 2018 LiDAR



STATE OF MICHIGAN
CENTRAL PROCUREMENT SERVICES
Department of Technology, Management, and Budget
525 W. ALLEGAN ST., LANSING, MICHIGAN 48913
P.O. BOX 30026 LANSING, MICHIGAN 48909

CONTRACT CHANGE NOTICE

Change Notice Number 1

to

Contract Number 071B6600036

CONTRACTOR	
	The Sanborn Map Company, Inc.
	1935 Jamboree Drive , Suite 100
	Colorado Springs, CO 80920
	Brad Arshat
	443-603-7725
	barshat@sanborn.com
	CV0002134

STATE		
	Everett Root	DTMB
	517-335-7180	
	RootE@Michigan.gov	
	Mike Breen	DTMB
	(517) 249-0428	
	breenm@michigan.gov	

CONTRACT SUMMARY			
AERIAL IMAGING SERVICES			
INITIAL EFFECTIVE DATE	INITIAL EXPIRATION DATE	INITIAL AVAILABLE OPTIONS	EXPIRATION DATE BEFORE
February 10, 2016	February 9, 2019	5 - 1 Year	February 9, 2019
PAYMENT TERMS		DELIVERY TIMEFRAME	
ALTERNATE PAYMENT OPTIONS			EXTENDED PURCHASING
☐ P-Card	☐ Payment Request (PRC)	☒ Other	☒ Yes ☐ No
MINIMUM DELIVERY REQUIREMENTS			

DESCRIPTION OF CHANGE NOTICE				
OPTION	LENGTH OF OPTION	EXTENSION	LENGTH OF EXTENSION	REVISED EXP. DATE
☐		☐		
CURRENT VALUE	VALUE OF CHANGE NOTICE	ESTIMATED AGGREGATE CONTRACT VALUE		
$4,689,190.00	$0.00	$4,689,190.00		

DESCRIPTION

Effective with mutual signature the contract is amended to add 2 C.F.R. Part 200 Appendix II. Required contract Clauses per result of federal desk audit. All other terms and conditions remain the same.

2 C.F.R. § 200.326 and 2 C.F.R. Part 200, Appendix II, Required Contract Clauses

Requirements under the Uniform Rules. A non-Federal entity's contracts must contain the applicable contract clauses described in Appendix II to the Uniform Rules (Contract Provisions for non-Federal Entity Contracts Under Federal Awards), which are set forth below. 2 C.F.R. § 200.326. For some of the required clauses we have included sample language or a reference a non-Federal entity can go to in order to find sample language. Please be aware that this is sample language only and that the non-Federal entity alone is responsible ensuring that all language included in their contracts meets the requirements of 2 C.F.R. § 200.326 and 2 C.F.R. Part 200, Appendix II. We do not include sample language for certain required clauses (remedies, termination for cause and convenience, changes) as these must necessarily be written based on the non-Federal entity's own procedures in that area.

1. Remedies.

    a. Standard: Contracts for more than the simplified acquisition threshold ($150,000) must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate. See 2 C.F.R. Part 200, Appendix II, ¶ A.

    b. Applicability: This requirement applies to all FEMA grant and cooperative agreement programs.

2. Termination for Cause and Convenience.

    a. All contracts in excess of $10,000 must address termination for cause and for convenience by the non-Federal entity including the manner by which it will be effected and the basis for settlement. See 2 C.F.R. Part 200, Appendix II, ¶ B.

    b. Applicability. This requirement applies to all FEMA grant and cooperative agreement programs.

3. Equal Employment Opportunity.

    a. Standard. Except as otherwise provided under 41 C.F.R. Part 60, all contracts that meet the definition of "federally assisted construction contract" in 41 C.F.R. § 60-1.3 must include the equal opportunity clause provided under 41 C.F.R. § 60-1.4(b), in accordance with Executive Order 11246, *Equal Employment Opportunity* (30 Fed. Reg. 12319, 12935, 3 C.F.R. Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, *Amending Executive Order 11246 Relating to Equal Employment Opportunity*, and implementing regulations at 41 C.F.R. Part 60 (Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor). See 2 C.F.R. Part 200, Appendix II, ¶ C.

    b. Key Definitions.

(1) Federally Assisted Construction Contract. The regulation at 41 C.F.R. § 60-1.3 defines a "federally assisted construction contract" as any agreement or modification thereof between any applicant and a person for construction work which is paid for in whole or in part with funds obtained from the Government or borrowed on the credit of the Government pursuant to any Federal program involving a grant, contract, loan, insurance, or guarantee, or undertaken pursuant to any Federal program involving such grant, contract, loan, insurance, or guarantee, or any application or modification thereof approved by the Government for a grant, contract, loan, insurance, or guarantee under which the applicant itself participates in the construction work.

(2) Construction Work. The regulation at 41 C.F.R. § 60-1.3 defines "construction work" as the construction, rehabilitation, alteration, conversion, extension, demolition or repair of buildings, highways, or other changes or improvements to real property, including facilities providing utility services. The term also includes the supervision, inspection, and other onsite functions incidental to the actual construction.

c. Applicability. This requirement applies to all FEMA grant and cooperative agreement programs.

d. The regulation at 41 C.F.R. Part 60-1.4(b) requires the insertion of the following contract clause:

"During the performance of this contract, the contractor agrees as follows:

(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

(2) The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive considerations for employment without regard to race, color, religion, sex, or national origin.

(3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of the contractor's commitments under this section,

and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions as may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The contractor will include the portion of the sentence immediately preceding paragraph (1) and the provisions of paragraphs (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The contractor will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, That in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency the contractor may request the United States to enter into such litigation to protect the interests of the United States."

4. Davis Bacon Act and Copeland Anti-Kickback Act.

   a. Applicability of Davis-Bacon Act. The Davis-Bacon Act only applies to the emergency Management Preparedness Grant Program, Homeland Security Grant Program, Nonprofit Security Grant Program, Tribal Homeland Security Grant Program, Port Security Grant Program, and Transit Security Grant Program. **It does not apply to other FEMA grant and cooperative agreement programs, including the Public Assistance Program**.

   b. All prime construction contracts in excess of $2,000 awarded by non-Federal entities must include a provision for compliance with the Davis-Bacon Act (40

U.S.C. §§ 3141-3144 and 3146-3148) as supplemented by Department of Labor regulations at 29 C.F.R. Part 5 (Labor Standards Provisions Applicable to Contracts Covering Federally Financed and Assisted Construction)). See 2 C.F.R. Part 200, Appendix II, ¶ D.

c. In accordance with the statute, contractors must be required to pay wages to laborers and mechanics at a rate not less than the prevailing wages specified in a wage determination made by the Secretary of Labor. In addition, contractors must be required to pay wages not less than once a week.

d. The non-Federal entity must place a copy of the current prevailing wage determination issued by the Department of Labor in each solicitation. The decision to award a contract or subcontract must be conditioned upon the acceptance of the wage determination. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.

e. In contracts subject to the Davis-Bacon Act, the contracts must also include a provision for compliance with the Copeland "Anti-Kickback" Act (40 U.S.C. § 3145), as supplemented by Department of Labor regulations at 29 C.F.R. Part 3 (Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States). The Copeland Anti-Kickback Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to FEMA.

f. The regulation at 29 C.F.R. § 5.5(a) does provide the required contract clause that applies to compliance with both the Davis-Bacon and Copeland Acts. However, as discussed in the previous subsection, the Davis-Bacon Act does not apply to Public Assistance recipients and subrecipients. **In situations where the Davis-Bacon Act does not apply, neither does the Copeland "Anti-Kickback Act."** However, for purposes of grant programs where both clauses do apply, FEMA requires the following contract clause:

"Compliance with the Copeland "Anti-Kickback" Act.

(1) Contractor. The contractor shall comply with 18 U.S.C. § 874, 40 U.S.C. § 3145, and the requirements of 29 C.F.R. pt. 3 as may be applicable, which are incorporated by reference into this contract.

(2) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clause above and such other clauses as the FEMA may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all of these contract clauses.

(3) Breach. A breach of the contract clauses above may be grounds for termination of the contract, and for debarment as a contractor and subcontractor as provided in 29 C.F.R. § 5.12."

5. Contract Work Hours and Safety Standards Act.

a. Applicability: This requirement applies to all FEMA grant and cooperative agreement programs.

b. Where applicable (see 40 U.S.C. § 3701), all contracts awarded by the non-Federal entity in excess of $100,000 that involve the employment of mechanics or laborers must include a provision for compliance with 40 U.S.C. §§ 3702 and 3704, as supplemented by Department of Labor regulations at 29 C.F.R. Part 5. See 2 C.F.R. Part 200, Appendix II, ¶ E.

c. Under 40 U.S.C. § 3702, each contractor must be required to compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week.

d. The requirements of 40 U.S.C. § 3704 are applicable to construction work and provide that no laborer or mechanic must be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

e. The regulation at 29 C.F.R. § 5.5(b) provides the required contract clause concerning compliance with the Contract Work Hours and Safety Standards Act:

"Compliance with the Contract Work Hours and Safety Standards Act.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (1) of this section the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work

done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The (write in the name of the Federal agency or the loan or grant recipient) shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2) of this section.

(4) Subcontracts. The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1) through (4) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1) through (4) of this section."

6. Rights to Inventions Made Under a Contract or Agreement.

   a. Stafford Act Disaster Grants. This requirement **does not apply to the Public Assistance**, Hazard Mitigation Grant Program, Fire Management Assistance Grant Program, Crisis Counseling Assistance and Training Grant Program, Disaster Case Management Grant Program, and Federal Assistance to Individuals and Households – Other Needs Assistance Grant Program, as FEMA awards under these programs do not meet the definition of "funding agreement."

   b. If the FEMA award meets the definition of "funding agreement" under 37 C.F.R. § 401.2(a) and the non-Federal entity wishes to enter into a contract with a small business firm or nonprofit organization regarding the substitution of parties, assignment or performance of experimental, developmental, or research work under that "funding agreement," the non-Federal entity must comply with the requirements of 37 C.F.R. Part 401 (Rights to Inventions Made by Nonprofit Organizations and Small Business Firms Under Government Grants, Contracts and Cooperative Agreements), and any implementing regulations issued by

FEMA. See 2 C.F.R. Part 200, Appendix II, ¶ F.

c. The regulation at 37 C.F.R. § 401.2(a) currently defines "funding agreement" as any contract, grant, or cooperative agreement entered into between any Federal agency, other than the Tennessee Valley Authority, and any contractor for the performance of experimental, developmental, or research work funded in whole or in part by the Federal government. This term also includes any assignment, substitution of parties, or subcontract of any type entered into for the performance of experimental, developmental, or research work under a funding agreement as defined in the first sentence of this paragraph.

7. Clean Air Act and the Federal Water Pollution Control Act. Contracts of amounts in excess of $150,000 must contain a provision that requires the contractor to agree to comply with all applicable standards, orders, or regulations issued pursuant to the Clean Air Act (42 U.S.C. §§ 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. §§ 1251-1387). Violations must be reported to FEMA and the Regional Office of the Environmental Protection Agency. See 2 C.F.R. Part 200, Appendix II, ¶ G.

a. The following provides a sample contract clause concerning compliance for contracts of amounts in excess of $150,000:

"Clean Air Act

(1) The contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act, as amended, 42 U.S.C. § 7401 et seq.

(2) The contractor agrees to report each violation to the (name of the state agency or local or Indian tribal government) and understands and agrees that the (name of the state agency or local or Indian tribal government) will, in turn, report each violation as required to assure notification to the (name of recipient), Federal Emergency Management Agency, and the appropriate Environmental Protection Agency Regional Office.

(3) The contractor agrees to include these requirements in each subcontract exceeding $150,000 financed in whole or in part with Federal assistance provided by FEMA.

Federal Water Pollution Control Act

(1) The contractor agrees to comply with all applicable standards, orders or regulations issued pursuant to the Federal Water Pollution Control Act, as amended, 33 U.S.C. 1251 et seq.

(2) The contractor agrees to report each violation to the (name of the state agency or local or Indian tribal government) and understands and agrees that the (name of the state agency or local or Indian tribal

government) will, in turn, report each violation as required to assure notification to the (name of recipient), Federal Emergency Management Agency, and the appropriate Environmental Protection Agency Regional Office.

(3) The contractor agrees to include these requirements in each subcontract exceeding $150,000 financed in whole or in part with Federal assistance provided by FEMA."

8. Debarment and Suspension.

a. Applicability: This requirement applies to all FEMA grant and cooperative agreement programs.

b. Non-federal entities and contractors are subject to the debarment and suspension regulations implementing Executive Order 12549, *Debarment and Suspension* (1986) and Executive Order 12689, *Debarment and Suspension* (1989) at 2 C.F.R. Part 180 and the Department of Homeland Security's regulations at 2 C.F.R. Part 3000 (Nonprocurement Debarment and Suspension).

c. These regulations restrict awards, subawards, and contracts with certain parties that are debarred, suspended, or otherwise excluded from or ineligible for participation in Federal assistance programs and activities. See 2 C.F.R. Part 200, Appendix II, ¶ H; and *Procurement Guidance for Recipients and Subrecipients Under 2 C.F.R. Part 200 (Uniform Rules): Supplement to the Public Assistance Procurement Disaster Assistance Team (PDAT) Field Manual* Chapter IV, ¶ 6.d, and Appendix C, ¶ 2 [hereinafter *PDAT Supplement*]. A contract award must not be made to parties listed in the SAM Exclusions. SAM Exclusions is the list maintained by the General Services Administration that contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549. SAM exclusions can be accessed at www.sam.gov. See 2 C.F.R. § 180.530; *PDAT Supplement,* Chapter IV, ¶ 6.d and Appendix C, ¶ 2.

d. In general, an "excluded" party cannot receive a Federal grant award or a contract within the meaning of a "covered transaction," to include subawards and subcontracts. This includes parties that receive Federal funding indirectly, such as contractors to recipients and subrecipients. The key to the exclusion is whether there is a "covered transaction," which is any nonprocurement transaction (unless excepted) at either a "primary" or "secondary" tier. Although "covered transactions" do not include contracts awarded by the Federal Government for purposes of the nonprocurement common rule and DHS's implementing regulations, it does include some contracts awarded by recipients and subrecipient.

e. Specifically, a covered transaction includes the following contracts for goods or services:

(1) The contract is awarded by a recipient or subrecipient in the amount of at least $25,000.

(2) The contract requires the approval of FEMA, regardless of amount.

(3) The contract is for federally-required audit services.

(4) A subcontract is also a covered transaction if it is awarded by the contractor of a recipient or subrecipient and requires either the approval of FEMA or is in excess of $25,000.

d. The following provides a debarment and suspension clause. It incorporates an optional method of verifying that contractors are not excluded or disqualified:

"Suspension and Debarment

(1) This contract is a covered transaction for purposes of 2 C.F.R. pt. 180 and 2 C.F.R. pt. 3000. As such the contractor is required to verify that none of the contractor, its principals (defined at 2 C.F.R. § 180.995), or its affiliates (defined at 2 C.F.R. § 180.905) are excluded (defined at 2 C.F.R. § 180.940) or disqualified (defined at 2 C.F.R. § 180.935).

(2) The contractor must comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C and must include a requirement to comply with these regulations in any lower tier covered transaction it enters into.

(3) This certification is a material representation of fact relied upon by (insert name of subrecipient). If it is later determined that the contractor did not comply with 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C, in addition to remedies available to (name of state agency serving as recipient and name of subrecipient), the Federal Government may pursue available remedies, including but not limited to suspension and/or debarment.

(4) The bidder or proposer agrees to comply with the requirements of 2 C.F.R. pt. 180, subpart C and 2 C.F.R. pt. 3000, subpart C while this offer is valid and throughout the period of any contract that may arise from this offer. The bidder or proposer further agrees to include a provision requiring such compliance in its lower tier covered transactions."

9. Byrd Anti-Lobbying Amendment.

a. Applicability: This requirement applies to all FEMA grant and cooperative agreement programs.

b. Contractors that apply or bid for an award of $100,000 or more must file the required certification. See 2 C.F.R. Part 200, Appendix II, ¶ I; 44 C.F.R. Part 18; *PDAT Supplement*, Chapter IV, 6.c; Appendix C, ¶ 4.

c. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or

attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. § 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award. See *PDAT Supplement*, Chapter IV, ¶ 6.c and Appendix C, ¶ 4.

d. The following provides a Byrd Anti-Lobbying contract clause:

"Byrd Anti-Lobbying Amendment, 31 U.S.C. § 1352 (as amended)

Contractors who apply or bid for an award of $100,000 or more shall file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant, or any other award covered by 31 U.S.C. § 1352. Each tier shall also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the recipient."

APPENDIX A, 44 C.F.R. PART 18 – CERTIFICATION REGARDING LOBBYING

Certification for Contracts, Grants, Loans, and Cooperative Agreements

(To be submitted with each bid or offer exceeding $100,000)

The undersigned [Contractor] certifies, to the best of his or her knowledge, that:

1. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or

cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

3. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31, U.S.C. § 1352 (as amended by the Lobbying Disclosure Act of 1995). Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

The Contractor, The Sanborn Map Company, Inc, certifies or affirms the truthfulness and accuracy of each statement of its certification and disclosure, if any. In addition, the Contractor understands and agrees that the provisions of 31 U.S.C. § 3801 *et seq.*, apply to this certification and disclosure, if any.

John R. Copple

Signature of Contractor's Authorized Official

John R. Copple, President/CEO

Name and Title of Contractor's Authorized Official

September 27, 2018

Date"

10. Procurement of Recovered Materials.

a. Applicability: This requirement applies to all FEMA grant and cooperative agreement programs.

b. A non-Federal entity that is a state agency or agency of a political subdivision of a state and its contractors must comply with Section 6002 of the Solid Waste Disposal Act, Pub. L. No. 89-272 (1965) (codified as amended by the Resource Conservation and Recovery Act at 42 U.S.C. § 6962). See 2 C.F.R. Part 200, Appendix II, ¶ J; 2 C.F.R. § 200.322; *PDAT Supplement*, Chapter V, ¶ 7.

c. The requirements of Section 6002 include procuring only items designated in guidelines of the EPA at 40 C.F.R. Part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of

competition, where the purchase price of the item exceeds $10,000 or the value of the quantity acquired by the preceding fiscal year exceeded $10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

d. The following provides the clause that a state agency or agency of a political subdivision of a state and its contractors can include in contracts meeting the above contract thresholds:

> "(1) In the performance of this contract, the Contractor shall make maximum use of products containing recovered materials that are EPA-designated items unless the product cannot be acquired—
>
> (i) Competitively within a timeframe providing for compliance with the contract performance schedule;
>
> (ii) Meeting contract performance requirements; or
>
> (iii) At a reasonable price.
>
> (2) Information about this requirement, along with the list of EPA-designate items, is available at EPA's Comprehensive Procurement Guidelines web site, https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program."

11. Additional FEMA Requirements.

a. The Uniform Rules authorize FEMA to require additional provisions for non-Federal entity contracts. FEMA, pursuant to this authority, requires or recommends the following:

b. Changes.

To be eligible for FEMA assistance under the non-Federal entity's FEMA grant or cooperative agreement, the cost of the change, modification, change order, or constructive change must be allowable, allocable, within the scope of its grant or cooperative agreement, and reasonable for the completion of project scope. FEMA recommends, therefore, that a non-Federal entity include a changes clause in its contract that describes how, if at all, changes can be made by either party to alter the method, price, or schedule of the work without breaching the contract. The language of the clause may differ depending on the nature of the contract and the end-item procured.

c. Access to Records.

All non-Federal entities must place into their contracts a provision that all contractors and their successors, transferees, assignees, and subcontractors acknowledge and

agree to comply with applicable provisions governing Department and FEMA access to records, accounts, documents, information, facilities, and staff. See DHS Standard Terms and Conditions, v 3.0, ¶ XXVI (2013).

d. The following provides a contract clause regarding access to records:

"Access to Records. The following access to records requirements apply to this contract:

(1) The contractor agrees to provide (insert name of state agency or local or Indian tribal government), (insert name of recipient), the FEMA Administrator, the Comptroller General of the United States, or any of their authorized representatives access to any books, documents, papers, and records of the Contractor which are directly pertinent to this contract for the purposes of making audits, examinations, excerpts, and transcriptions.

(2) The Contractor agrees to permit any of the foregoing parties to reproduce by any means whatsoever or to copy excerpts and transcriptions as reasonably needed.

(3) The contractor agrees to provide the FEMA Administrator or his authorized representatives access to construction or other work sites pertaining to the work being completed under the contract."

12. DHS Seal, Logo, and Flags.

a. All non-Federal entities must place in their contracts a provision that a contractor shall not use the DHS seal(s), logos, crests, or reproductions of flags or likenesses of DHS agency officials without specific FEMA pre-approval. See DHS Standard Terms and Conditions, v 3.0, ¶ XXV (2013).

b. The following provides a contract clause regarding DHS Seal, Logo, and Flags: "The contractor shall not use the DHS seal(s), logos, crests, or reproductions of flags or likenesses of DHS agency officials without specific FEMA pre-approval."

13. Compliance with Federal Law, Regulations, and Executive Orders.

a. All non-Federal entities must place into their contracts an acknowledgement that FEMA financial assistance will be used to fund the contract along with the requirement that the contractor will comply with all applicable federal law, regulations, executive orders, and FEMA policies, procedures, and directives.

b. The following provides a contract clause regarding Compliance with Federal Law, Regulations, and Executive Orders: "This is an acknowledgement that FEMA financial assistance will be used to fund the contract only. The contractor

will comply will all applicable federal law, regulations, executive orders, FEMA policies, procedures, and directives."

14. No Obligation by Federal Government.

a. The non-Federal entity must include a provision in its contract that states that the Federal Government is not a party to the contract and is not subject to any obligations or liabilities to the non-Federal entity, contractor, or any other party pertaining to any matter resulting from the contract.

b. The following provides a contract clause regarding no obligation by the Federal Government: "The Federal Government is not a party to this contract and is not subject to any obligations or liabilities to the non-Federal entity, contractor, or any other party pertaining to any matter resulting from the contract."

15. Program Fraud and False or Fraudulent Statements or Related Acts.

a. The non-Federal entity must include a provision in its contract that the contractor acknowledges that 31 U.S.C. Chap. 38 (Administrative Remedies for False Claims and Statements) applies to its actions pertaining to the contract.

b. The following provides a contract clause regarding Fraud and False or Fraudulent or Related Acts: "The contractor acknowledges that 31 U.S.C. Chap. 38 (Administrative Remedies for False Claims and Statements) applies to the contractor's actions pertaining to this contract."

Form No. DTMB-3522 (Rev. 10/2015)
AUTHORITY: Act 431 of 1984
COMPLETION: Required
PENALTY: Contract change will not be executed unless form is filed

STATE OF MICHIGAN

DEPARTMENT OF TECHNOLOGY, MANAGEMENT & BUDGET

PROCUREMENT

525 W. ALLEGAN STREET
LANSING, MI 48933

P.O. BOX 30026
LANSING, MI 48909

NOTICE OF CONTRACT NO. **071B6600036**

between

THE STATE OF MICHIGAN

and

NAME & ADDRESS OF CONTRACTOR	PRIMARY CONTACT	EMAIL
The Sanborn Map Company, Inc.	Brad Arshat	barshat@sanborn.com
1935 Jamboree Drive, Suite 100	**PHONE**	**VENDOR TAX ID # (LAST FOUR DIGITS ONLY)**
Colorado Springs, CO 80920	(443) 603-7725	**1409**

STATE CONTACTS	AGENCY	NAME	PHONE	EMAIL
PROGRAM MANAGER	**DTMB - CSS**	**Everett Root**	**517-335-7180**	**RootE@michigan.gov**
CONTRACT ADMINISTRATOR	**DTMB - Procurement**	**Terry Mead**	**517-284-7035**	**meadt@michigan.gov**

CONTRACT SUMMARY			
DESCRIPTION: **Aerial Imaging services to include: Lidar Imagery and Optional Hosting Services – DTMB CSS**			
INITIAL TERM	**EFFECTIVE DATE**	**INITIAL EXPIRATION DATE**	**AVAILABLE OPTIONS**
3 Years	**02/10/2016**	**02/09/2019**	**5, 1-Year Options**
PAYMENT TERMS	**F.O.B.**	**SHIPPED TO**	
Net 45	**NA**	**NA**	
ALTERNATE PAYMENT OPTIONS			**EXTENDED PURCHASING**
☐ P-card ☐ Direct Voucher (DV) ☐ Other			☒ Yes ☐ No
MINIMUM DELIVERY REQUIREMENTS			
NA			
MISCELLANEOUS INFORMATION			
Sanborn Mapping for LiDAR in the amount of $4,212,900.00, and optional Hosting Services in the amount of $476,290.00.			
ESTIMATED CONTRACT VALUE AT TIME OF EXECUTION	**$4,689,190.00**		

For the Contractor:

_____ _____

John R. Copple**,**
Contract Administrator
The Sanborn Map Company, Inc.

Date

For the State:

_____ _____

Bill Pemble,
IT Division Director
State of Michigan

Date

STATE OF MICHIGAN

STANDARD CONTRACT TERMS

This STANDARD CONTRACT ("**Contract**") is agreed to between the State of Michigan (the "**State**") and **The Sanborn Map Company, Inc.** ("**Contractor**"), a Delaware corporation. This Contract is effective on February 10, 2016 ("**Effective Date**"), and unless terminated, expires on February 9, 2019 (the "**Term**").

This Contract may be renewed for up to five (5) additional one (1) year periods. Renewal must be by written notice from the State and will automatically extend the Term of this Contract.

The parties agree as follows:

1. **Statements of Work**. Contractor shall provide the services ("**Services**") and deliverables ("**Deliverables**") for each project pursuant to an executed Statement of Work entered into under this Contract (each, a "**Statement of Work**"). No Statement of Work shall be effective unless signed by each party's Project Manager. The term of each Statement of Work shall commence on the parties' full execution of the Statement of Work and terminate when the parties have fully performed their obligations. The terms and conditions of this Contract will apply at all times to any Statements of Work entered into by the parties under this Contract. The State shall have the right to terminate a Statement of Work as set forth in **Sections 20 and 21** of this Contract. Once a Statement of Work has been agreed to by the parties, the State will issue a corresponding purchase order ("**Purchase Order**"). The Statement of Work must identify each parties' project manager for that particular Statement of Work ("**Project Manager**")

2. **Change Control Process**. The State may at any time request in writing (each, a "**Change Request**") changes to a Statement of Work, including changes to the Services and Deliverables (each, a "**Change**"). Upon the State's submission of a Change Request, the parties will evaluate and implement all Changes in accordance with this **Section 2**.

    a. As soon as reasonably practicable, and in any case within fifteen (15) business days following receipt of a Change Request, Contractor will provide the State with a written proposal for implementing the requested Change ("**Change Proposal**"), setting forth:

        i. a written description of the proposed Changes to any Services or Deliverables;

        ii. the schedule for commencing and completing any additional or modified Services or Deliverables; and

        iii. any increase or decrease in costs resulting from the proposed Changes, which increase or decrease will reflect only the increase or decrease in time and expenses Contractor requires to carry out the Change.

    b. Within fifteen (15) Business Days following the State's receipt of a Change Proposal, the State will by written notice to Contractor, approve, reject, or propose modifications to such Change Proposal. If the State proposes modifications, Contractor must modify and re-deliver the Change Proposal reflecting such modifications, or notify the State of any disagreement, in which event the parties

will negotiate in good faith to resolve their disagreement. Upon the State's approval of the Change Proposal or the parties' agreement on all proposed modifications, as the case may be, the parties will execute a written agreement to the Change Proposal ("**Change Notice**"), which Change Notice will be signed by the State's Contract Administrator and will constitute an amendment to the Statement of Work to which it relates.

c. If the parties fail to enter into a Change Notice within fifteen (15) Business Days following the State's response to a Change Proposal, the State may, in its discretion:

i. require Contractor to perform the Services under the Statement of Work without the Change;

ii. require Contractor to continue to negotiate a Change Notice;

iii. initiate a dispute resolution procedure under **Section 38**; or

iv. notwithstanding any provision to the contrary in the Statement of Work, terminate the Statement of Work.

d. No Change will be effective until the parties have executed a Change Notice. Except as the State may request in its Change Request or otherwise in writing, Contractor must continue to perform its obligations in accordance with the Statement of Work pending negotiation and execution of a Change Notice. Contractor will use its best efforts to limit any delays or cost increases from any Change to those necessary to perform the Change in accordance with the applicable Change Notice. Each party is responsible for its own costs and expenses of preparing, evaluating, negotiating, and otherwise processing any Change Request, Change Proposal, and Change Notice.

e. The performance of any functions, activities, tasks, obligations, roles and responsibilities comprising the Services as described in this Contract are considered part of the Services and, thus, will not be considered a Change. This includes the delivery of all Deliverables in accordance with their respective specifications, and the diagnosis and correction of deficiencies discovered in Deliverables prior to their Acceptance by the State.

f. Contractor may, on its own initiative and at its own expense, prepare and submit its own Change Request to the State. However, the State will be under no obligation to approve or otherwise respond to a Change Request initiated by Contractor.

3. **Performance of Services**. Contractor will provide all Services and Deliverables in a timely, professional and workmanlike manner and in accordance with the terms, conditions, and specifications set forth in this Contract and the applicable Statement of Work.

a. State Standards

i. To the extent that Contractor has access to the State's computer system, The Contractor must adhere to all existing standards as described within the comprehensive listing of the State's existing technology standards at http://www.michigan.gov/dmb/0,4568,7-150-56355-108233--,00.html

ii. To the extent that Contractor has access to the State's computer system, Contractor must comply with the State's Acceptable Use Policy, see

http://michigan.gov/cybersecurity/0,1607,7-217-34395_34476---,00.html. All Contractor personnel will be required, in writing, to agree to the State's Acceptable Use Policy before accessing the State's system. The State reserves the right to terminate Contractor's access to the State's system if a violation occurs.

b. Contractor Personnel

i. Contractor is solely responsible for all Contractor personnel and for the payment of their compensation, including, if applicable, withholding of income taxes, and the payment and withholding of social security and other payroll taxes, unemployment insurance, workers' compensation insurance payments and disability benefits.

ii. Prior to any Contractor personnel performing any Services, Contractor will:

1. ensure that such Contractor personnel have the legal right to work in the United States; and

2. require such Contractor Personnel to execute written agreements, in form and substance acceptable to the State, that bind such Contractor Personnel to confidentiality provisions that are at least as protective of the State's information (including all Confidential Information) as those contained in this Contract and intellectual property rights provisions that grant the State rights in the Deliverables consistent with the provisions of **Section 10** and, upon the State's request, provide the State with a copy of each such executed Contract.

iii. Contractor and all Contractor Personnel will comply with all rules, regulations, and policies of the State that are communicated to Contractor in writing, including security procedures concerning systems and data and remote access, building security procedures, including the restriction of access by the State to certain areas of its premises or systems, and general health and safety practices and procedures.

iv. The State reserves the right to require the removal of any Contractor personnel found, in the judgment of the State, to be unacceptable. The State's request must be written with reasonable detail outlining the reasons for the removal request. Replacement personnel for the removed person must be fully qualified for the position. If the State exercises this right, and Contractor cannot immediately replace the removed personnel, the State agrees to negotiate an equitable adjustment in schedule or other terms that may be affected by the State's required removal.

c. **Background Checks.** Upon request, Contractor must perform background checks on all employees and subcontractors and its employees prior to their assignment. The scope is at the discretion of the State and documentation must be provided as requested. Contractor is responsible for all costs associated with the requested background checks. The State, in its sole discretion, may also perform background checks.

d. **Contractor's Key Personnel**

i. The State has the right to recommend and approve in writing the initial assignment, as well as any proposed reassignment or replacement, of any key personnel, identified in a Statement of Work ("**Key Personnel**"). Before assigning an individual to any Key Personnel position, Contractor will notify the State of the proposed

assignment, introduce the individual to the State's Project Manager, and provide the State with a resume and any other information about the individual reasonably requested by the State. The State reserves the right to interview the individual before granting written approval. In the event the State finds a proposed individual unacceptable, the State will provide a written explanation including reasonable detail outlining the reasons for the rejection.

ii. Contractor will not remove any Key Personnel from their assigned roles on this Contract without the prior written consent of the State. The Contractor's removal of Key Personnel without the prior written consent of the State is an unauthorized removal ("**Unauthorized Removal**"). An Unauthorized Removal does not include replacing Key Personnel for reasons beyond the reasonable control of Contractor, including illness, disability, leave of absence, personal emergency circumstances, resignation, or for cause termination of the Key Personnel's employment. Any Unauthorized Removal may be considered by the State to be a material breach of this Contract, in respect of which the State may elect to terminate this Contract for cause under **Section 20**.

iii. It is further acknowledged that an Unauthorized Removal will interfere with the timely and proper completion of this Contract, to the loss and damage of the State, and that it would be impracticable and extremely difficult to fix the actual damage sustained by the State as a result of any Unauthorized Removal. Therefore, Contractor and the State agree that in the case of any Unauthorized Removal in respect of which the State does not elect to exercise its rights under **Section 20**, Contractor will issue to the State the corresponding credits set forth below (each, an "**Unauthorized Removal Credit**"):

1. For the Unauthorized Removal of any Key Personnel designated in the applicable Statement of Work, the credit amount will be $25,000.00 per individual if Contractor identifies a replacement approved by the State and assigns the replacement to shadow the Key Personnel who is leaving for a period of at least 30 calendar days before the Key Personnel's removal.

2. If Contractor fails to assign a replacement to shadow the removed Key Personnel for at least 30 calendar days, in addition to the $25,000.00 credit specified above, Contractor will credit the State $833.33 per calendar day for each day of the 30 calendar-day shadow period that the replacement Key Personnel does not shadow the removed Key Personnel, up to $25,000.00 maximum per individual. The total Unauthorized Removal Credits that may be assessed per Unauthorized Removal and failure to provide 30 calendar days of shadowing will not exceed $50,000.00 per individual.

iv. Contractor acknowledges and agrees that each of the Unauthorized Removal Credits assessed under **Subsection iii** above: (i) is a reasonable estimate of and compensation for the anticipated or actual harm to the State that may arise from the Unauthorized Removal, which would be impossible or very difficult to accurately estimate; and (ii) may, at the State's option, be credited or set off against any fees or other charges payable to Contractor under this Contract.

4. **Notices.** All notices and other communications required or permitted under this Contract must be in writing and will be considered given and received: (a) when verified by written receipt if sent by courier; (b) when actually received if sent by mail without verification of receipt; or (c) when verified by automated receipt or electronic logs if sent by facsimile or email.

If to State:	If to Contractor:
Terry Mead 525 W. Allegan, 1st Floor Lansing, MI 48913 meadt@michigan.gov 517-284-7035	Brad Arshat 1935 Jamboree Drive Suite 100 Colorado Springs, CO 80920 barshat@sanborn.com 443-603-7725 cc to: Amy E. Kappel 1935 Jamboree Drive Suite 100 Colorado Springs, CO 80920 akappel@sanborn.com 719-264-5510

5. **Contract Administrators.** The Contract Administrator for each party is the only person authorized to modify any terms and conditions of this Contract (each a "**Contract Administrator**"):

State:	Contractor:
Terry Mead 525 W. Allegan, 1st Floor Lansing, MI 48913 meadt@michigan.gov 517-284-7035	John Copple 1935 Jamboree Drive Suite 100 Colorado Springs, CO 80920 jcopple@sanborn.com 719-593-0093

6. **Program Manager.** The Program Manager for each party will monitor and coordinate the day-to-day activities of the Contract (each a "**Program Manager**"):

State:	Contractor:
Everett Root 111 S. Capitol Avenue, 10th Floor Lansing, MI 48933 roote@michigan.gov 517-335-7180	Shawn Benham, Director, Colorado Springs Mapping Project Management Office 1935 Jamboree Drive Suite 100 Colorado Springs, CO 80920 sbenham@sanborn.com 719-502-1296

7. **Insurance Requirements.** Contractor must maintain the insurances identified below and is responsible for all deductibles. All required insurance must: (a) protect the State from claims that may arise out of, are alleged to arise out of, or result from Contractor's or a subcontractor's performance; (b) be primary and non-contributing to any comparable liability insurance (including self-insurance) carried by the State; and (c) be provided by an company with an A.M. Best rating of "A" or better and a financial size of VII or better.

Insurance Type	Additional Requirements
Commercial General Liability Insurance	

Minimal Limits: $1,000,000 Each Occurrence Limit $1,000,000 Personal & Advertising Injury Limit $2,000,000 General Aggregate Limit $2,000,000 Products/Completed Operations Deductible Maximum: $50,000 Each Occurrence	Contractor must have their policy endorsed to add “the State of Michigan, its departments, divisions, agencies, offices, commissions, officers, employees, and agents” as additional insureds using endorsement CG 20 10 11 85, or both CG 2010 07 04 and CG 2037 07 0.
Umbrella or Excess Liability Insurance	
Minimal Limits: $5,000,000 General Aggregate	Contractor must have their policy endorsed to add “the State of Michigan, its departments, divisions, agencies, offices, commissions, officers, employees, and agents” as additional insureds.
Automobile Liability Insurance	
Minimal Limits: $1,000,000 Per Occurrence	
Workers' Compensation Insurance	
Minimal Limits: Coverage according to applicable laws governing work activities.	Waiver of subrogation, except where waiver is prohibited by law.
Employers Liability Insurance	
Minimal Limits: $500,000 Each Accident	

$500,000 Each Employee by Disease $500,000 Aggregate Disease.	
Privacy and Security Liability (Cyber Liability) Insurance	
<u>Minimal Limits:</u> $1,000,000 Each Occurrence $1,000,000 Annual Aggregate	Contractor must have their policy: (1) endorsed to add “the State of Michigan, its departments, divisions, agencies, offices, commissions, officers, employees, and agents” as additional insureds; and (2) cover information security and privacy liability, privacy notification costs, regulatory defense and penalties, and website media content liability.

Hired and Non-Owned Motor Vehicle Insurance	
Minimal Limits: $1,000,000 Per Accident	Contractor must have their policy endorsed to add "the State of Michigan, its departments, divisions, agencies, offices, commissions, officers, employees, and agents" as additional insureds.
Professional Liability (Errors and Omissions) Insurance	
Minimal Limits: $3,000,000 Each Occurrence $3,000,000 Annual Aggregate Deductible Maximum: $50,000 Per Loss	

If any of the required policies provide **claims-made** coverage, the Contractor must: (a) provide coverage with a retroactive date before the effective date of the contract or the beginning of Services; (b) maintain coverage and provide evidence of coverage for at least three (3) years after completion of the Services; and (c) if coverage is canceled or not renewed, and not replaced with another claims-made policy form with a retroactive date prior to the contract effective date, Contractor must purchase extended reporting coverage for a minimum of three (3) years after completion of work.

Contractor must: (a) provide insurance certificates to the Contract Administrator, containing the agreement or purchase order number, at Contract formation and within 20 calendar days of the expiration date of the applicable policies; (b) require that subcontractors maintain the required insurances contained in this Section; (c) notify the Contract Administrator within 5 business days if any insurance is cancelled; and (d) waive all rights against the State for damages covered by insurance. Failure to maintain the required insurance does not limit this waiver.

This Section is not intended to and is not be construed in any manner as waiving, restricting or limiting the liability of either party for any obligations under this Contract (including any provisions hereof requiring Contractor to indemnify, defend and hold harmless the State).

8. **Extended Purchasing Program.** This Contract is extended to MiDEAL members. MiDEAL members include local units of government, school districts, universities, community colleges, and nonprofit hospitals. A current list of MiDEAL members is available at www.michigan.gov/mideal. Upon written agreement between the State and Contractor, this Contract may also be extended to other states (including governmental subdivisions and authorized entities).

If extended, Contractor must supply all Services and Deliverables at the established Contract prices and terms. The State reserves the right to negotiate additional discounts based on any increased volume generated by such extensions.

Contractor must submit invoices to, and receive payment from, extended purchasing program members on a direct and individual basis.

9. **Independent Contractor.** Contractor is an independent contractor and assumes all rights, obligations and liabilities set forth in this Contract. Contractor, its employees, and agents will not be considered employees of the State. No partnership or joint venture relationship is created by virtue of this Contract. Contractor, and not the State, is responsible for the payment of wages, benefits and taxes of Contractor's employees and any subcontractors. Prior performance does not modify Contractor's status as an independent contractor.

10. **Intellectual Property Rights**. Contractor hereby acknowledges that the State is and will be the sole and exclusive owner of all right, title, and interest in the Services and Deliverables and all associated intellectual property rights, if any. Such Services and Deliverables are works made for hire as defined in Section 101 of the Copyright Act of 1976. To the extent any Services and Deliverables and related intellectual property do not qualify as works made for hire under the Copyright Act, Contractor will, and hereby does, (a) immediately on its creation, assign, transfer and otherwise convey to the State, irrevocably and in perpetuity, throughout the universe, all right, title and interest in and to the Services and Deliverables, including all intellectual property rights therein, and (b) irrevocably waives any and all claims Contractor may now or hereafter have in any jurisdiction to so-called "moral rights" or rights of *droit moral* with respect to the Services or Deliverables. For purposes of this Contract, "**intellectual property rights**" means all or any of the following: (a) patents, patent disclosures, and inventions (whether patentable or not); (b) trademarks, service marks, trade dress, trade names, logos, corporate names, and domain names, together with all of the associated goodwill; (c) copyrights and copyrightable works (including computer programs), mask works and rights in data and databases; (d) trade secrets, know-how and other confidential information; and (e) all other intellectual property rights, in each case whether registered or unregistered and including all applications for, and renewals or extensions of, such rights, and all similar or equivalent rights or forms of protection provided by applicable law in any jurisdiction throughout the world.

11. **Subcontracting.**

    a. Contractor may not delegate any of its obligations under the Contract without the prior written approval of the State. Contractor must notify the State at least 3 calendar days before the proposed delegation, and provide the State any information it requests to determine whether the delegation is in its best interest. If approved, Contractor must: (a) be the sole point of contact regarding all contractual matters, including payment and charges for all Services and Deliverables; (b) make all payments to the subcontractor; and (c) incorporate the terms and conditions contained in this Contract in any subcontract with a subcontractor. Contractor remains responsible for the completion of the Services and Deliverables, compliance with the terms of this Contract, and the acts and omissions of the subcontractor. The State, in its sole discretion, may require the replacement of any subcontractor.

    b. Prior to the provision of Services or creation of Deliverables by any subcontractor:

        i. obtain from such subcontractor confidentiality, work-for-hire and intellectual property rights assignment agreements, in form and substance acceptable by the State, giving the State rights consistent with those set forth in **Section 10** and, upon request, provide the State with a fully-executed copy of each such contract; and

        ii. with respect to all subcontractor employees providing Services or Deliverables, comply with its obligations under **Section 3.b**.

12. **Assignment.** Contractor may not assign this Contract to any other party without the prior written approval of the State. Upon notice to Contractor, the State, in its sole discretion, may assign in whole or in part, its rights or responsibilities under this Contract to any other party.

13. **Acceptance.** All Services and Deliverables must conform to the specifications and requirements set forth in the applicable Statement of Work, including any attachments thereto. Unless otherwise provided in the applicable Statement of Work, this Section shall control acceptance of all Services and Deliverables. Services and Deliverables are subject to inspection by the State within fifteen (15) calendar days of the State's receipt of them ("**State Review Period**"). If the Services and Deliverables are not fully accepted by the State, the State will notify Contractor by the end of the State Review Period that either: (a) the Services or Deliverables are accepted, but noted deficiencies must be corrected; or (b) the Services or Deliverables are rejected. If the State finds material deficiencies, it may: (i) reject the Services or Deliverables without performing any further inspections; (ii) demand performance at no additional cost; or (iii) terminate the applicable Statement of Work in accordance with **Section 20**, Termination for Cause.

    Within ten (10) business days from the date of Contractor's receipt of notification of acceptance with deficiencies or rejection of any Services or Deliverables, Contractor must cure, at no additional cost, the deficiency and deliver acceptable Services or Deliverables to the State. If acceptance with deficiencies or rejection of the Services or Deliverables impacts the content or delivery of other non-completed Services or Deliverables, the parties' respective Project Managers must determine an agreed to number of days for re-submission that minimizes the overall impact to the Contract. However, nothing herein affects, alters, or relieves Contractor of its obligations to correct deficiencies in accordance with the time response standards set forth in this Contract.

    If Contractor is unable or refuses to correct the deficiency within the time response standards set forth in this Contract, the State may cancel the Statement of Work in whole or in part. The State, or a third party identified by the State, may perform the Services and recover the difference between the cost to cure and the Contract price plus an additional 10% administrative fee.

14. **Delivery of Physical Media.** Delivery of Physical Media must be FOB Destination, and delivered as follows:
    a. All GeoTIFF image tiles must be organized into one sub-directory per County and as items identified in MiSAIL Appendix A – Imagery Specifications, Section 7, Deliverables,
    b. Must be delivered to SOM via non-returnable external hard drive, and
    c. Each partner must also receive a non-returnable external hard drive with the GeoTIFF image tiles and items identified in MiSAIL Appendix A – Imagery Specifications, Section 7, Deliverables, for their AOI.

15. **Title and Risk of Loss**. Until final acceptance, title and risk of loss or damage to physical media Deliverables remains with Contractor. Contractor is responsible for filing, processing, and collecting all damage claims. The State will record and report to Contractor any evidence of visible damage. The risk of loss of rejected or non-conforming physical media Deliverables remains with Contractor. Contractor must reimburse the State for costs and expenses incurred in storing or effecting removal, return or disposition of rejected physical media Deliverables.

16. **Warranty.** Defects in imagery and LiDAR that are reported by the customer during the customer Quality Control (QC) period shall be corrected by re-acquisition and/or re-processing. Defects in image processing reported by the customer within 12 months of the delivery of final deliverables shall be corrected by re-processing.

17. **Terms of Payment.** Invoices must conform to the requirements set forth in the Statement of Work. Overtime, holiday pay, and travel expenses will not be paid. For this Contract, an invoice must be submitted for 25% of the project cost when acquisition is complete, with the remaining balance invoiced following final acceptance of Deliverables by the State. All undisputed amounts are payable within 45 days of the State's receipt. Contractor may only charge for Services and Deliverables performed as specified in the Statement of Work. Invoices must include an itemized statement of all charges. The State is exempt from State sales

tax for direct purchases and may be exempt from federal excise tax, if Services and Deliverables purchased under this Contract are for the State's exclusive use. Notwithstanding the foregoing, all prices are inclusive of taxes, and Contractor is responsible for all sales, use and excise taxes, and any other similar taxes, duties and charges of any kind imposed by any federal, state, or local governmental entity on any amounts payable by the State under this Contract.

The State has the right to withhold payment of any disputed amounts until the parties agree as to the validity of the disputed amount. The State will notify Contractor of any dispute within a reasonable time. Payment by the State will not constitute a waiver of any rights as to Contractor's continuing obligations, including claims for deficiencies or substandard Services or Deliverables. Contractor's acceptance of final payment by the State constitutes a waiver of all claims by Contractor against the State for payment under this Contract, other than those claims previously filed in writing on a timely basis and still disputed.

The State will only disburse payments under this Contract through Electronic Funds Transfer (EFT). Contractor must register with the State at http://www.michigan.gov/cpexpress to receive electronic fund transfer payments. If Contractor does not register, the State is not liable for failure to provide payment.

Without prejudice to any other right or remedy it may have, the State reserves the right to set off at any time any amount then due and owing to it by Contractor against any amount payable by the State to Contractor under this Contract.

18. **Liquidated Damages.**

a. The parties agree that any delay or failure by Contractor to timely perform its obligations in accordance with the Statement of Work will cause loss and damage to the State. Further, the State will incur major costs to perform the obligations that would have otherwise been performed by Contractor. The parties understand and agree that any liquidated damages Contractor must pay to the State as a result of such nonperformance are described in the Statement of Work, and that these amounts are reasonable estimates of the State's damages in accordance with applicable law.

b. The parties acknowledge and agree that Contractor could incur liquidated damages for more than one event if Contractor fails to timely perform its obligations for acquisition services and production services.

c. The assessment of liquidated damages will not constitute a waiver or release of any other remedy the State may have under this Contract for Contractor's breach of this Contract, including without limitation, the State's right to terminate a Statement of Work for cause under **Section 20**, and the State will be entitled in its discretion to recover actual damages caused by Contractor's failure to perform its obligations under this Contract. However, the State will reduce such actual damages by the amount of liquidated damages received for the same events causing the actual damages.

d. Amounts due the State as liquidated damages may be set off against any fees payable to Contractor under this Contract, or the State may bill Contractor as a separate item and Contractor will promptly make payments on such bills.

19. **Stop Work Order.** The State may suspend any or all activities under the Contract at any time. The State will provide Contractor a written stop work order detailing the suspension. Contractor must comply with the stop work order upon receipt. Within 90 calendar days, or any longer period agreed to by Contractor, the State will either: (a) issue a notice authorizing Contractor to resume work, or (b) terminate the Contract. The State will not pay for Services or Deliverables, Contractor's lost profits, or any additional compensation during a stop work period.

20. **Termination for Cause.** The State may terminate this Contract, or an individual Statement of Work, for cause, in whole or in part, if Contractor, as determined by the State: (a) endangers the value, integrity, or security of any State location, data, or personnel; (b) becomes insolvent, petitions for bankruptcy court proceedings, or has an involuntary bankruptcy proceeding filed against it by any creditor; (c) engages in any conduct that may expose the State to liability; (d) breaches any of its material duties or obligations under this Contract; or (e) fails to cure a breach within the time stated in a notice of breach. Any reference to specific breaches being material breaches within this Contract will not be construed to mean that other breaches are not material.

    If the State terminates this Contract, or a individual Statement of Work, under this Section, the State will issue a termination notice specifying whether Contractor must: (a) cease performance immediately, or (b) continue to perform for a specified period. If it is later determined that Contractor was not in breach of the Contract, the termination will be deemed to have been a termination for convenience, effective as of the same date, and the rights and obligations of the parties will be limited to those provided in Section 21, Termination for Convenience.

    The State will only pay for amounts due to Contractor for Services and Deliverables accepted by the State on or before the date of termination, subject to the State's right to set off any amounts owed by the Contractor for the State's reasonable costs in terminating this Contract. Contractor must reimburse the State for any prepaid fees. The Contractor must pay all reasonable costs incurred by the State in terminating this Contract for cause, including administrative costs, attorneys' fees, court costs, transition costs, and any costs the State incurs to procure the Services and Deliverables from other sources.

21. **Termination for Convenience.** The State may immediately terminate this Contract, or an individual Statement of Work, in whole or in part without penalty and for any reason, including but not limited to, appropriation or budget shortfalls. The termination notice will specify whether Contractor must: (a) cease performance of the Services immediately, or (b) continue to perform the Services in accordance with **Section 22**, Transition Responsibilities. If the State terminates this Contract for convenience, the State will pay all reasonable costs, as determined by the State, for State approved Transition Responsibilities.

22. **Transition Responsibilities.** Upon termination or expiration of this Contract for any reason, Contractor must, for a period of time specified by the State (not to exceed 90 calendar days), provide all reasonable transition assistance requested by the State, to allow for the expired or terminated portion of the Services and Deliverables to continue without interruption or adverse effect, and to facilitate the orderly transfer of such Services and Deliverables to the State or its designees. Such transition assistance may include, but is not limited to: (a) continuing to perform the Services at the established Contract rates; (b) taking all reasonable and necessary measures to transition performance of the work, including all applicable Services, training, reports and other documentation, to the State or the State's designee; (c) taking all necessary and appropriate steps, or such other action as the State may direct, to preserve, maintain, protect, or return to the State all materials, data, property, and confidential information provided directly or indirectly to Contractor by any entity, agent, vendor, or employee of the State; (d) transferring title in and delivering to the State, at the State's discretion, all completed or partially completed Deliverables prepared under this Contract as of the Contract termination date; and (e) preparing an accurate accounting from which the State and Contractor may reconcile all outstanding accounts (collectively, "**Transition Responsibilities**"). This Contract will automatically be extended through the end of the transition period.

23. **General Indemnification.** Contractor must defend, indemnify and hold the State, its departments, divisions, agencies, offices, commissions, officers, and employees harmless, without limitation, from and against any and all actions, claims, losses, liabilities, damages, costs, attorney fees, and expenses (including those required to establish the right to indemnification), arising out of or relating to: (a) any breach by Contractor (or any of Contractor's employees, agents, subcontractors, or by anyone else for whose acts any of them may be liable) of any of the promises, agreements, representations, warranties, or insurance requirements contained in this Contract; (b) any infringement, misappropriation, or other violation of any intellectual property right or other right of any third party; (c) any bodily injury, death, or damage to real or tangible personal property occurring wholly or in part due to action or inaction by Contractor (or any of Contractor's employees, agents, subcontractors, or by anyone else for whose acts any of them may be

liable); and (d) any acts or omissions of Contractor (or any of Contractor's employees, agents, subcontractors, or by anyone else for whose acts any of them may be liable).
The State will notify Contractor in writing if indemnification is sought; however, failure to do so will not relieve Contractor, except to the extent that Contractor is materially prejudiced. Contractor must, to the satisfaction of the State, demonstrate its financial ability to carry out these obligations.

The State is entitled to: (i) regular updates on proceeding status; (ii) participate in the defense of the proceeding; and (iii) employ its own counsel. Contractor will not, without the State's written consent (not to be unreasonably withheld), settle, compromise, or consent to the entry of any judgment in or otherwise seek to terminate any claim, action, or proceeding. To the extent that any State employee, official, or law may be involved or challenged, the State may, at its own expense, control the defense of that portion of the claim.

Any litigation activity on behalf of the State, or any of its subdivisions under this Section, must be coordinated with the Department of Attorney General. An attorney designated to represent the State may not do so until approved by the Michigan Attorney General and appointed as a Special Assistant Attorney General.

24. **Infringement Remedies.** If, in either party's opinion, any of the Services or Deliverables supplied by Contractor or its subcontractors, or its operation, use or reproduction, is likely to become the subject of a copyright, patent, trademark, or trade secret infringement claim, Contractor must, at its expense: (a) procure for the State the right to continue using the Services or Deliverables, or if this option is not reasonably available to Contractor, (b) replace or modify the same so that it becomes non-infringing; or (c) accept its return by the State with appropriate credits to the State against Contractor's charges and reimburse the State for any losses or costs incurred as a consequence of the State ceasing its use and returning it.

25. **Limitation of Liability.** THE STATE WILL NOT BE LIABLE, REGARDLESS OF THE FORM OF ACTION, WHETHER IN CONTRACT, TORT, NEGLIGENCE, STRICT LIABILITY OR BY STATUTE OR OTHERWISE, FOR ANY CLAIM RELATED TO OR ARISING UNDER THIS CONTRACT FOR CONSEQUENTIAL, INCIDENTAL, INDIRECT, OR SPECIAL DAMAGES, INCLUDING WITHOUT LIMITATION LOST PROFITS AND LOST BUSINESS OPPORTUNITIES. IN NO EVENT WILL THE STATE'S AGGREGATE LIABILITY TO CONTRACTOR UNDER THIS CONTRACT EXCEED THE MAXIMUM AMOUNT OF FEES SPECIFIED IN THE APPLICABLE STATEMENT OF WORK.

26. **Disclosure of Litigation, or Other Proceeding.** Contractor must notify the State within 14 calendar days of receiving notice of any litigation, investigation, arbitration, or other proceeding (collectively, "**Proceeding**") involving Contractor, a subcontractor, or an officer or director of Contractor or subcontractor, that arises during the term of the Contract, including: (a) a criminal Proceeding; (b) a parole or probation Proceeding; (c) a Proceeding under the Sarbanes-Oxley Act; (d) a civil Proceeding involving: (1) a claim that might reasonably be expected to adversely affect Contractor's viability or financial stability; or (2) a governmental or public entity's claim or written allegation of fraud; or (e) a Proceeding involving any license that Contractor is required to possess in order to perform under this Contract.

27. **Non-Disclosure of Confidential Information**. The parties acknowledge that each party may be exposed to or acquire communication or data of the other party that is confidential, privileged communication not intended to be disclosed to third parties. The provisions of this Section survive the termination of this Contract.

    a. Meaning of Confidential Information. For the purposes of this Contract, the term "**Confidential Information**" means all information and documentation of a party that: (a) has been marked "confidential" or with words of similar meaning, at the time of disclosure by such party; (b) if disclosed orally or not marked "confidential" or with words of similar meaning, was subsequently summarized in writing by the disclosing party and marked "confidential" or with words of similar meaning; and, (c) should reasonably be recognized as confidential information of the disclosing party. The term "Confidential Information" does not include any information or documentation that was or is: (a) subject to disclosure under the Michigan Freedom of Information Act (FOIA) by the receiving party; (b) already in the possession of the receiving party without an obligation of confidentiality; (c) developed independently by the receiving party, as demonstrated by the receiving party, without violating the disclosing party's proprietary rights; (d) obtained from a source

other than the disclosing party without an obligation of confidentiality; or, (e) publicly available when received, or thereafter became publicly available (other than through any unauthorized disclosure by, through, or on behalf of, the receiving party).

b. Obligation of Confidentiality. The parties agree to hold all Confidential Information in strict confidence and not to copy, reproduce, sell, transfer, or otherwise dispose of, give or disclose such Confidential Information to third parties other than employees, agents, or subcontractors of a party who have a need to know in connection with this Contract or to use such Confidential Information for any purposes whatsoever other than the performance of this Contract. The parties agree to advise and require their respective employees, agents, and subcontractors of their obligations to keep all Confidential Information confidential. Disclosure to a subcontractor is permissible where: (a) use of a subcontractor is authorized under this Contract; (b) the disclosure is necessary or otherwise naturally occurs in connection with work that is within the subcontractor's responsibilities; and (c) Contractor obligates the subcontractor in a written contract to maintain the State's Confidential Information in confidence. At the State's request, any employee of Contractor or any subcontractor may be required to execute a separate agreement to be bound by the provisions of this Section.

c. Cooperation to Prevent Disclosure of Confidential Information. Each party must use its best efforts to assist the other party in identifying and preventing any unauthorized use or disclosure of any Confidential Information. Without limiting the foregoing, each party must advise the other party immediately in the event either party learns or has reason to believe that any person who has had access to Confidential Information has violated or intends to violate the terms of this Contract and each party will cooperate with the other party in seeking injunctive or other equitable relief against any such person.

d. Remedies for Breach of Obligation of Confidentiality. Each party acknowledges that breach of its obligation of confidentiality may give rise to irreparable injury to the other party, which damage may be inadequately compensable in the form of monetary damages. Accordingly, a party may seek and obtain injunctive relief against the breach or threatened breach of the foregoing undertakings, in addition to any other legal remedies which may be available, to include, in the case of the State, at the sole election of the State, the immediate termination, without liability to the State, of this Contract or any Statement of Work corresponding to the breach or threatened breach.

e. Surrender of Confidential Information upon Termination. Upon termination of this Contract or a Statement of Work, in whole or in part, each party must, within 5 calendar days from the date of termination, return to the other party any and all Confidential Information received from the other party, or created or received by a party on behalf of the other party, which are in such party's possession, custody, or control. Should Contractor or the State determine that the return of any Confidential Information is not feasible, such party must destroy the Confidential Information and must certify the same in writing within 5 calendar days from the date of termination to the other party.

28. **Records Maintenance, Inspection, Examination, and Audit.** The State or its designee may audit Contractor to verify compliance with this Contract. Contractor must retain, and provide to the State or its designee and the auditor general upon request, all financial and accounting records related to the Contract through the term of the Contract and for 4 years after the latter of termination, expiration, or final payment under this Contract or any extension ("**Audit Period**"). If an audit, litigation, or other action involving the records is initiated before the end of the Audit Period, Contractor must retain the records until all issues are resolved.

Within 10 calendar days of providing notice, the State and its authorized representatives or designees have the right to enter and inspect Contractor's premises or any other places where Services are being performed, and examine, copy, and audit all records related to this Contract. Contractor must cooperate and provide reasonable assistance. If any financial errors are revealed, the amount in error must be

reflected as a credit or debit on subsequent invoices until the amount is paid or refunded. Any remaining balance at the end of the Contract must be paid or refunded within 45 calendar days.

This Section applies to Contractor, any parent, affiliate, or subsidiary organization of Contractor, and any subcontractor that performs Services in connection with this Contract.

29. **Warranties and Representations.** Contractor represents and warrants to the State that: (a) it will perform all Services in a professional and workmanlike manner in accordance with best industry standards and practices for similar services, using personnel with the requisite skill, experience and qualifications, and will devote adequate resources to meet its obligations under the applicable Statement of Work; (b) the Services and Deliverables provided by Contractor will not infringe the patent, trademark, copyright, trade secret, or other proprietary rights of any third party; (c) it has the full right, power, and authority to enter into this Contract, to grant the rights granted under this Contract, and to perform its contractual obligations; and (d) all information furnished and representations made in connection with the award of this Contract is true, accurate, and complete, and contains no false statements or omits any fact that would make the information misleading. A breach of this Section is considered a material breach of this Contract, which entitles the State to terminate this Contract under **Section 20**, Termination for Cause.

30. **Conflicts and Ethics.** Contractor will uphold high ethical standards and is prohibited from: (a) holding or acquiring an interest that would conflict with this Contract; (b) doing anything that creates an appearance of impropriety with respect to the award or performance of the Contract; (c) attempting to influence or appearing to influence any State employee by the direct or indirect offer of anything of value; or (d) paying or agreeing to pay any person, other than employees and consultants working for Contractor, any consideration contingent upon the award of the Contract. Contractor must immediately notify the State of any violation or potential violation of these standards. This Section applies to Contractor, any parent, affiliate, or subsidiary organization of Contractor, and any subcontractor that performs Services in connection with this Contract.

31. **Compliance with Laws.** Contractor must comply with all federal, state and local laws, rules and regulations.

32. **Change of Control.** Contractor will notify, at least 90 calendar days before the effective date, the State of a change in Contractor's organizational structure or ownership. For purposes of this Contract, a change in control means any of the following: (a) a sale of more than 50% of Contractor's stock; (b) a sale of substantially all of Contractor's assets; (c) a change in a majority of Contractor's board members; (d) consummation of a merger or consolidation of Contractor with any other entity; (e) a change in ownership through a transaction or series of transactions; (f) or the board (or the stockholders) approves a plan of complete liquidation. A change of control does not include any consolidation or merger effected exclusively to change the domicile of Contractor, or any transaction or series of transactions principally for bona fide equity financing purposes.

    In the event of a change of control, Contractor must require the successor to assume this Contract and all of its obligations under this Contract.

33. **Nondiscrimination.** Under the Elliott-Larsen Civil Rights Act, 1976 PA 453, MCL 37.2101, *et seq*., and the Persons with Disabilities Civil Rights Act, 1976 PA 220, MCL 37.1101, *et seq*., Contractor and its subcontractors agree not to discriminate against an employee or applicant for employment with respect to hire, tenure, terms, conditions, or privileges of employment, or a matter directly or indirectly related to employment, because of race, color, religion, national origin, age, sex, height, weight, marital status, or mental or physical disability. Breach of this covenant is a material breach of this Contract.

34. **Unfair Labor Practice.** Under MCL 423.324, the State may void any Contract with a Contractor or subcontractor who appears on the Unfair Labor Practice register compiled under MCL 423.322.

35. **Governing Law.** This Contract is governed, construed, and enforced in accordance with Michigan law, excluding choice-of-law principles, and all claims relating to or arising out of this Contract are governed by Michigan law, excluding choice-of-law principles. Any dispute arising from this Contract must be resolved in Michigan Court of Claims. Contractor consents to venue in Ingham County, and waives any objections, such as lack of personal jurisdiction or *forum non conveniens*. Contractor must appoint agents in Michigan to receive service of process.

36. **Non-Exclusivity.** Nothing contained in this Contract is intended nor will be construed as creating any requirements contract with Contractor. This Contract does not restrict the State or its agencies from acquiring similar, equal, or like Services from other sources.

37. **Force Majeure.** Neither party will be in breach of this Contract because of any failure arising from any disaster or acts of god that are beyond their control and without their fault or negligence. Each party will use commercially reasonable efforts to resume performance. Contractor will not be relieved of a breach or delay caused by its subcontractors. If immediate performance is necessary to ensure public health and safety, the State may immediately contract with a third party.

38. **Dispute Resolution.** The parties will endeavor to resolve any Contract dispute in accordance with this provision. The dispute will be referred to the parties' respective Project Managers. Such referral must include a description of the issues and all supporting documentation. The parties must submit the dispute to their Contract Administrator if unable to resolve the dispute within fifteen (15) business days. The parties will continue performing while a dispute is being resolved, unless the dispute precludes performance. A dispute involving payment does not preclude performance.

    Litigation to resolve the dispute will not be instituted until after the dispute has been elevated to the parties' senior executive and either concludes that resolution is unlikely, or fails to respond within fifteen (15) business days. The parties are not prohibited from instituting formal proceedings: (a) to avoid the expiration of statute of limitations period; (b) to preserve a superior position with respect to creditors; or (c) where a party makes a determination that a temporary restraining order or other injunctive relief is the only adequate remedy. This Section does not limit the State's right to terminate the Contract.

39. **Media Releases.** News releases (including promotional literature and commercial advertisements) pertaining to the Contract or project to which it relates must not be made without prior written State approval, and then only in accordance with the explicit written instructions of the State.

40. **Severability.** If any part of this Contract is held invalid or unenforceable, by any court of competent jurisdiction, that part will be deemed deleted from this Contract and the severed part will be replaced by agreed upon language that achieves the same or similar objectives. The remaining Contract will continue in full force and effect.

41. **Waiver.** Failure to enforce any provision of this Contract will not constitute a waiver.

42. **Survival.** The provisions of this Contract that impose continuing obligations, including warranties and representations, termination, transition, insurance coverage, indemnification, and confidentiality, will survive the expiration or termination of this Contract.

43. **Entire Agreement.** This Contract, including Statements of Work, constitutes the sole and entire agreement of the parties to this Contract with respect to the subject matter contained herein, and supersedes all prior and contemporaneous understandings and agreements, both written and oral, with respect to such subject matter. In the event of any conflict between the terms of this Contract and those of any Statement of Work or other document, the following order of precedence governs: (a) first, this Contract; and (b) second, an individual Statement of Work as of the Effective Date of that Statement of Work. NO TERMS ON CONTRACTOR'S WEBSITE, BROWSE-WRAP, SHRINK-WRAP, CLICK-WRAP OR OTHER NON-NEGOTIATED TERMS AND CONDITIONS PROVIDED WITH ANY OF THE SERVICES, OR DOCUMENTATION HEREUNDER WILL CONSTITUTE A PART OR AMENDMENT OF THIS CONTRACT

OR IS BINDING ON THE STATE OR ANY AUTHORIZED USER FOR ANY PURPOSE. ALL SUCH OTHER TERMS AND CONDITIONS HAVE NO FORCE AND EFFECT AND ARE DEEMED REJECTED BY THE STATE AND THE AUTHORIZED USER, EVEN IF ACCESS TO OR USE OF SUCH SERVICE OR DOCUMENTATION REQUIRES AFFIRMATIVE ACCEPTANCE OF SUCH TERMS AND CONDITIONS.

STATE OF MICHIGAN

Contract No. **071B6600036**
LiDAR Services and Optional Hosting

EXHIBIT A STATEMENT OF WORK CONTRACT ACTIVITIES

I. Background

This Contract is designed to expand the availability of high quality data through the addition of Light-Detection and Ranging (LiDAR) data. In addition, the State plans to extend services and pricing established through this Contract to State partners, which may include, but are not limited to, local and federal government entities (collectively, "**State Partners**"). This Contract also includes optional imagery hosting services and optional offshore pricing for imagery to be used in cases where offshore completion of work is acceptable.

II. Required Services and Deliverables.

Contractor must provide the following services ("**Services**") and deliverables ("**Deliverables**"):

1. Contractor must provide Light-Detection and Ranging (LiDAR) and associated products. See Attachment 1 – LiDAR Specifications for more detailed specifications.

2. All Services and Deliverables will be implemented using the following process:

1. The State will issue an initial, project-specific Statement of Work to Contractor, defining the individual project and its specific requirements (the "**Project SOW**").
2. Within ten (10) business days of receipt of the initial Project SOW, Contractor must respond with a written proposal for implementing the requested Project SOW, which must include Contractor's: (i) proposed modifications and clarifications and (ii) proposed costs for completing the project.
3. The State will have ten (10) business days to review and, in its discretion, approve or raise objections to Contractor's response proposal. If the State raises any objections, the parties shall negotiate in good faith to amend the proposal, provided that, to the extent the proposal does not comply with the requirements of this Contract or the State's requirements set forth in the Project SOW, it shall be amended to so comply.
4. Upon the parties' agreement to a final Project SOW, each party shall cause the same to be executed by its project manager ("**Project Manager**"). The State will then issue a formal purchase order, which will reference the executed Project SOW (the "**Purchase Order**").
5. After the flight and Contractor data preparation activities covered under the final Project SOW included with the Purchase Order take place, the following process will be utilized for revisions, correction and acceptance:
    i. Contractor shall provide access to the data Deliverables via an application on a secure website as described in IV-A below. The application shall provide **timely access** to data processed for this project. Timely access means specifically, i**magery shall become available for viewing with the completion of the first AOI**.
    ii. A 2-week time period designated for State Quality Control (QC) on each AOI made available for review will commence upon data delivery to the OGC WMS imagery service.
    iii. Imagery made available for review shall be fully processed and shall have passed the

Contractor's preliminary quality control process.

iv. The application shall allow project stake-holders the ability to review ortho-imagery, identification and attribute items requiring discussion between the State's Project Manager and the Contractor's PM to determine correction/resolution activities necessary for acceptance of Deliverables.

v. Defects in imagery collection that are found and reported as a result of the QC process by the customer, shall be corrected by re-processing.

vi. Final corrected imagery data including all required peripherals for each season shall be delivered to the customer within 4 months of the end of the applicable flying season. This time period includes the 2-week QC period described above. **Timely receipt of Deliverables, means specifically, all corrections are made and data is acceptable to customer within the 4-month window.**

vii. Defects discovered after receipt and acceptance of final deliverable(s) shall be covered under the Warranty provisions, Terms and Conditions, Section 16.

III. Optional Services and Deliverables.

Contractor will provide imagery hosting services as outlined in SOWs and Purchase Orders (PO) issued against this contract for these optional services. See Attachment 2 – Optional Imagery Hosting Service for more detailed specifications.

IV. Detailed Requirements for Services and Deliverables

A more detailed description of the required Services and Deliverables and the optional Services and Deliverables is provided in the Sections below.

ALL DELIVERABLES, AND ASSOCIATED DATA, ACQUIRED UNDER THIS CONTRACT ARE COVERED BY THE RULES SET FORTH IN THE MICHIGAN ENHANCED ACCESS TO PUBLIC RECORDS ACT, ACT 462 OF 1996, WHICH ALLOWS THE STATE TO CHARGE REASONABLE FEES FOR ACCESS TO THE DELIVERABLES. FURTHER, PURSUANT TO SECTION 10 OF THE STANDARD CONTRACT TERMS, THE STATE WILL BE THE SOLE AND EXCLUSIVE OWNER OF ALL RIGHT, TITLE, AND INTEREST IN THE SERVICES AND DELIVERABLES AND ALL ASSOCIATED INTELLECTUAL PROPERTY RIGHTS THERETO.

A. Required - LiDAR Acquisition and Data

For purposes of this Contract, "acquisition" means perform all tasks necessary to plan and coordinate flying missions, maintaining equipment and operating airborne sensors and ensuring that all data is collected and organized for further processing. Contractor must be ready to fly and begin LiDAR Acquisition by March 1, 2016. Contractor will provide the services in accordance with the requirements set forth in the Project SOW. Individual projects will vary, based on the specific needs of the State and its State Partners. Without making any binding commitment to purchase a specific amount of Services or Deliverables, the State anticipates a potential need for ad-hoc LiDAR projects.

Tasks will be identified within the Project SOW.

Specific types of data to be provided will be determined within the Project SOW. However, general details of the data to be provided are listed in Attachment 1 – LiDAR Specifications. Specifications are based on the United States Geologic Survey (USGS) Lidar Base Specification Version 1.2 (http://pubs.usgs.gov/tm/11b4/). Version 2.0 is expected to be released in 2016. Contractor must be willing to accommodate mutually agreed upon updates to Attachment 1 - LiDAR Specifications based on changes that may occur in the USGS V2.0. Should significant changes to the Base Specification occur in V2.0, mutually agreed upon cost adjustments may be required.

Deliverables and Acceptance Criteria

Contractor will provide Deliverables as identified in the Project SOW. All data provided under the Contract shall be considered a Deliverable of the specific Project SOW and shall be subject to the State's review and acceptance, based on the requirements set forth in the Project SOW and the Standard Contract Terms.

Contractor Commitment:

A.1 LiDAR Acquisition

Project Planning

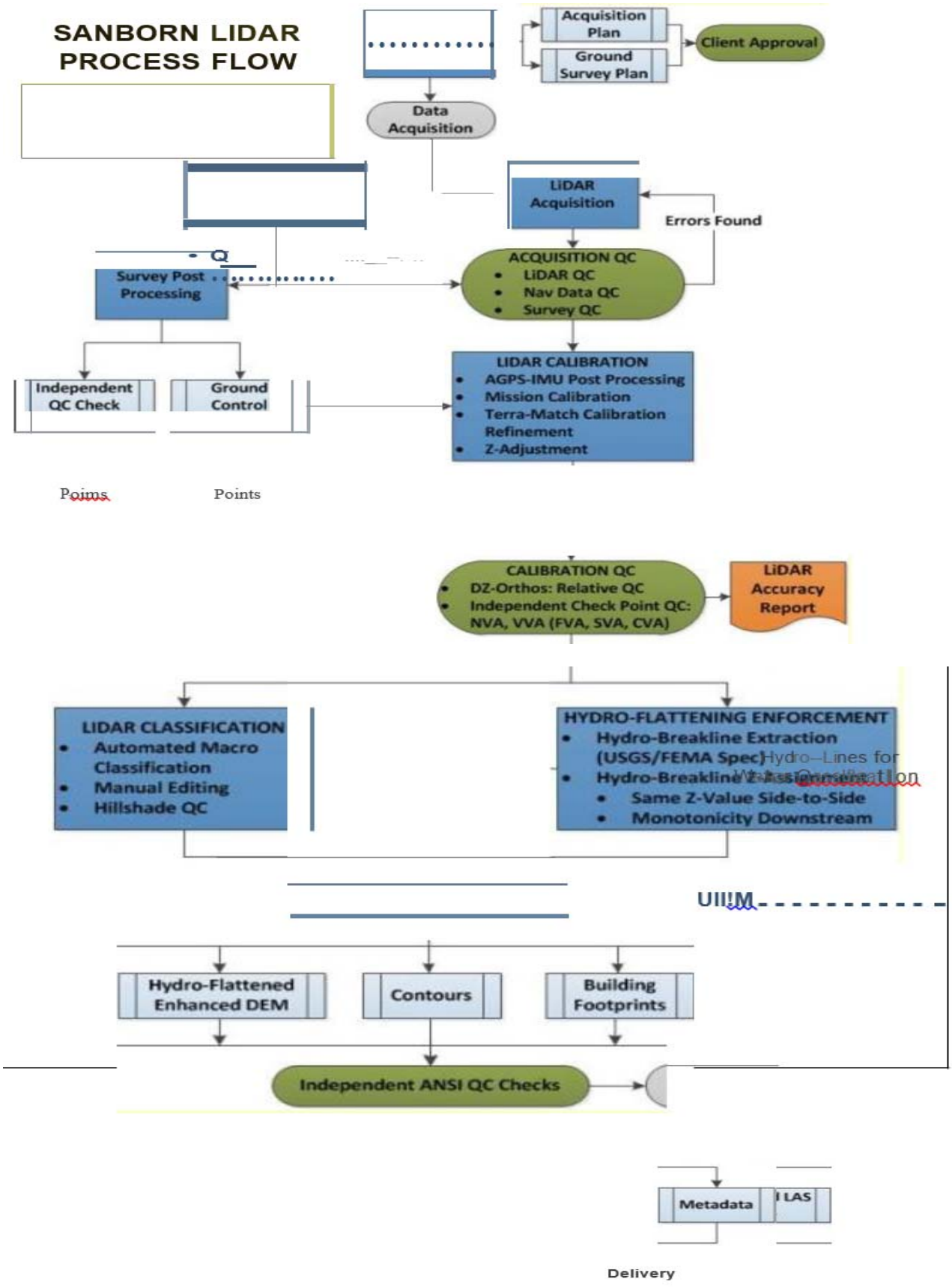
Project planning will begin when Contractor's project manager receives a Statement of Work and ESRI shapefiles for the AOI(s) from the State. As the program manager, Contractor will be performing all planning and coordination associated with LiDAR data acquisition.

Contractor will be directly responsible for all tasks related to acquisition, processing, and quality control of LiDAR data and related deliverables. Following primary data acquisition, all work will be performed in Contractors headquarters office.

The State's roles and responsibilities under the LiDAR portion of the program will be to:

- Provide an ESRI Shapefile defining the area of interest and any required buffer;
- Provide a Statement of Work that clearly outlines the data products desired, makes clear choices where there are options associated with the technical specifications, and states any requirements and specifications that differ from those in "MiSAIL Attachment 1 - Lidar Specifications" of the RFP;
- Coordinate and communicate with Contractor, or facilitate coordination and communication between Contractor and the State's partner(s) for whom the Statement of Work is being performed;
- Review Contractor's LiDAR flight plans and related documents, and provide comments or approval in a timely manner;
- Perform reviews and quality control checks of interim and final deliverables in a timely manner, and communicate the results to Contractor;
- Respond in a timely manner to requests for information, data, and meetings or conference calls;
- Coordinate with Contractor regarding fees, scheduling, and other administrative matters.
- Process all contractually-related documents in a timely manner; and
- Review and pay Contractor's invoices in a timely manner.

The major phases of a LiDAR project lifecycle are illustrated in the flowchart on the following page.


SANBORN LIDAR PROCESS FLOW
Acquisition Plan
Ground Survey Plan
Client Approval
Data Acquisition
LiDAR Acquisition
Errors Found
Survey Post Processing
ACQUISITION QC
LiDAR QC
Nav Data QC
Survey QC
Independent QC Check
Ground Control
LIDAR CALIBRATION
AGPS-IMU Post Processing
Mission Calibration
Terra-Match Calibration Refinement
Z-Adjustment
Poims
Points
CALIBRATION QC
DZ-Orthos: Relative QC
Independent Check Point QC: NVA, VVA (FVA, SVA, CVA)
LiDAR Accuracy Report
LIDAR CLASSIFICATION
Automated Macro Classification
Manual Editing
Hillshade QC
HYDRO-FLATTENING ENFORCEMENT
Hydro-Breakline Extraction (USGS/FEMA Spec)
Hydro-Breakline Z-Assignment
Same Z-Value Side-to-Side
Monotonicity Downstream
Hydro-Flattened Enhanced DEM
Contours
Building Footprints
Independent ANSI QC Checks
Metadata
LAS
Delivery

Sensor Selection

Contractor operates the Leica ALS70-HP sensor, which is the primary system they will use to task on the State's projects. Contractor has developed processes to integrate multiple sensors into the LiDAR workflow if the added capacity is needed, and has standardized
data formatting to maintain data integrity and accuracies.

Installation Calibration

Contractor conducts rigorous and regular calibration of LiDAR systems. All sensors are calibrated: (1) prior to and after installation (2) every three months, and (3) during every mission. This enables Contractor to guarantee the data accuracies required.

Contractor performs extensive calibration and GPS lever arm surveys for all sensors and aircraft installations. The GPS antenna in the aircraft and its reference to the LiDAR sensor head are surveyed using a Leica total station. Several reference points on the aircraft and sensor are measured to validate the location of the GPS antenna in relation to the sensor head. These reference points include the tail, nose, antenna, sensor reference location, and a point below sensor scanner on the ground. This process consistently yields GPS lever arm offsets (x, y, z) locations within two millimeters or less.

A LiDAR sensor is calibrated after every installation into an aircraft. Providing a stable platform of all sensors is critical for project success so the removal and installation of sensors from Contractor's aircraft seldom occurs. As a result, Contractor has instituted a routine calibration schedule of every three months for every LiDAR sensor.

Given that Contractor's sensors remain stable once in an aircraft platform, it is often not necessary to change these parameters, but it is necessary to validate them routinely. In addition, several tests are done on the IMU and GPS systems to validate proper operation and accuracy. It is imperative to continuously check these sensors and make necessary adjustments as required.

Airborne LiDAR Acquisition

Contractor recognizes that one of the most critical phases of this project is acquisition of LiDAR. Timely collection of consistent, high quality LiDAR and related data is the foundation for generating high quality derivative data products.

Contractor's aerial LiDAR team provides the following:

- Extensive, wholly-owned data acquisition resources to ensure collection within optimal windows of opportunity;
- A fleet of fifteen (15) aircraft, including high performance multi-engine and turbine-powered aircraft and one craft that is equipped with dual ports, and is capable of performing acquisition with multiple sensors;
- Three (3) airborne LiDAR systems; and
- Aircrews with 3 years of experience throughout the State of Michigan under the MISAIL program.

Acquisition Equipment and Resources

A summary of LiDAR acquisition assets available to the State through Contractor's airborne data acquisition team is shown below.

Owner	Aircraft Type and FAA Registration Number	Camera Systems
Sanborn	Piper Navajo PA-31-325; N27693 Piper Navajo PA-31-310; N278RC Aero Commander 500S; N9UB Aero Commander 500B; 6172X Turbo Commander 680W; N940U Aero Commander 680FL; N4998E Aero Commander 690B; N600WS	One (1) Leica ALS70 HP Airborne LiDAR System

	Aero Commander 690A; N892WA Aero Commander 690A; N690EH Cessna TU206F; N603ET Cessna TU206G; N735BT Cessna TU206G; N2326B	
DAS	Cessna Conquest II; N207SS Cessna 421C; N112MJ Cessna 421C; N13RF	One (1) Leica ALS80 HP Airborne LiDAR System One (1) Leica ALS60 Airborne LiDAR System

Acquisition Resource Plan

Contractor recognizes the exceptional challenges involved in acquiring quality LiDAR in a timely manner in the State of Michigan, especially where snow free and leaf-off conditions are concerned, combined with weather conditions suitable for optimal collection. The necessary combination of conditions prevail for only a few weeks during the spring and fall flying seasons, making resource planning and adequate application of resources critical to successful acquisition.

Based upon the experience gained over the past three years flying in the State of Michigan, and using the meteorological and analytical tools available, contractor knows that they have a weather factor of approximately 2.5:1 for LiDAR. This means that for every day of optimal flying conditions, they will have about 2.5 days of suboptimal conditions. This allows them to calculate a conservative estimate of the number of aircraft and sensors required to complete acquisition for each AOI in a timely manner, and make them available to the program during the flying season. Additional resources can be allocated if weather or ground conditions, or the amount of LiDAR to be collected changes during the flying season. LiDAR systems can be operated day and night, and both Contractor and approved subcontractor are capable of deploying multiple crews with each aircraft and LiDAR system in order to enhance collection capacity.

Mission Planning

Contractor will carefully plan all missions to ensure that resulting data will be compliant with the requirements set for the program, and review their proposed flight and plans with the State prior to mobilizing any airborne resources. Proposed plans will be provided to the State in shapefile format at least two weeks prior to mobilization. The table below presents acquisition specifications for a typical QL2 LiDAR collection.

Planning is performed by Contractor's flight department, in close cooperation with their project manager and their acquisition manager. All flight and control plans will be reviewed by Contractor's Mapping Operations Director.

Contractor's flight planning is based upon the shapefile AOI boundaries and the requirements in the Statements of Work provided by the State. Contractor will add a buffer around the perimeter of the AOI to ensure adequate LiDAR coverage.

A summary of procedures and considerations in flight mission planning is as follows:

- Contractor will prepare a digital flight line layout for the project area(s) using Track'Air software, taking into account the configuration of the proposed LiDAR sensor.
- Contractor will limit our flight line lengths in the collection areas in order to ensure proper function of the ABGPS and IMU systems and the integrity of their data.
- Contractor's flight plan will contain the following information:
    - Projected flight lines
    - Flight line numbers
    - Intended coverage
    - Flight altitude

- Contractor will overlay the flight line layout over Google Earth imagery, and determine optimum locations for the placement of calibration points, ground checkpoints, and GPS base stations. Following the State's approval, the control locations will be passed along to the project surveyor who will survey in the required points and provide any other needed resources or information in support of the airborne acquisition mission.
- The final flight line map will be delivered in ESRI shapefile format.

Mobilization Planning

Contractor will perform mobilization planning to ensure that airborne data acquisition can progress in accordance with the project schedule. This will include:

- Monitoring conditions to determine when the ground is clear of snow, leaf conditions of deciduous trees, and the conditions of lakes, streams and rivers.
- Monitoring weather conditions.
- Locating airports at which to stage aircraft and aircrews, and arranging for their accommodations.
- Coordinating the activities of our acquisition subcontractors.
- Making arrangements to access restricted airspace, if needed. Contractor will coordinate all flight plans with air traffic control (ATC) well in advance of mobilization.
- Monitoring GNSS satellite configuration

Mission Execution

LiDAR acquisition is accomplished by flight crews who will be temporarily based in close proximity to the collection areas. The acquisition team will monitor flight conditions and determine, in coordination with Contractor's project manager and the State, when to initiate LiDAR collection flights. As we have during the past contract period, Contractor will hold daily calls with the State and its partners during the acquisition season to determine if optimal conditions for flying exist for each AOI, and if there are any special issues to be considered, such as unusual flooding.

Contractor relies on a variety of sources to determine the suitability of conditions for acquisition. Our first and primary source is the flight crews and surveyors in the areas of interest. Flight crews are trained to observe and report the conditions as they see them on the ground and in flight. We will also coordinate with and defer to the State and its Environmental Conditions (EC) contact(s) if there is any question regarding suitability of conditions. Finally, there are a variety of ways to observe conditions remotely, including NOAA weather reporting stations, daily weather satellite reports, weather video cams, and a variety of public sources that can be accessed for detailed observations.

- Here are the key operational best practices that Contractor employs to ensure the quality of the LiDAR data acquisition:
- Calibration lines: For each LiDAR mission
  - 1 parallel and 1 perpendicular to the run-way at the beginning of the flight
  - 2 parallel to the run-way at the end of the flight
- 2 cross flights are planned at the each edge of the block.
- Cross-flights are planned to connect adjacent flight blocks.
- The quality of the GPS-IMU solution is critical to LiDAR. In order to make sure that we are getting the best quality of GPS-IMU solution, here are the key operational considerations:
  - The base-line distance should be less than 25 miles
  - Only the CORS stations with 1 hertz frequency or better are considered to be usable for GPS-IMU processing
  - Kp index less than 4
  - PDoP < 3.2: Minimum satellite lock of 6 satellites.
  - Airplane banking turn angles < 20 degrees for LiDAR
  - The plane sits static on the tarmac for about 10 minutes before (after the GPS is turned on) and 10 minutes after the collection (before switching off the system)

        - A single flight-line is never planned to be longer than 20 minutes at a stretch. This is to minimize the IMU-drifting affect
    - The deviation from the planned flight course should be less than 5 degrees in all three angular degree of freedoms (roll<5 degrees; pitch<5 degrees and heading <5 degrees).
    - The plane will to stay on course within 50-70 ft from the planned trajectory (in the horizontal plane).
    - All the arrangements and timing coordination for restricted airspaces are made before mobilizing to the project site.
    - Teams monitor atmospheric and safety considerations, including relative humidity, clouds and haze conditions. If smoke exists in the collection area, missions will not be flown.
    - If optimal conditions exist at night, operations can be conducted then as well. We will not collect data in moderate to severe turbulence, or with a cross wind of 25 knots or more.
    - Contractor employs QC processes during and immediately following data collection to ensure that the data acquired meets the requirements of the project.
    - *Field data verification*: The field crew downloads the data, and ships a duplicate set on portable hard drives via next-day courier delivery to the production office. The field crew then processes the approximate GPS-IMU solution, the decimated flight lines, and views the point cloud to confirm the quality of the data collected. This is accomplished within 24 hours of data collection. Special attention is paid to flight lines where any turbulence/disturbance or sensor-related problems are marked on the flight logs. The flight plan for the next day is updated on the basis of the lines flagged by the acquisition team during the field data verification process.
    - *Office data verification*: The data for each mission arrives in the production office on the day after acquisition. The LiDAR processing team processes the data with precise GPS-IMU solutions and generates the full resolution LAS flight line strips. The team then checks the data carefully for gaps, sensor anomalies, NPS, FOV, side-lap, and other flight-related parameters. Any re-flights needs identified during this QC process are then transmitted back to the acquisition team by the acquisition manager. The office data verification is completed within 24 hours of receiving the LIDAR data in the office.

Operational Considerations

Contractor and subcontractor's aircrews are highly familiar with the airspace system in the region, and know how to navigate safely and efficiently within its boundaries. All flights will be coordinated with the appropriate civilian and military air traffic control authorities. The aerial team has the relationships needed to gain access to sensitive and restricted, or controlled airspace.

The aircraft are equipped with all of the communication and navigation avionics required to operate safely in the federal airspace system. All of the aircrews are appropriately licensed and qualified, and the aircraft are operated and maintained in accordance with applicable Federal Aviation Administration (FAA) regulations at all times.

Contractor's aerial team must be prepared to make any necessary operational adjustments should airspace changes or temporary restrictions require them. Contractor will provide immediate notification to the State if there are any acquisition issues.

Post-Acquisition

Flight Logs will be prepared following each mission. The pilot or system operator will prepare a flight log for each flight day containing the date, project name, aircraft used, and names of crewmembers. In addition, the following information is recorded for each flight line: altitude, sensor number and any other comments relative to the flight conditions. These flight logs will be submitted digitally. All AGPS, IMU, and image data will be downloaded the day of collection. Preliminary processing of the ABGPS data is performed to ensure the data is complete and correct.

Communication Plan

Customer communication and status reporting is the most important aspect of project management. The continuous communication between Contractor and the State will provide insight to the project process and eliminate gaps in communication on technical and schedule issues.

Communication requirements must be incorporated and documented in the work plan. The specific requirements for each project are unique; therefore, the tracking and reporting tools and procedures necessary for effectively managing the project are established specifically for the State's project and maintained throughout the term of the contract. Contractor is responsible for communicating status back to the State and assisting the State with project messaging to partners and stakeholders.

Meetings and Conference Calls

Contractor and the State will meet daily on a 30 minute conference call to discuss the previous day's progress as well as identify the goals and objectives in the coming days. Any program decisions will be documented in writing and distributed to stakeholders and State agencies as needed. In addition to the daily calls, the Contractor PM will meet with relevant State officials in Michigan every quarter to provide a more thorough review of the program.

Meeting minutes from project team meetings and conference calls will be produced and distributed by Contractor PM. These minutes shall include descriptions of the issues discussed during the meeting, their resolutions, and the necessary follow-up. All project records, including correspondence, reports, invoices, and specifications, will be maintained in the project files by PM.

MiSAIL Collaboration Portal

Contractor will establish a Microsoft SharePoint portal as a repository for important program documents as well as State provided input data for the program. Examples of information to be exchanged on SharePoint are:

- Statement of work
- Program specifications
- Acceptance criteria documentation
- Program schedule
- AOI Shapefiles
- Tile grids
- Metadata templates
- Flight Logs

Status Reporting

Contractor requires flight crews to electronically submit a daily status report to the acquisition manager immediately after that day's operations. The report states what occurred during the day. If the crew didn't fly, they report why. If they did fly, they report what was flown, and the weather and ground conditions. This information is also used to plan the following day's operations.

After receiving the reports from the field, the Contractor's production office will compile the results into one daily status report to send to the Contractor project manager. This report will be reviewed and sent to the State on a daily basis.

Ground Control Plan and Spatial Reference System

Contractor's control plan will leverage any available CORS/VRS, NGS, and HARN stations in the project area. This will help tie all the LiDAR data together, including in cases where geographic boundaries that are not adjoining. In addition, Contractor will provide baseline ties between all project areas collected, when appropriate. This provides additional verification of multiple collection areas.

Contractor will conduct a LiDAR check-point survey to collect calibration points, and at a minimum, the ASPRS prescribed number of checkpoints required for each AOI. These field-surveyed points will be used in the calibration/boresight process to ensure the vertical accuracy of the LiDAR data, and to test processed LiDAR data and derivative data products prior to delivery. Methods and procedures for the ground control surveys will be as previously outlined in the orthoimagery portion of this response. A complete survey report will be provided for each AOI, with supporting data in ESRI shapefile format.

All survey data and LiDAR deliverables will be reported or provided in the following spatial reference systems:

- Coordinate Reference System: Michigan State Plane
- Horizontal Datum: Most current NAD83 Realization
- Horizontal Units: International Feet
- Vertical Datum: NAVD88
- Vertical Units: International Feet
- Vertical Reference: Orthometric Heights
- Geoid Model: Most Current NGS Geoid Model, presently GEOID12A

Each discrete project will be processed using the single predominant State Plane zone for the overall collection area.

LiDAR Post-Processing and Creation of Deliverables

All data will be post-processed in a controlled environment following strict procedures designed to maintain data integrity and to provide the best possible data to the State. The following is an outline of the data processing work flow performed at Contractor's office after the field verification and in-field QA/QC processes have been completed.

- Data Management / Production Management using GeoCue
- LiDAR Calibration
- LiDAR Classification
- Final Product Generation
- Creation of Metadata
- Quality Control

LiDAR Calibration Overview

Contractor's LiDAR calibration process is detailed below.

- GPS-IMU Processing
- Mission Calibration
- Final LiDAR Calibration Using TerraMatch
- DZ Ortho process: for relative accuracy
- Check-Point Z Adjustment

GPS-IMU Processing

Contractor will use the latest version of Applanix MMS kinematic AGPS post-processing software to process all AGPS/IMU data. The differential kinematic data are processed together with a minimum of two static base stations and the solutions are compared. This procedure verifies the integrity of the base-station coordinates and elevations. Each processing session is computed in both forward and reverse temporal directions.

LiDAR Mission Calibration

In addition to the process Contractor conducts at installation and every three months, Contractor will perform an abbreviated version of the installation calibration process for every LiDAR mission. The vertical accuracy will be no less than 3 cm (1 sigma). Elevation points will be sufficiently dense to adequately represent the surface to the required accuracy. The test surface will be approximately 70 meters wide and 500 meters long.

Final LiDAR Calibration Using TerraMatch

TerraMatch, a product from TerraSolid, is used to correct a data set for systematic biases. These adjustments are almost completely automated, and leverage the field-surveyed calibration points to check and enhance accuracy. TerraMatch further improves roll, pitch, heading, and torsion between each mission to form a data set that is precise, and well within the client-defined accuracy specifications. By placing sample tiles perpendicular to the direction of flight, TerraMatch analyzes each swath simultaneously. A file is then output containing each swath's corrections. This correction file is then applied to the entire project and/or block.

Dz Ortho Imagery Process

Contractor uses Dz Ortho images to analyze the calibration. These images are specific to LiDAR processing, and quickly reveal any potential calibration issues.

Image settings are as follows:

- Green: 0-7cm offset
- Yellow: 7.1-14cm offset
- Orange: 14.1-21cm offset
- Red: >21.1cm offset

The Contractor's LiDAR team will manually analyze the data to ensure data quality. After all TerraMatch corrections are applied, the dataset is filtered and manually edited for anomalies to provide a clean, artifact-free bare earth dataset.

Check Point Z Adjustment

Contractor uses the field-surveyed calibration points for each AOI to accurately adjust data Z. Once the data has been through the editing process, the bare earth from the LiDAR data is compared to the processed survey points. In order to achieve the lowest RMSE, the data is adjusted to the Average Dz. This is the mean of all points and their offset to the LiDAR. Once the LiDAR is vertically adjusted, it's ready for product generation. Minimum errors, the range, the mean, the Root Mean Square Error (RMSE), and the standard deviation are calculated for every mission. This will be provided to the State in the final LiDAR project report.

The calibration of the LiDAR data will be verified by independently checking the relative and absolute accuracies of the final calibrated dataset. Independent LiDAR checkpoints will be collected in the recommended land cover classes as per the guidelines of the new USGS LiDAR Base Specification V1.2, as shown below.

Land Cover Classes	
Non-Vegetated Vertical Accuracy	
Class 1	Clear or open, bare earth, low grass; for example, sand, rock, dirt, plowed fields, lawns, golf courses
Class 2	Urban areas; for example, tall, dense man-made structures
Vegetated Accuracy	
Class 3	Tall grass, tall weeds, and crops; for example, hay, corn, and wheat fields
Class 4	Brush lands and short trees; for example, chaparrals, mesquite
Class 5	Forested areas, fully covered by trees; for example, hardwoods, conifers, mixed forests

The LiDAR calibration will meet the following accuracy requirements, again, per USGS BaseSpecification V1.2.

QL2 Accuracy Requirements	
Relative Vertical Accuracy	
Smooth surface repeatability (cm)	≤ 6
Swath overlap difference, RMSDZ (cm)	≤ 8
Swath overlap difference, maximum (cm)	±16
DAbsolute Accuracy	
RMSEZ (non-vegetated) (cm)	≤ 10.0
NVA at 95-percent confidence level (cm)	≤ 19.6
VVA at 95th percentile (cm)	≤ 29.4

LiDAR Classification

The first step in the creation of topographic products from LiDAR (following post processing and calibration) is classification of the point cloud. The classification scheme in USGS Base Specification V1.2, shown in the table below, will be followed for the project. All processing is performed in a manner that ensures classified point deliverables are fully compliant with desired classification scheme, and that raw and classified point cloud deliverables are compliant with the .LAS V1.4 data format.

Code	Description
1	Processed, but unclassified.
2	Bare earth.
7	Low noise.
9	Water.
10	Ignored ground (near a
17	Bridge decks.
18	High noise.

Contractor will ensure that the point classification will be consistent across the entire project and there are no noticeable variations in the character, texture, or quality of the classification between tiles, swaths, lifts, or other non-natural divisions existing in the data. Contractor will make sure that within any 1km x 1km area, not more than 1 percent of the points will possess a demonstrably erroneous classification value, for QL2 data.

The point classification is divided into the following steps.

- Automated macro filtering
- Manual QC and editing of the classification
- Final classification QC using the hillshade surfaces

Automated Macro Filtering

The initial LiDAR point cloud classification is done using the automated Terra-Scan macros. The routines will classify points based upon the laser attributes including intensity, elevation and the numeric value of the return.

Manual QC and Editing of the Classification

Following the automated classification process, a supervised or manual classification is performed. Contractor's software can handle an unlimited number of different surfaces in the same digital file. Contractor's LiDAR editing team goes through the tiles with great precision to make sure that the points are classified correctly. 3D tools

include cross-section or profile views of points to aid in classification and surface model visualization with rapid contour development to spot bare earth blunders for re-classification. Color triangles display of TINs, colored grids for shaded relief, and other sophisticated visualization tools support the manual classification. Imagery files of the project area is made available to the editors so that in case of any confusion in feature identification, they can verify the feature in the imagery and classify the points in the right class accordingly.

Final Classification QC Using the Hillshade Surface

Part of Contractor's QC process is eliminating the need for extensive manual editing, and replacing this with an automated way to quickly depict outliers or anomalies in a bare earth dataset. Through the production of hillshaded surfaces, Contractor's LiDAR team can scroll through hillshades (TIF images) generated from the bare earth. The team member can also import these hillshades into Google Earth to provide an even better perspective on the terrain.

Hydro Flattening and Enforcement

Contractor has designed custom workflows to produced hydro-flattened and hydro-enforced DEM's in compliance with the latest USGS LiDAR Base Specification V1.2 requirements.

Contractor digitizes hydrology features and edge-of-water breaklines into a 3D dataset using stereo- intensity images. All hydrology and select man-made features, such as bridges and dams that affect hydrological flow are extracted. During this phase, each tile is viewed in both 2D and 3D perspectives as intensity images, shaded relief maps and/or digital surface models (DSM). Contractor populates the "Z" value for the points, lines, and polygons referencing the bare-earth LiDAR. Each hydrology feature is digitized in true horizontal position, and the Feature Type and Class are captured along with the X, Y, and Z attributes. Once all of the features have been captured, a second technician performs a review for content and accuracy referencing the collected features to the base LiDAR data and reference imagery before releasing the tile for final edit.

Contractor will perform hydro-flattening to the following parameters:

Inland ponds and lakes

- Water bodies of 8,000 m2 (2 acres) or greater surface area at the time of collection are flattened.
- Flattened water bodies are represented as flat and level water surface (a single elevation for every bank vertex defining the water body's perimeter).
- The entire water-surface edge is at or below the immediately surrounding terrain
- Long impoundments, such as reservoirs, inlets, and fjords, whose water-surface elevations decrease with downstream travel, are compiled as streams or rivers.

Inland streams and rivers

- Streams and rivers of a 30-m (100-ft) nominal width are flattened.
- Streams or rivers whose width varies above and below 30-m will not be broken into multiple segments.
- Flattened streams and rivers are represented as a flat and level water surface from bank to bank, perpendicular to the apparent flow centerline.
- Flattened streams and rivers are represented as a gradient downhill water surface, following the immediately surrounding terrain.
- In cases of sharp turns of rapidly moving water, where the natural water surface is notably not level bank-to-bank, the water surface is represented as it exists while maintaining an aesthetic cartographic appearance.
- The entire water surface edges are at or below the immediately surrounding terrain.
- Stream channels shall break at culvert locations, leaving the roadway over the culvert intact.
- Bridges in all their forms are removed from the DEM.
- Streams are continuous at bridge locations.

- When the identification of a structure as a bridge or culvert cannot be made definitively, the feature is regarded as a culvert.

Non-tidal boundary waters

- Boundary waters, regardless of size, are represented only as an edge or edges within the project. Collection does not include the opposite shore.
- The entire water surface edges are at or below the immediately surrounding terrain.
- The water surface elevation will be consistent throughout the project.
- The water surfaces are flat and level, or as appropriate for the type of water body (level for lakes, a gradient for streams and rivers).
- Any unusual changes in the water surface elevation during the course of the collection (such as increased upstream dam discharge) are documented in the project metadata.

Islands

- Permanent islands of 4,000 sq m (1 acre) or larger shall be delineated in all water bodies.

Tidal Waters

- Tidal water bodies are defined as any water body that is affected by tidal variations, including oceans, seas, gulfs, bays, inlets, salt marshes, and large lakes. As per the USGS LiDAR base specification guidelines, collections are planned to minimize tidal differences at the land-water interface if possible. In addition to meeting the requirements for inland water bodies listed in inland ponds and lakes and inland streams and rivers sections above, as appropriate, the tidal water bodies are compiled to meet the following requirements.
    - Within each water body, the water surfaces are flat and level for each different water surface elevation.
    - Vertical discontinuities within a water body resulting from tidal variations during the collection are considered normal and are retained in the final DEM.
    - Horizontal discontinuities along the shoreline of a water body resulting from tidal variations during the collection are considered normal and are retained in the final DEM.

Contractor's final processing includes the use of custom routines to validate flow direction and monotonicity to ensure all vector nodes are flowing downhill for single- and double-line streams, or are the same elevation for pools of water, including lakes and ponds. Other processing may include using standard ESRI tools to eliminate pseudo-nodes that would impair hydrologic analysis.

Bare Earth DEM

A gridded bare earth DEM will be produced from the classified point cloud. Proposed cell size is 2 feet for QL2 data and 1 foot for QL1 data. Delivery will be in an industry-standard, GIS-compatible, 32-bit floating point raster format, ASCII format, or other formats of the State's choosing.

Intensity Images

Intensity images represent a grey scale rendition of the LiDAR data set that results in a geo-referenced raster image. Contractor will provide intensity images, tiled, in georeferenced, 8-bit grey scale GeoTIFF/.TIFW format.

LiDAR Quality Control

Contractor uses a quality-review process for all data to ensure adherence to product specifications, data formats, and data completeness for all deliverables. All data is post-processed in a controlled environment based on strict ISO 9001:2008 compliant procedures designed to maintain data integrity through highly standardized and controlled procedures for data acquisition, post-processing, and validation. LiDAR data will be analyzed against the mandated

field checkpoints as outlined in the USGS and ASPRS specifications, and an accuracy report generated. No out of compliance data sets will be delivered to the State.

Summary of Deliverables

Contractor will provide a copy of all deliverables as summarized in the table below. All data will be quality controlled and in full compliance with the standards and specifications set forth by the State in the Contract, including USGS Base Specification V1.2.

Summary of LiDAR Deliverables	
Deliverable	**Description**
Metadata, Reports, and Documentation.	▪ FDGC/USGS compliant metadata ▪ Data Acquisition Report ▪ Survey Report ▪ Production Process Report (Calibration, Classification, product generation) ▪ Control and Calibration Report (NVA and VVA reporting) ▪ Accuracy Report
Raw Point Cloud	▪ Calibrated raw point cloud in LAS V1.4 format ▪ Each file size < 2GB (1 file per swath)
Classified point cloud	▪ In LAS V1.4 format ▪ Classification schema per USGS Base Spec V1.2 ▪ Each file size < 2GB (1 file per swath)
Bare Earth DEM	▪ Cell size per USGS Base Spec V1.2 ▪ Tiled delivery ▪ Raster, ASCII, or other format per State option ▪ Hydro-flattened or enforced surface per USGS Base Spec V1.2, if opted
Hydro Breaklines	▪ Delivered if optional hydro flattening or enforcement is chosen ▪ Esri feature class geodatabase format (PolylineZ or PolygonZ format) ▪ Continuous layer for each AOI
Intensity Images	▪ Tiled delivery ▪ 8-bit grey scale GeoTIFF/TIFW

Geiger Mode LiDAR Option

Contractor has included Harris Corporation as a subcontractor on the team to offer their Geiger Mode LiDAR as an option. Their topographic LiDAR mapping technology includes sensors, processing tools, and analytics. Their topographic mapping solution uses Harris- developed Geiger-mode LiDAR that maps land features at high point densities (from 2 points/m2 to greater than 20 points/m2) at area collection rates greater than 1000 km2/hour. The Contractor team will leverage Geiger mode LiDAR for very large collection areas only. Pricing will be on a custom basis, and will be at rates at or below the >5,000 square mile rates in the pricing tables in Schedule B.

Harris' Geiger-mode LiDAR tool suite is specifically designed to reduce the cost of high-density data production without reducing data quality by focusing on:

- Reducing Acquisition Time – Harris' Geiger-mode LiDAR enables collection >10 times faster to collect dense data over a wider area by flying higher and faster.
- Increasing Processing Automation – A world leader in high-volume geospatial data production, Harris has developed an extensive, scalable hardware and software infrastructure for automating LiDAR production that results in faster delivery times without sacrificing product quality.
- Improved Data Quality – their high-quality LiDAR data delivers ~0.1 m accuracy and 2 to >20 point/m2 density—engineering quality that would support any large-area LIDAR mapping project needs, but also allow for greater multiuse for other mapping projects.

The below table compares the best available Linear-mode LiDAR sensor technologies available for commercial use today to Harris' Geiger-mode LiDAR. Contractor and Harris also have the capability of operating a Geiger mode LiDAR concurrently with an UltraCam Eagle sensor in a dual-port aircraft. Equipping the Eagle with a 210mm focal

length lens enables highly efficient concurrent collection of imagery at resolutions of up to 4-inches, along with the LiDAR data.

Comparison of Harris Geiger-mode and Typical Linear-mode LiDAR					
	Typical Linear LiDAR*		**Harris' IntelliEarth™ Geiger-Mode LiDAR**		
Density (points/m2)	2	8	2	8	20
Instantaneous Coverage Rate (mi2/hr)	**190**	**50**	**1300**	**850**	**580**
RMSEz (cm)	9.25	9.25	9.25	9.25	9.25
Altitude (AGL ft)	8,000	3,200	45,000	27,000	18,000
Swath Width (ft)	8,800	3,300	25,000	16,000	13,000
Ground Speed (kts)	140	90	450	290	290
K samples/sec (k)	600	600	200,000		
Grayscale Reflectance Image	Yes		Yes		
Operations	Day or Night		Day or Night		

Geiger-mode LiDAR Technical Overview

The focus of Harris' IntelliEarth™ Geiger-mode LiDAR design was to maximize the data collection rate, enabling USGS Quality Level One (QL1) collection at an area coverage rate exceeding 1,000 km2/hour, with 50 percent swath-to-swath overlap.

B. Optional - Imagery Hosting Service

This is an optional service that the State is seeking proposals for, but is not a required service under this Contract. Individual projects will vary, based on the specific needs of the State and its State Partners. Without making any binding commitment to purchase the services, the State anticipates a potential need for an imagery hosting service.

Basic types of imagery hosting services to be provided will be determined within the Project SOW. However, general details of the services to be provided are listed in Attachment 2 – Optional Imagery Hosting Service.

Contractor Commitment

Optional Imagery Hosting Service

Contractor geospatial cloud based solutions range from enterprise-wide spatially enabled corporate systems to individually focused, custom applications. A variety of different technologies are utilized based upon the needs of the business model. Contractor's cloud-based solutions incorporate scalable design models, tested development, systematic implementation and ongoing maintenance/support to ensure the full lifecycle of geospatial data integration focused on the complete business need.

Contractor is a Service Partner within the Google Cloud Platform (GCP) Partner Program. GCP is a set of modular cloud-based services that allow you to create anything from simple websites to complex applications. We have a team of Google Qualified Cloud Platform developers fully certified in five disciplines critical for building effective client solutions. Contractor has also brought in one of our long term partners, AppGeo, to support us in this effort.

> AppGeo's capabilities cover the entire lifecycle of geospatial IT implementation; starting with strategic planning, and including data development, system architecture, custom applications, technical support and hosting services. AppGeo is also an authorized GCP with deep knowledge of the GCP specifications, hosting environments, performance, SLAs, etc. Furthermore, AppGeo brings direct experience deploying and supporting statewide imagery services for the States of Utah and Texas.
>
> Combined, AppGeo and Contractor represent an incredibly strong team to support Google Cloud services and solutions to help the State build and run geospatial applications to store/access data by leveraging one of the largest IT infrastructures in the world.

The Contractor Team is proposing an innovative, cloud-based approach that includes managed services for the State's infrastructure. The benefits to State include:

- Secure, cloud-based infrastructure that involves no State obligation to purchase or maintain physical hardware, power consumption or a need for air conditioning
- Minimal data storage costs
- Access to the imagery through consumable, Open Geospatial Consortium (OGC) compliant web services
- Tools to enable image download from the cloud
- Hands-off management of imagery hosting through managed services that provide high levels of uptime
- Cloud-based redundancy to any on-premise uses of the new imagery that the State implements

The Google Cloud

Google's Cloud Platform utilizes a technology called Compute Engine, which are high- performance virtual machines (VM). Compute Engine's Linux VMs are consistently performing, scalable, highly secure and reliable.

All data written to disk in Compute Engine is encrypted on the fly and then transmitted and stored in encrypted form. Google Compute Engine has completed ISO 27001, SSAE-16, SOC 1, SOC 2, and SOC 3 certifications, demonstrating our commitment to information security.

Building business solutions on Google's cloud platform allows Contractor to eliminate concerns about future scalability and lack of infrastructure. As a Google Cloud Platform Channel Partner, the Contractor Team is able to offer the service of the most advanced and robust new cloud-based solutions. Customers benefit by engaging with Contractor, as a result of our investment in developing the skills needed to build these powerful new solutions on top of Google's Cloud Platform. These solutions are accessible by all forms of devices from workstations to mobile platforms.

The benefits for this architecture include:

- Hosting on Google Cloud Platform allows consumers to get the advantage of Google's SLA that includes guaranteed 99.95% up time.
- Using Google Compute Engine to handle excess web-traffic only if necessary, leads to reduced costs for most day-to-day solutions.
- OAuth 2.0 Authentication

Front End Data Discovery

Contractor will be deploying a web-based GIS server solution to make it convenient for the state agencies and the general public to discover and access imagery data sets. The tool will be designed to provide different levels of authenticated access based on user credentials, e.g., state employees could see more data than the general public. It will also include the serving of the imagery data as a WMS, or WMTS. Contractor is familiar with the State IT standards, policies and procedures and will incorporate them in the development workflow.

Each of the footprints for the imagery coverage will be displayed as wire frames and will contain metadata as attributes of the frames and hyperlink to data access. The users will be able to select footprints and retrieve attribute data for all footprints in selected locations. They can also query for data footprints that meet specified conditions. Once a selection is made, users will be presented with a list of attributes for all polygons selected. Contractor will work with the State to understand if any data access restrictions or hyperlinking for direct data download will be relevant, e.g., there can be restrictions on the download of multiple tiles or images at one time, based on overall size of download to user or the number of tiles that can be downloaded at one time.

The statistics of web traffic will be captured and the SOM staff personnel will be able to configure the look and feel of the tool and adding additional layers that may be queried.

Web Map Service / Web Map Tile Service

The Team's WMS/WMTS Imagery Appliance was designed to do one focused thing and do it well: the serving of large imagery data sets from the cloud to end users via Open Geospatial Consortium (OGC) web services. Specifically, the Appliance delivers high performance WMS (Web Map Service) and WMTS (Web Map Tile Service) from Google's cloud to end users who can consume the imagery into ESRI and open source desktops (e.g., QGIS), and also into web applications.

The following provides an overview of key Appliance features:

- Creation of WMS/WMTS end-points for imagery data sets stored in Google's cloud
- Web services can be publicly available, or restricted to certain users and/or groups
- Creation and management of users of the imagery (when necessary).
- Creation and management of groups of users of the imagery (when necessary).
- Reporting of usage by user and group when users and groups are utilized.

Implementation

The Contractor Team will follow the steps below:

1. Establishing a Google Cloud Platform (GCP) account on behalf of the state of Michigan. This account will provide access to GCP Cloud Storage (GCS) and GCP Compute Engine (GCE). Use of GCS will provide a cloud-based repository for the Michigan imagery, and GCE will provide a platform for establishing the virtual machine instances that power the WMS and WMTS web services.

2. The Contractor Team will work together to stage the Michigan imagery inside of GCP. This involves uploading the raw imagery files as well as a tile pyramid that is derived from the raw imagery.

3. The Contractor Team will stage the WMS/WMTS Imagery Appliance software onto a load balanced cluster of virtual servers.

4. The Contractor Team will provide ongoing managed services to ensure uptime and high- performance of the Appliance and for ongoing inclusion of new imagery that may be provided by Contractor after the first year. Other managed service activities include:

- User administration
- Imagery layer administration
- Creation of appropriate service end-points and URLs
- Facilitation of download of raw imagery from GCSe.
- Reports summarizing end-user consumption (i.e., the use of the WMS/WMTS services by agency or individual user)

The solution will not be a physical part of the state's IT network. Rather, the cloud- base infrastructure will be accessed in only two potential ways that do not involve login:

1. The State, and potentially public end-users, will access the imagery through public web service end-points and URLs. End-user desktop software, such as ESRI ArcGIS, include built-in functionality for consuming OGC compliant WMS/WMTS web services directly from those end points, and without login. Similarly, the State web applications can consume these same web services.

2. If needed and desired by the State, administrative access to WMS/WMTS Imagery Appliance can be provided to authorize the State personnel. The Appliance's administrative console is a simple, web-based user interface and the Contractor team will provide appropriate credentials to identified personnel to access managed services infrastructure that is maintained by the Contractor Team.

Since the end-user experience does not involve a user interface, i.e., it is only web service consumption, there are no ADA compliance, or look-and-feel requirements.

Customer Service Support

Contractor maintains a customer service representative for client relations between the hours of 8:00am and 5:00pm, Monday through Friday, excluding holidays. Contractor has a toll free line as well as an e-mail address set up to specifically address customer services inquires. In the rare case where a voice message is left or if an e-mail is sent, Contractor's customer service representative is prepared to respond within a one-hour timeframe. Since most of the setup for the MISAIL Imagery Hosting Service will be performed in the cloud infrastructure, a site visit is redundant. However, Contractor staff will be happy to perform any end-user troubleshooting tasks using WebEx sessions. Contractor also offers a Customer Service hotline that can be reached at (1-866-726-2676).

Contractor will also be setting up an Email Ticketing System that will let users submit and categorize their tickets, provide the desired status and priority. With custom filters to group and sort tickets, Contractor staff can then assign tickets to the correct support staff and share constant updates with the end users about the status of their issues. Contractor will also be measuring key metrics like average first response time, average time spent on resolving tickets, etc. to revamp the workflow using SLA performance measures.

V. Contractor Staff, Roles, and Responsibilities

The Contractor will provide sufficient staffing to provide the requested Services and Deliverables, and meet all requirements under this Contract.

A. Subcontractors

Applied Geographics, Inc.
24 School St., 5th Floor
Boston, MA 02108
Michael Terner
617-447-2468

Distinguishing characteristics of AppGeo's approach and experience that are relevant to this project include:

- More than a decade of experience hosting data and applications, on their own infrastructure and in the last five years on today's leading cloud hosting platforms, such as Google Cloud Platform (GCP) and Amazon Web Services (AWS)
- Status as an authorized Google partner with deep knowledge of the GCP specifications, hosting environments, performance, SLAs, etc.
- Direct experience deploying and supporting statewide imagery services for the States of Utah and Texas.

Digital Aerial Solutions, LLC
8409 Laurel Fair Circle, Suite 100
Tampa, FL 33610
Joshua Helton
813-628-0788

DAS' primary focus is digital aerial imagery and LiDAR acquisition and processing, ground control surveying, DTM/DEM development, planimetrics and contour development, topographic mapping, softcopy photogrammetry, GIS, and digital orthophotography. DAS also provides significant support with equipment and capabilities.

Shandong Eastdawn Corporation
10th floor, Sinosteel Plaza
No. 8 Haidian Street
Haidian District, Beijing, P.R. China
P.C.: 100080
Yasunori Ono
86-10-62686799

Eastdawn is a leading international geospatial service provider with established clients in Asia, Europe, South America, Africa and North America. As a Class-A surveying and mapping company certified by the National Administration of Surveying, Mapping and Geoinformation, the company serves its customers across a wide range of geospatial services including GIS, LiDAR and photogrammetry from space, airborne and terrestrial data sources.

Shandong Eastdawn Corporation may only be used if and when cases of offshore completion of work is approved and acceptable. This would also require written permission from the State of Michigan.

Harris Corporation
1025 W. NASA Boulevard
Melbourne, FL 32919
Katherine Shogren

321-984-5824

Harris has significant capabilities and experience with topographic mapping from LiDAR and stereo imagery, photogrammetric mapping and orthophotography. In addition, Harris offers access to a number of satellite systems, including the TerraSAR-X and TanDEM-X satellite. Team member Harris also brings the capability for Geiger Mode LiDAR, including 3 proprietary Geiger Mode systems developed by Harris. Geiger Mode LiDAR is an emerging commercial technology that enables the collection of data at higher resolutions and from higher elevations than traditional linear-mode LiDAR.

Keystone Aerial Surveys, Inc.
9800 Ashton Road
P.O. Box 21059
Philadelphia, PA 19114
John Schmitt
215-677-3119

Keystone specializes in providing quality aerial surveys throughout North America, including Mexico and Canada. Keystone's Flight Department has considerable experience collecting airborne imagery at high and low altitudes in several formats including digital, film and LiDAR. Keystone also collects and processes both Airborne GPS (ABGPS) and Inertial Measurement Unit (IMU) data. Keystone operates 20 aircraft, 10 metric film camera systems, 8 large format digital sensors and 2 LiDAR systems; employs flight crews consisting of pilots, camera operators, four full time licensed aircraft mechanics and a fully equipped and staffed photo lab and IT Department for extensive post processing support.

Luminary Mapping Services, Inc.
27785 McKee Road
Toney, AL 35773
Paul Weyant Jr.
256-919-3036

Luminary Mapping Services, Inc. (Luminary) is a company that specializes in the development and processing of numerous geospatial-based products, metadata, GIS technology and quality assurance.

As set forth in Section 11 of the Standard Contract Terms, Contractor must ensure specific obligations of its subcontractors.

B. Key Personnel

Any Key Personnel substitution must have the prior written approval of the State. Contractor agrees that unauthorized removal of Key Personnel may be subject to monetary credits to the State. The Contractor shall be responsible for the continuous training of its staff.

The State has identified the following as Key Personnel for this Contract:

Contract Administrator: This individual will supervise all contract management activities, which include but are not limited to the following:

- supporting the management of the Contract;
- facilitating dispute resolution; and
- advising the State of performance under the terms and conditions of the Contract.

Project Manager: Contractor will provide a Project Manager to interact with designated personnel from the State to ensure on-time delivery of Services and Deliverables meeting all requirements of the Project SOW. The Project Manager will coordinate all of the activities of Contractor personnel assigned to the project and sign-off on

all reports required by the State. Contractor's Project Manager is responsible, at a minimum, for all of the following:

- Manage all defined Contractor responsibilities
- Manage Contractor's subcontractors, if any
- Develop the project plan and schedule, and update as needed
- Serve as the point person for all project issues
- Coordinate and oversee the day-to-day project activities of the project team including:
- Insure timely and quality provision and completion of all acquisitions and Deliverables.
- Schedule and participate in daily phone calls with State personnel during acquisition season
- Assess and report project feedback and status
- Escalate project issues, project risks, and other concerns
- Review all project Deliverables and provide feedback
- Proactively propose options and alternatives for consideration
- Utilize change control procedures
- Prepare project documents and materials
- Manage and report on the projects budget

Certified Photogrammetrist: All production shall be under the supervision of an American Society of Photogrammetry and Remote Sensing (ASPRS) Certified Photogrammetrist. All products shall be reviewed and approved by an ASPRS Certified Photogrammetrist. The name of the supervising Certified Photogrammetrist shall be included in the metadata.

Production Manager: All steps in the Deliverable production process will be under the supervision of an identified Production Manager.

Acquisition Manager: All steps in the data acquisition process will be under the supervision of an identified Acquisition Manager.

Contractor Commitment

The State's project will be completed out of our main production facility and corporate headquarters located in Colorado Springs, Colorado. The technical managers and production staff all work together in a single facility, which creates the ideal conditions for effective communication and productive workflows. Also of note, we have several Certified Photogrammetrists on staff, which will help ensure the State's products conform to the required mapping standards.

Contractor has appointed the following Program/Project Manager, Contract Administrator, Flight Operations/Acquisition Manager, Production Manager, and Certified Photogrammetrist for the State of Michigan project as described below.

Program/Project Management

Each project is assigned a project manager with responsibilities including customer communication, scheduling, and ensuring adherence to the project specifications. The project manager works with department managers and production staff in establishing an implementation plan that outlines the project's technical requirements. The department managers draw on their production staff, as required, to meet the project objectives. The specific list of employees involved in any given project can be extensive with up to 25 employees or more, depending on the project size and schedule.

Sanborn's Project Manager for the State's program will be Mr. Shawn Benham, PMP. Mr. Benham has over 15 years of experience in the field of GIS, including project management and consulting services, quality assurance/quality control management, and data processing. Mr. Benham's experience includes managing and implementing large, complex orthoimagery and LiDAR collection projects. As project manager, he oversees project timelines and budgets and works directly with clients to ensure project success. He has had direct accountability for project development and execution throughout the project

management lifecycle including proposal writing; project scheduling; project deliverables; production and QC; project budgeting; and controlling all aspects of projects in accordance with contract documents. Mr. Benham has extensive experience in managing all phases of imagery and mapping projects. As a certified Project Management Professional (PMP), Mr. Benham's skills, knowledge, and abilities are recognized by the Project Management Institute (PMI).

Contract Manager/Administrator

Mr. Arshat, CP, EIT, has 31 years of geospatial industry experience, with an emphasis on photogrammetry, LiDAR, and GIS. Throughout his career, he has worked with a diverse clientele consisting of federal, state and local government agencies, public and private utilities, and commercial sector customers. Mr. Arshat possesses a thorough understanding of photogrammetry, LiDAR, GIS system implementation, and data conversion. He has experience managing projects from start to finish, including project design, cost estimating and proposal preparation, client interaction and contract negotiations, project mobilization, scheduling of equipment and personnel, subcontractor management, tracking of work flow, quality control and problem resolution, and preparation of billing summaries. Acting as client liaison and contract manager, Mr. Arshat has supported several multi-year, multi-partner projects by providing technical assistance, pricing information, and proposals; coordinating completion and conveyance of contractually-related documents between Sanborn and client staff; assisting clients program with marketing; participating in kickoff and quarterly progress meetings; and assisting the project manager in meeting client requests, assessing client satisfaction, and problem resolution.

Flight Operations/Acquisition Manager

Mr. Reyes has more than 20 years in the Aviation and Logistics industries and more than 10 years of experience in Program Management and Strategic Planning. He joined Sanborn in 2014 and previously served as a career Naval Aviator, flying fighter aircraft from aircraft carriers during multiple combat deployments. Since joining Sanborn, he has had notable success directing a broad range of aircraft and sensor initiatives; participating in planning, analysis, and implementation of solutions in support of business objectives. Mr. Reyes has extensive experience working with executives at all levels of the government to implement the collection of spatial technologies.

Production Manager

Mr. Sanchit Agarwal, CMS, CP, is Sanborn's Mapping Operations and Quality Director. Mr. Agarwal has over nine years of experience in the field of Geo-informatics. He is proficient in both production and research and development working environments and has in-depth knowledge of GIS technologies, aerial triangulation, GPS-IMU processing, LiDAR data processing, digital imaging,
flight planning, DEM editing and RADAR data processing. He has experience in handling data from multiple sensor platforms: aerial/terrestrial, push-broom/frame sensors, panoramic/oblique imaging systems, and LiDAR/RADAR systems. He has excellent skills in managing large scale projects in production environment and a proven ability to train and develop production teams for new technologies.

Certified Photogrammetrist

Mr. Doug Zehr has 27 years of industry experience and is a member of Sanborn's photogrammetric management team. His responsibilities include project planning and design, overseeing aerial triangulation, and the support of photogrammetric and LiDAR production processes.

VI. Project Management

A. Project Management Website

Contractor must develop a secure, limited access project management website to assist in the dissemination of project communication and status information to the State project staff, subcontractors, and other project stakeholders where appropriate, updating and documenting the status of the project in relation to the project schedule and identifying any issues, concerns, decisions, outstanding items, and next steps.

Contractor Commitment:

Contractor will create a secure Microsoft SharePoint portal as a repository for important program documents as well as State provided input data for the program. The portal is accessed through a web browser and will require unique login for each user. The portal is compatible with Internet Explorer, Firefox, Safari, Chrome and on tablet devices and requires no plug-ins.

This portal will serve as the project management website and will contain official program documents. Examples of information to be exchanged on SharePoint are:

- Statement of work
- Program specifications
- Acceptance criteria documentation
- Program schedule
- AOI Shapefiles
- Tile grids
- Metadata templates
- Flight logs

VII. Pricing and Payment

A. Pricing

This is a firm, fixed price Contract. For all required Services and Deliverables, pricing tables are included as Schedule B - Pricing Table. For optional Services and Deliverables, hosting services, pricing is also included in Schedule B.

B. Payment Holdback

The State will pay 25% of the total project cost when *acquisition* is complete. The State will release any remaining balance upon final acceptance of the Deliverable.

C. Liquidated Damages

Contractor agrees that any delay or failure by Contractor to timely and acceptably perform its obligations in accordance with the Project SOW will interfere with the proper and timely delivery of the required Deliverables, to the loss and damage of the State. Further, the State will incur major costs to perform the obligations that would have otherwise been performed by Contractor. The parties understand and agree that liquidated damages Contractor must pay to the State as a result of such nonperformance, will be assessed in the amount of $5,000 per affected AOI, with an additional $250 per week for each week Contractor fails to remedy the late or improper completion of the Work, and that these amounts are reasonable estimates of the State's damages in accordance with applicable law.

Contractor Commitment:

1. Contractor Schedule B – Pricing Table is attached.
2. Hosting optional service pricing provided in Schedule B – Pricing Table 4.
3. Contractor acknowledges understands, and accepts the payment process, including the holdback until final acceptance of the Deliverable.
4. Contractor further acknowledges, understands, and accepts the State's right to assess liquidated damages terms in accordance with 08192015_Schedule A SOW.doc section VIIC, for any delay or failure by Contractor to timely perform its obligations under the Project SOW.

VIII. Reporting Obligations

Reporting shall be accomplished through the project management website.

IX. Transition Services

PURSUANT TO SECTION 22 OF THE STANDARD CONTRACT TERMS, upon termination or expiration of this Contract for any reason, Contractor must, for a period of time specified by the State (not to exceed 90 calendar days), provide all reasonable transition assistance requested by the State.

X. Additional Services

1.1 Technical Support, Repairs and Maintenance	
The Contractor must specify its toll-free number for the State to make contact with the Contractor for technical support, repairs and maintenance. The Contractor must be available for calls and service during the hours of 8 am to 5 pm EST.	**This applies to Contractor, only when or if their proposed hosting solution is accepted by the State of Michigan and implemented.**
When providing technical support, the Call Center must respond to the caller's issue within **[60]** minutes. If the caller's issue cannot be resolved within **[48]** hours, on-site service must be scheduled. The on-site service must be performed within (1) week of the time the issue was scheduled for service.	**This applies only if the State of Michigan decides to accept and implement contractors Optional Hosting solution.**
1.2 Place of Performance	
Work is to be performed within the United States (US). In the event of Federal projects being completed under this Contract, work must be performed in the US.	**Contractor has included off shore pricing which is available for those projects where it is an option.**

Attachment 1: MiSAIL State of Michigan Lidar Specification, 2015

Derived from the USGS Lidar Base Specification Version 1.2

1.0 Conversion Factors

Altitude and Elevation, as used in this report, refers to the distance above the geoid, unless specifically referenced to the ellipsoid.

Height, as used in this report, refers to the height above ground.

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch (in.)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
meter (m)	1.094	yard (yd)
	Area	
square meter (m^2)	0.0002471	acre
square meter (m^2)	10.76	square foot (ft^2)
hectare (ha)	2.471	acre
hectare (ha)	0.003861	square mile (mi^2) = 640 acres = 1 section
square kilometer (km^2)	247.1	acre
square kilometer (km^2)	0.3861022	square mile (mi^2)

2.0 Abbreviations and Acronyms

ANPD	Aggregate Nominal Pulse Density
ANPS	Aggregate Nominal Pulse Spacing
ASPRS	American Society for Photogrammetry and Remote Sensing
CLICK	Center for Lidar Information, Coordination, and Knowledge
CONUS	Conterminous United States
CORS	Continuously Operating Reference Stations
CVA	Consolidated Vertical Accuracy
DEM	Digital Elevation Model
DSM	Digital Surface Models
DTED	digital terrain elevation data
DTM	digital terrain model
EDNA	Elevation Derivatives for National Applications
EPSG	European Petroleum Survey Group
FGDC	Federal Geographic Data Committee
FOV	field of view
FVA	Fundamental Vertical Accuracy
GB	gigabyte
GPS	Global Positioning System
GSD	ground sample distance
H&H	hydraulic and hydrologic
IFSAR	Interferometric Synthetic Aperature Radar
lidar	light detection and ranging
IMU	Inertial Measurement Unit
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NDEP	National Digital Elevation Program
NEEA	National Enhanced Elevation Assessment
NED	National Elevation Dataset
NGP	National Geospatial Program
NGS	National Geodetic Survey
NIR	near infra-red
NIST	National Institute of Standards and Technology
NPD	Nominal Pulse Density
NPS	Nominal Pulse Spacing
NSRS	National Spatial Reference System
NSSDA	National Standards for Spatial Data Accuracy
OCONUS	Outside the Conterminous United States
QA/QC	Quality Assurance/Quality Control
RMSE	Root Mean Square Error
SOM	State of Michigan
SVA	Supplemental Vertical Accuracy
TIN	Triangulated Irregular Network
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
XML	eXtensible Markup Language

3.0 Introductory Material

3.1 Purpose and Scope

The State of Michigan (SOM) intends to use this specification to acquire and procure light detection and ranging (lidar) data, and to create consistency across all SOM and partner funded lidar collections.
Most of the information in this specification was extracted from the USGS Lidar Base Specification Version 1.2.
Reference: Heidemann, Hans Karl, 2014, Lidar Base Specification (ver. 1.2, November 2014): U.S. Geological Survey Techniques and Methods, book 11, chap. B4, 67 p. with appendixes.
*Note: Version 2.0 is expected to be released in 2016. Contractor must be willing to accommodate mutually agreed upon updates to Attachment 2 - LiDAR Specifications based on changes that may occur in the USGS V2.0.

While changes have been made to various sections to improve the applicability for the SOM and its partners, the specification still meets USGS standards. Also, some sections have been purposely excluded but still apply to this specification. In addition to reviewing this document, vendors responding to Request for Proposals for SOM lidar data collection should reference the following sections in the USGS Lidar Base Specification Version 1.2:

- Glossary (for terminology)
- Appendix 3. Lidar Metadata Example
- Appendix 4. Lidar Metadata Template

It must be emphasized that this is a base specification, defining minimum parameters for acceptance of the acquired lidar data. It is expected that local conditions in any given project area, specialized applications for the data, or the preferences of cooperators, may mandate more stringent requirements. The SOM encourages the collection of more detailed, accurate, or value-added data. A list of common upgrades to the minimum requirements defined in this report is provided in appendix 1.

3.2 Applicability

These specifications and guidelines are applicable to lidar data and deliverables supported in whole or in part, with either financial or in-kind contributions, by the SOM and/or the USGS.

3.3 Warranty Against Data Defects

Defects in imagery collection that are reported by the customer shall be addressed in accordance with the Contract Terms and Conditions, Section 16.

4.0 Collection

4.1 Multiple Discrete Returns

Deriving and delivering multiple discrete returns is required in all data collection efforts. Data collection shall be capable of at least three returns per pulse. Full waveform collection is acceptable and will be promoted; however, full waveform data are regarded as supplemental information.

4.2 Intensity Values

Intensity values are required for each multiple discrete return. The values recorded in the LAS files shall be normalized to 16 bit, as described in the LAS Specification version 1.4 (American Society for Photogrammetry and Remote Sensing, 2011).

4.3 Nominal Pulse Spacing (NPS)

In this specification, the terms NPS and NPD will continue to reference single instrument, single swath, first return only lidar point data. Maintaining this terminology provides a consistent and understandable metric for communication regarding data collection. Multiple channels of data from a single instrument are regarded as a

single swath. In this sense, a single instrument is regarded as one in which both channels meet the following criteria:

- They share fundamental hardware components of the system, such as global positioning system (GPS), Inertial Measurement Unit (IMU), laser, mirror or prism, and detector assembly,
- They share a common calibration or boresighting procedure and solution, and
- They are designed and intended to operate as a single-sensor unit.

Assessment and reporting of the NPS is made against single swath, single instrument, first return only data, including only the geometrically usable part of the swath (typically the center 95 percent) and excluding acceptable data voids.

The table “Aggregate nominal pulse spacing and density, Quality Level 0–Quality Level 3” (table 1) lists the required ANPS and ANPD by QL. Dependent on the local terrain and land cover conditions in a project, a greater pulse density may be required on specific projects.

Table 1. Aggregate nominal pulse spacing and density, Quality Level 0–Quality Level 3.
[m, meters; pls/m2, pulses per square meter; ≤, less than or equal to; ≥, greater than or equal to]

Quality Level	Aggregate nominal pulse spacing (ANPS)	Aggregate nominal pulse density (ANPD)
QL0	≤0.35	≥8.0
QL1	≤0.35	≥8.0
QL2	≤0.71	≥2.0
QL3	≤1.41	≥0.5

4.4 Data Voids

Data voids within a single swath are not acceptable, except in the following circumstances:

- Where caused by water bodies,
- Where caused by areas of low near infra-red (NIR) reflectivity such as asphalt or composition roofing, or
- Where appropriately filled-in by another swath.

4.5 Spatial Distribution

The spatial distribution of geometrically usable points is expected to be uniform. Although it is understood that lidar instruments do not produce regularly gridded points, collections should be planned and executed to produce a first-return point cloud that approaches a regular lattice of points, rather than a collection of widely spaced high density profiles of the terrain. The uniformity of the point density throughout the dataset is important and will be assessed using the following steps:

- Generating a density grid from the data with cell sizes equal to twice the design ANPS, using a radius equal to the design ANPS.
- Ensuring at least 90 percent of the cells in the grid contain at least one lidar point.
- The assessment is to be made against individual (single) swaths, using only the first-return points located within the geometrically usable center portion (typically 95 percent) of each swath.
- Excluding acceptable data voids previously identified in this specification.

Note: This requirement may be relaxed in areas of substantial relief where it is impractical to maintain a consistent and uniform distribution.

Note: The process described in this section relates only to the uniformity of the point distribution. It in no way relates to, nor can it be used for the assessment of point density or NPS or ANPS.

4.6 Collection Conditions

Conditions for collection of lidar data will follow these guidelines:

- Atmospheric conditions must be cloud and fog-free between the aircraft and ground during all collection operations.
- Ground conditions must be snow free. Very light, undrifted snow may be acceptable in special cases, with prior written approval from the SOM.
- Water conditions must be free of any unusual flooding or inundation, except in cases where the goal of the collection is to map the inundation.

Leaf-off vegetation conditions are preferred. If project delays are caused by the SOM and resulting conditions are deemed acceptable to meet or exceed the specifications for anticipated ground point returns, the program (data collection) may be permitted to continue with prior approval from the SOM.

4.7 Collection Area

Data collection will cover the entire project area as defined by SOM. SOM will provide AOI boundaries in ESRI Shapefile format. All AOI shapefiles will include a buffer of at least 100 meters. Data delivered to the SOM will include all areas specified by the AOI shapefiles.

5.0 Data Processing and Handling

5.1 ASPRS LAS File Format

All processing will be carried out with the understanding that all point deliverables are required to be fully compliant with ASPRS LAS Specification, version 1.4, using Point Data Record Format 6, 7, 8, 9 or 10. Data producers are encouraged to review the LAS Specification version 1.4 in detail (American Society for Photogrammetry and Remote Sensing, 2011).

5.2 Full Waveform

If full waveform data are collected, delivery of the waveform packets is required in LAS v1.4. Deliverables with waveform data are to use external auxiliary files with the extension .wdp for the storage of waveform packet data. See the appropriate LAS Specification for additional information (ASPRS, 2011).

5.3 Global Positioning System (GPS) Times

GPS times are to be recorded as Adjusted GPS Time, at a precision sufficient to allow unique timestamps for each pulse. Adjusted GPS Time is defined to be Standard (or satellite) GPS time minus 1*109. See the appropriate LAS Specification for more detail (ASPRS, 2011).

5.4 Datums

All data collected must be tied to the datums listed below:

- Horizontal Datum: Most current realization of the North American Datum of 1983 (NAD83), including epoch, as determined by the National Geodetic Survey (NGS), and which existing Continuously Operating Reference Station (CORS) data is referenced.
- Vertical Datum: Data must be referenced to the North American Vertical Datum of 1988 (NAVD 88).
- Geoid Model: The most current National Geodetic Survey (NGS)-approved geoid model is required to perform conversions from ellipsoidal heights to orthometric heights. As of 10/1/2012 the most current Geoid Model as defined by the NGS is GEOID12A.

5.5 Coordinate Reference System

The SOM required Coordinate Reference System is as follows:
Coordinate Reference System: Michigan State Plane (appropriate zone)

Horizontal Datum: Most current realization of NAD83 (see 5.4 above)
Horizontal Units: International Feet
Vertical Datum: NAVD88
Vertical Units: International Feet
Vertical Reference: Orthometric Heights
Geoid Model: Most Current NGS Geoid model

Each discrete project is to be processed using the single predominant State Plane zone for the overall collection area (e.g., North, Central, South).

5.6 Units of Reference

All references to the unit of measure “Feet” and “Foot” must specify “International” or “Intl”, U.S. survey feet are not to be used as a unit of measure.

5.7 Swath Identification

Each swath will be assigned a unique File Source ID. It is required that the Point Source ID field for each point within each LAS swath file be set equal to the File Source ID before any processing of the data. Refer to the appropriate LAS Specification (ASPRS, 2011).

5.8 Point Families

Point families (multiple return “children” of a single “parent” pulse) shall be maintained intact through all processing before tiling. Multiple returns from a given pulse will be stored in sequential (collected) order.

5.9 Swath Size and Segmentation

The widespread adoption of 64-bit operating systems in mainstream computing (most notably Windows-7, 64-bit or newer operating systems) has obviated the earlier need for 2 GB limits on swath file sizes. Unless otherwise required by the data producer, lidar swaths may be of any file size supported within a 64-bit computing system. In cases where segmentation of the swaths is required by the data producer, the following requirements apply:

- Each sub-swath will retain the original File Source ID of the original complete swath.
- Points within each sub-swath will retain the Point Source ID of the original complete swath.
- Each sub-swath file will be named identically to the original complete swath, with the addition of an ordered alphabetic suffix to the name (“-a”, “-b” … “-n”). The order of the named sub-swaths shall be consistent with the collection order of the points (“-a” will be the chronological beginning of the swath; “-n” will be the chronological end of the swath).
- Point families shall be maintained intact within each sub-swath.
- Sub-swaths should be broken at the edge of the scan line.
- Other swath segmentation approaches may be acceptable, with prior approval.

5.10 Scope of Collection

All collected swaths are to be delivered as part of the Calibrated Raw Data Deliverable. This includes calibration swaths and cross-ties. This in no way requires or implies that calibration swath data are to be included in product generation. All collected points are to be delivered. No points are to be deleted from the swath LAS files. Excepted from this are extraneous data outside of the buffered project area (aircraft turns, transit between the collection area and airport, transit between fill-in areas, and the like). These points may be permanently removed. Busted swaths that are being completely discarded by the vendor and re-flown do not need to be delivered.

5.11 Positional Accuracy Validation

Before classification of and development of derivative products from the point cloud, the absolute and relative vertical accuracy of the point cloud shall be verified. A detailed report of the validation processes used shall be delivered.

5.12 Relative Vertical Accuracy

Relative vertical accuracy refers to the internal geometric quality of a lidar dataset, without regard to surveyed ground control. Two primary factors need to be considered in lidar data vertical accuracy:

- Smooth surface repeatability (intraswath), and
- Overlap consistency (interswath).

In ideal theoretical conditions, smooth surface repeatability is a measure of variations documented on a surface that would be expected to be flat and without variation. Users of lidar technology commonly refer to these variations as “noise.” Single-swath data will be assessed using only single returns in nonvegetated areas. Repeatability will be evaluated by measuring departures from planarity of single returns from hard planar surfaces, normalizing for actual variation in the surface elevation. Repeatability of only single returns will then be assessed at multiple locations within hard surfaced areas (for example, parking lots or large rooftops).

Each sample area will be evaluated using a signed difference raster (maximum elevation − minimum elevation) at a cell size equal to twice the ANPS, rounded up to the next integer. Sample areas will be approximately 50 square meters (m2). The maximum acceptable variations within sample areas at each QL are listed in the table “Relative vertical accuracy for lidar-swath data, Quality Level 0–Quality Level 3” (table 2). Isolated noise is expected within the sample areas and will be disregarded.
Overlap consistency is a measure of geometric alignment of two overlapping swaths; the principles used with swaths can be applied to overlapping lifts and projects as well. Overlap consistency is the fundamental measure of the quality of the calibration or boresight adjustment of the data from each lift, and is of particular importance as the match between the swaths of a single lift is a strong indicator of the overall geometric quality of the data, establishing the quality and accuracy limits of all downstream data and products.
Overlap consistency will be assessed at multiple locations within overlap in nonvegetated areas of only single returns. The overlap areas that will be tested are those between the following:

- Adjacent, overlapping parallel swaths within a project,
- Cross-tie swaths and the intersecting project swaths, and
- Adjacent, overlapping lifts.

Each overlap area will be evaluated using a signed difference raster with a cell size equal to twice the ANPS, rounded up to the next integer. The difference rasters will be visually examined using a bicolor ramp from the negative acceptable limit to the positive acceptable limit. Although isolated excursions beyond the limits are expected and accepted, differences in the overlaps shall not exceed the limits listed in table 2 for the QL of information that is being collected.
The difference rasters will be statistically summarized to verify that root mean square difference in z (RMSDz) values do not exceed the limits set forth in the table “Relative vertical accuracy for lidar-swath data, Quality Level 0–Quality Level 3” (table 2) for the QL of information that is being collected. Consideration will be given for the effect of the expected isolated excursions over limits.

Table 2. Relative vertical accuracy for lidar-swath data, Quality Level 0–Quality Level 3.

[cm, centimeter; $RMSD_Z$, root mean square difference in z; ≤, less than or equal to; ±, plus or minus]

Quality Level (QL)	Smooth surface repeatabilit	Swath overlap difference, $RMSD_Z$ (cm)	Swath overlap difference, maximum (cm)
QL0	≤3	≤4	±8
QL1	≤6	≤8	±16
QL2	≤6	≤8	±16
QL3	≤12	≤16	±32

5.13 Checkpoints

The Positional Accuracy Standards for Digital Geospatial Data (American Society for Photogrammetry and Remote Sensing, 2014) ties the required number of check points for vertical accuracy assessment to the areal extent of the project. Data producers are encouraged to carefully review the new and revised requirements in that document.

Check points for NVA assessments shall be surveyed in clear, open areas (which typically produce only single lidar returns), devoid of vegetation and other vertical artifacts (such as boulders, large riser pipes, and vehicles). Ground that has been plowed or otherwise disturbed is not acceptable. The same check points may be used for NVA assessment of the point cloud and DEM.

Check points for VVA assessments shall be surveyed in vegetated areas (typically characterized by multiple return lidar). Although the nature of vegetated areas makes absolute definition of a suitable test area difficult, these areas will meet the requirements below.

Suitable areas for check point survey are defined as having a minimum homogeneous area of ()2 5 ANPS×, with less than one-third of the required RMSEz deviation from a low-slope (less than 10 degrees) plane. In land covers other than forested and dense urban, the tested point will have no obstructions above 45 degrees over the horizon (to improve GPS reception and maximize lidar point collection). Check points will not be surveyed in areas of extremely high NIR absorption (fresh asphalt, wet soil, or tar), or in areas that are near abrupt changes in NIR reflectivity (asphalt pavement with runway stripes or white beach sand adjacent to water) because these abrupt changes usually cause unnatural vertical shifts in lidar elevation measurements. All tested locations will be photographed showing the position of the survey tripod and the ground condition of the surrounding area.

Additionally, control points used in the calibration process for data acquisition shall not be used as check points. Check points shall be an independent set of points used for the sole purpose of assessing the vertical accuracy of the project.

As stated in the National Standards for Spatial Data Accuracy (NSSDA) (Federal Geographic Data Committee, 1998) and reiterated in the ASPRS Positional Accuracy Standards for Digital Geospatial Data (American Society for Photogrammetry and Remote Sensing, 2014), it is unrealistic to prescribe detailed requirements for check point locations, as many unpredictable factors will affect field operations and decisions, and the data producer must often have the freedom to use their best professional judgment. The quantity and location of check points shall meet the following requirements, unless alternative criteria are approved by the SOM in advance:

1. The ASPRS-recommended total number of check points for a given project size shall be met.

2. The ASPRS-recommended distribution of the total number of check points between NVA and VVA assessments shall be met.

3. Check points within each assessment type (NVA and VVA) will be well-distributed across the entire project area. See the glossary at the end of this specification for a definition of “well-distributed.”

4. Within each assessment type, check points will be distributed among all constituent land cover types in approximate proportion to the areas of those land cover types (American Society for Photogrammetry and Remote Sensing, 2014).

5.14 Absolute Vertical Accuracy

Absolute vertical accuracy of the lidar data and the derived DEM will be assessed and reported in accordance with the ASPRS Positional Accuracy Standards for Digital Geospatial Data (American Society for Photogrammetry and Remote Sensing, 2014). Two broad land cover types shall be assessed: vegetated and nonvegetated. The Guidelines And Specifications For Flood Hazard Mapping Partners (Federal Emergency Management Agency, 2003) identifies seven land cover types; the “Guidelines For Digital Elevation Data” (National Digital Elevation Program, 2004) and the “Vertical Accuracy Reporting For Lidar” (American Society for Photogrammetry and Remote Sensing, 2004) reiterate the first five of those types. The table “Land cover classes” (table 3) presents how each of the seven classes was reported under the previous standards and how they are reported under the new ASPRS standards and by this specification.

Three absolute accuracy values shall be assessed and reported: NVA for the point cloud, NVA for the DEM, and VVA for the DEM. The minimum NVA and VVA requirements for all data, using the ASPRS methodology, are listed in the tables “Absolute vertical accuracy for lidar-swath data, Quality Level 0–Quality Level 3” (table 4) and “Absolute vertical accuracy for digital elevation models, Quality Level 0–Quality Level 3” (table 5). Both the NVA

and VVA required values shall be met. For projects dominated by dense forests, the SOM may accept higher VVA values.
The unclassified point cloud shall meet the required NVA before further classification and processing. The NVA for the point cloud is assessed by comparing check points surveyed in clear, open, nonvegetated areas (which typically produce only single lidar returns) to a triangulated irregular network (TIN) constructed from the single return lidar points in those areas. The NVA and VVA for the DEM are assessed by comparing check points to the final bare-earth surface.
The minimum required thresholds for absolute and relative accuracy may be increased when any of the following items are met:

- A demonstrable and substantial increase in cost is needed to obtain this accuracy.
- An alternate specification is needed to conform to previously contracted phases of a single larger overall collection effort such as for multiyear statewide collections.

Table 3. Land cover classes.
[Fundamental Vertical Accuracy (FVA); Nonvegetated Vertical Accuracy (NVA); Supplemental Vertical Accuracy (SVA); Vegetated Vertical Accuracy (VVA); Not Applicable (N/A)]

Class	Land cover class or description	Previous reporting	Current reporting
1	Clear or open, bare earth, low grass; for example, sand, rock, dirt, plowed fields, lawns, golf	FVA	NVA
2	Urban areas; for example, tall, dense man-made	SVA	
3	Tall grass, tall weeds, and crops; for example, hay, corn, and wheat fields	SVA	VVA
4	Brush lands and short trees; for example, chaparrals,	SVA	
5	Forested areas, fully covered by trees; for example, hardwoods, conifers, mixed forests	SVA	
6	Sawgrass	n/a	n/a
7	Mangrove and swamps	n/a	

Table 4. Absolute vertical accuracy for lidar-swath data, Quality Level 0–Quality Level 3.

[RMSEZ, root mean square error in z; cm, centimeter; NVA, nonvegetated vertical accuracy; ≤, less than or equal to]

Quality Level	$RMSE_z$ (nonvegetated)	NVA at 95-percent confidence
QL0	≤5.0	≤9.8
QL1	≤10.0	≤19.6
QL2	≤10.0	≤19.6
QL3	≤20.0	≤39.2

Table 5. Absolute vertical accuracy for digital elevation models, Quality Level 0–Quality Level 3.
[RMSEZ, root mean square error in z; cm, centimeter; NVA, nonvegetated vertical accuracy; VVA, vegetated vertical accuracy; ≤, less than or equal to]

Quality Level	$RMSE_z$ (nonvegetated) (cm)	NVA at 95-percent confidence	VVA at 95th percenti
QL0	≤5.0	≤9.8	≤14.7
QL1	≤10.0	≤19.6	≤29.4
QL2	≤10.0	≤19.6	≤29.4
QL3	≤20.0	≤39.2	≤58.8

5.15 Use of the LAS Withheld Flag

Outliers, blunders, noise points, geometrically unreliable points near the extreme edge of the swath, and other points the data producer deems unusable are to be identified using the Withheld Flag, as defined in the LAS Specification version 1.4 (American Society for Photogrammetry and Remote Sensing, 2011).
The Withheld Flag is primarily used to denote points identified during preprocessing or through automated post-processing routines as geometrically unusable.
Noise points subsequently identified during manual classification and quality assurance/quality control (QA/QC) are typically assigned the appropriate standard LAS classification values for noise–Class 7 is used for Low Noise and Class 18 is used for High Noise.

5.16 Use of the LAS Overlap Flag

The LAS Specification version 1.4 (American Society for Photogrammetry and Remote Sensing, 2011) includes a new overlap flag. Although strictly speaking, the term “overlap” means all lidar points lying within any overlapping areas of two or more swaths, the flag is intended to identify overage points, which are only a subset of overlap points. See the glossary for more information on the difference between overlap and overage. Having overage points identified allows for their easy exclusion from subsequent processes where the increased density and elevation variability they introduce is unwanted (for example, DEM generation).
Overage points have commonly been identified using Class 12, precluding other valuable classification (for example, bare earth, water). The overlap flag provides a discrete method to identify overage points while preserving the ability to classify the points in the normal way.
Overage points shall be identified using the LAS overlap flag in all point cloud deliverables.

5.17 Point Classification

The minimum scheme required for lidar point clouds is listed in the table “Minimum classified point cloud classification scheme” (table 6). Additional classes may be required on specific projects. The following requirements apply to point classification:

- In the raw LAS deliverable, no classifications are required; however, Overage (overlap) and Withheld Flags will be properly set.
- In the Classified LAS deliverable,
    - All points not identified as Withheld shall be classified.
    - No points in the Classified LAS deliverable shall remain assigned to Class 0.
    - Overage points shall only be identified using the Overlap Flag, as defined in the LAS Specification version 1.4 (American Society for Photogrammetry and Remote Sensing, 2011). Use of the point classification field in any way for overage/overlap identification is prohibited.

Table 6. Minimum classified point cloud classification scheme.

Code	Description
1	Processed, but unclassified.
2	Bare earth.
7	Low noise.
9	Water.
10	Ignored ground (near a
17	Bridge decks.
18	High noise.

5.18 Classification Accuracy

It is required that due diligence in the classification process will produce data that meet the following tests:

- Following classification processing, no non-withheld points should remain in Class 0.
- For QL3 data, within any 1 km2, no more than 2 percent of nonwithheld points will have demonstrable errors in the classification value.
- For QL2 data, within any 1 km2, no more than 1 percent of nonwithheld points will have demonstrable errors in the classification value.
- For QL1 and QL0 data, within any 1 km2, no more than 0.5 percent of nonwithheld points will have demonstrable errors in the classification value.
- Points remaining in Class 1 that should be classified in any other required class are subject to these accuracy requirements and will be counted towards the percentage thresholds.

Note: These requirements may be relaxed to accommodate collections in areas where the SOM agrees classification to be particularly difficult.

5.19 Classification Consistency

Point classification is to be consistent across the entire project. Noticeable variations in the character, texture, or quality of the classification between tiles, swaths, lifts, or other non-natural divisions will be cause for rejection of the entire deliverable.

5.20 Tiles

A single non-overlapped tiling scheme (the Project Tiling Scheme) will be established and agreed upon by

the data producer and the SOM before collection (file size will be a determinant). This scheme will be used for ALL tiled deliverables.

- The tiling scheme shall use the same coordinate reference system and units as the data.
- The tile size shall be an integer multiple of the cell size for raster deliverables.
- The tiles shall be indexed in x and y to an integer multiple of the x and y dimensions of the tile.
- The tiled deliverables shall edge-match seamlessly and without gaps.
- The tiled deliverables shall conform to the project tiling scheme without added overlap.

Note: SOM recommends a tiling scheme of 10,000 feet x 10,000 feet. This may be changed after discussions between SOM and the vendor.

6.0 Hydro-Flattening

Note: Please refer to Appendix 2 USGS Lidar Base Specification Version 1.2.
Reference: Heidemann, Hans Karl, 2014, Lidar Base Specification (ver. 1.2, November 2014): U.S. Geological Survey Techniques and Methods, book 11, chap. B4, 67 p. with appendixes.

Hydro-flattening pertains only to the creation of derived DEMs. Breaklines may be used to help classify the point data. The goal of the SOM, through use of hydro-flattening, is to enhance the cartographic and aesthetic value of derived DEMs (and derived contours) concerning water features. The goal is not to produce either Hydro-conditioned or Hydro-enforced DEMs. To accomplish this goal will require that ponds and lakes (of the size specified) include shore breaklines and/or polygons possessing a single elevation representing the current water level. Inland rivers and streams (of the size specified) will be addressed through creation of breaklines on either shore, and contain a descending elevation in the direction of flow as required to accurately reflect the current elevation of the water surface.

6.1 Inland Ponds and Lakes

- 2 acres or greater surface area (approximately equal to a round pond 350 feet in diameter) at the time of collection.
- Flat and level water bodies (single elevation for every bank vertex defining a given water body).
- The entire water surface edge must be at or below the immediately surrounding terrain. The presence of floating water bodies will be cause for rejection of the deliverable.
- Long impoundments such as reservoirs or inlets, whose water surface elevations drop when moving downstream, are required to be treated as rivers.

Note: Feature size thresholds may be increased by the SOM if the current thresholds prove to be prohibitively expensive.

6.2 Inland Streams and Rivers

- 100 feet nominal width: This should not unnecessarily break a stream or river into multiple segments. At times it may squeeze slightly below 100 feet for short segments. Data producers should use their best professional cartographic judgment.

- Flat and level bank-to-bank (perpendicular to the apparent flow centerline); gradient to follow the immediately surrounding terrain. In cases of sharp turns of rapidly moving water, where the natural water surface is notably not level bank-to-bank, it is appropriate to represent the water surface as it exists in nature, while maintaining an aesthetic cartographic appearance.
- The entire water surface edge must be at or below the immediately surrounding terrain.
- Stream channels are required to break at road crossings (culvert locations). The roadway over a culvert should be continuous. A culvert, regardless of size, is defined as having earth between the road surface

and the top of the structure.

- Bridges are required to be removed from the DEM. Streams and rivers should be continuous at bridge locations. Bridges are defined as having an elevated deck structure that does not rest on earth.
- When the identification of a structure such as a bridge or culvert cannot be made reliably, the feature should be regarded as a culvert.

6.3 Great Lakes

- Water surface is to be flat and level.
- The entire water surface edge must be at or below the immediately surrounding terrain.

6.4 Islands

- Permanent islands 1 acre or larger shall be delineated within all water bodies. This includes the Great Lakes.

6.5 Single-Line Streams

Cooperating partners may require collection and integration of single-line streams within their lidar projects. Although the SOM does not require these breaklines be collected or integrated, it does require that if used and incorporated into the DEMs, the following guidelines are met:

- All vertices along single-line stream breaklines are at or below the immediately surrounding terrain.
- Single-line stream breaklines are not to be used to introduce cuts into the DEM at road crossings (culverts), dams, or other such features. This is hydro-enforcement and as discussed in appendix 3 will create a non-topographic DEM.
- All breaklines used to modify the surface are to be delivered to the SOM with the DEMs.

7.0 Deliverables

7.1 Metadata

The term “metadata” refers to all descriptive information about the project. This includes textual reports, graphics, supporting shapefiles, and Federal Geographic Data Committee (FGDC)-compliant metadata files. Metadata deliverables include the following items:

- Collection report detailing mission planning and flight logs.
- Survey report detailing the collection of control and reference points used for calibration and QA/QC.
  - Control points used to calibrate and process the lidar and derivative data.
  - Check points used to validate the lidar point data or any derivative product.
- Processing report detailing calibration, classification, and product generation procedures including methodology used for breakline collection and hydro-flattening if hydro-flattening is requested (see the section called Hydro-Flattening, USGS Lidar Base Specification Version 1.2 appendix 2 for additional information. , Lidar Base Specification
- QA/QC Reports (detailing the analysis, accuracy assessment and validation of the following:
  - Point data (absolute vertical accuracy [NVA], relative vertical accuracy)
  - Bare-earth surface (absolute vertical accuracy [NVA and VVA])
  - Other optional deliverables as appropriate
- Control and calibration points: All control and reference points used to calibrate, control, process, and validate the lidar point data or any derivative products that are to be delivered in report form including appropriate from/to diagrams and photographs.

- Georeferenced, digital spatial representation of the precise extents of each delivered dataset. This should reflect the extents of the actual lidar source or derived product data, exclusive of TIN artifacts or raster NODATA areas. A union of tile boundaries or minimum bounding rectangles is not acceptable. ESRI Polygon shapefile or geodatabase is preferred.
- Product metadata [FGDC compliant, eXtensible Markup Language (XML) format metadata]. Each Lift: Describing the extents of the lift, the swaths included in the lift, locations of GPS base stations and control for the lift, preprocessing and calibration details for the lift, adjustment and fitting processes applied to the lift in relation to other lifts, and other lift-specific information.
- Each tiled deliverable product group:
  - Raw point data (calibrated-unclassified)
  - Classified point data
  - Bare-earth DEMs
  - Breaklines (if generated)
  - Other datasets delivered under the contract (Hydro-flattened and/or Hydro-enforced DEM, intensity images, and others)
  - FGDC compliant metadata must pass the FGDC metadata parser (mp) with no errors.
  - A block of lidar-related metadata tags specified by the USGS shall be included in FGDC metadata files for all lidar point data deliverables. All tags are required.

  Note: Please refer to the metadata example and template in appendixes 3 and 4 of the USGS Lidar Base Specification Version 1.2 for additional information. , Lidar Base Specification

7.2 Raw Point Cloud

Delivery of the raw point cloud, otherwise known as the **Calibrated-unclassified point cloud**, is a standard requirement for SOM lidar projects. Raw point cloud deliverables include the following items:

- All swaths, returns, and collected points, fully calibrated and adjusted to ground, by swath.
  - Withheld points should not be included in this deliverable but are required in the Classified Point Cloud.
- Fully compliant LAS Specification version 1.4, Point Data Record Format 6, 7, 8, 9, or 10.
- If collected, waveform data are to use external auxiliary files with the extension .wdp for the storage of waveform packet data. See appropriate LAS Specification for additional information (ASPRS 2011).
- Correct and properly formatted georeference information a Open Geospatial Consortium (OGC) well known text (WKT) in all LAS file headers.
- GPS times are to be recorded as Adjusted GPS Time, at a precision sufficient to allow unique timestamps for each pulse.
- Intensity values, normalized to 16-bit. See ASPRS LAS specification 1.4.
- A report of the assessed relative vertical accuracy of the point cloud (smooth surface repeatability and overlap consistency). Relative vertical accuracy requirements are listed in table 2. Raw swath point cloud data shall meet the required accuracy levels before point cloud classification and derivative product generation.
- A report of the assessed absolute vertical accuracy (NVA only) of the unclassified lidar point data in accordance with the guidelines set forth in the Positional Accuracy Standards for Digital Geospatial Data (American Society for Photogrammetry and Remote Sensing, 2014). Absolute vertical accuracy requirements using the ASPRS methodology for the raw point cloud are listed in table 4. Raw swath point cloud data shall meet the required accuracy levels before point cloud classification and derivative product generation.

7.3 Classified Point Cloud

Delivery of classified point cloud data is an optional product for SOM lidar projects. Classified point cloud deliverables include the following items:

- All project swaths, returns, and collected points, fully calibrated, adjusted to ground, and classified, by tiles. Project swaths exclude calibration swaths, cross-ties, and other swaths not used, or intended to be used, in product generation.
- Fully compliant LAS Specification version 1.4, Point Data Record Format 6, 7, 8, 9, or 10.
- If collected, waveform data are to use external auxiliary files with the extension .wdp for the storage of waveform packet data. See appropriate LAS Specification for additional information (ASPRS 2011).
- Correct and properly formatted georeference information a Open Geospatial Consortium (OGC) well known text (WKT) in all LAS file headers.
- GPS times are to be recorded as Adjusted GPS Time, at a precision sufficient to allow unique timestamps for each pulse.
- Intensity values, normalized to 16-bit. See ASPRS LAS specification 1.4.
- Tiled delivery, without overlap, using project tiling scheme.
- Classification, as defined in table 6, at a minimum.

7.4 Bare-Earth Surface Digital Elevation Model (DEM)

Delivery of a bare-earth DEM in both Raster and ASCII format is an optional product for SOM lidar projects. Bare-earth surface deliverables include the following items:

- Bare-earth DEM, generated to the limits of the Buffered Project Area.
- Bare-earth DEM resolution as shown in the table “Digital elevation model cell size, Quality Level 0–Quality Level 3” (table 7).

Table 7. Digital elevation model cell size, Quality Level 0–Quality Level 3. [m, meter; ft, feet]

Quality Level	Minimum cell size (m)	Minimum cell size (ft)
QL0	0.5	1
QL1	0.5	1
QL2	1	2
QL3	2	5

- Raster data file with cell size per Table 7 in an industry-standard, GIS-compatible, 32-bit floating point raster format (ERDAS .IMG preferred).
- ASCII text file with cell size per Table 7.
- Georeference information shall be included in each raster and ASCII file.
- Tiled delivery, without overlap.

- DEM tiles will show no edge artifacts or mismatch. A quilted appearance in the overall project DEM surface, whether caused by differences in processing quality or character between tiles, swaths, lifts, or other non-natural divisions, will be cause for rejection of the entire deliverable.
- Void areas (for example, areas outside the Buffered Project Area but within the tiling scheme) shall be coded using a unique NODATA value. This value shall be identified in the appropriate location within the raster file header or external support files (for example, .aux).
- A report on the assessed absolute vertical accuracy (NVA and VVA) of the bare-earth surface in accordance with the guidelines set forth in the "Positional Accuracy Standards for Digital Geospatial Data" (American Society for Photogrammetry and Remote Sensing, 2014). Absolute vertical accuracy requirements using the ASPRS methodology for the bare-earth DEM are listed in "Absolute vertical accuracy for digital elevation models, Quality Level 0–Quality Level 3" (table 5).
- Depressions (sinks), natural or man-made, are not to be filled (as in hydro-conditioning and hydro-enforcement).

7.5 Hydro-flattened Digital Elevation Model (DEM) and Breaklines/Polygons

Hydro-flattened DEM in both Raster and ASCII format is an optional product for SOM lidar projects. Hydro-flattened surface deliverables include the following items:

- Hydro-flattened DEM, generated to the limits of the Buffered Project Area.
- Hydro-flattened DEM resolution as shown in the table "Digital elevation model cell size, Quality Level 0–Quality Level 3" (table 7).

Table 7. Digital elevation model cell size, Quality Level 0–Quality Level 3. [m, meter; ft, feet]

Quality Level	Minimum cell size (m)	Minimum cell size (ft)
QL0	0.5	1
QL1	0.5	1
QL2	1	2
QL3	2	5

- Raster data file with cell size per Table 7 in an industry-standard, GIS-compatible, 32-bit floating point raster format (ERDAS .IMG preferred).
- ASCII text file with cell size per Table 7.
- Georeference information shall be included in each raster and ASCII file.
- Tiled delivery, without overlap.
- DEM tiles will show no edge artifacts or mismatch. A quilted appearance in the overall project DEM surface, whether caused by differences in processing quality or character between tiles, swaths, lifts, or other non-natural divisions, will be cause for rejection of the entire deliverable.
- Void areas (for example, areas outside the Buffered Project Area but within the tiling scheme) shall be coded using a unique NODATA value. This value shall be identified in the appropriate location within the raster file header or external support files (for example, .aux).
- Vertical accuracy of the DEM must match the vertical accuracy of the point data.

- Depressions (sinks), natural or man-made, are not to be filled (as in hydro-conditioning and hydro-enforcement).
- Water bodies (ponds and lakes), wide streams and rivers (double-line), and other non-tidal water bodies as defined in the section called Hydro-flattening are to be hydro-flattened within the DEM. Hydro-flattening shall be applied to all water impoundments, natural or man-made, that are larger than 2 acres in area (approximately equal to a round pond 350 feet in diameter), to all streams that are nominally wider than 100 feet, and to all Great Lakes areas. The methodology used for hydro-flattening is at the discretion of the data producer.

Note: Please refer to the section called Hydro-Flattening and appendix 2 of the USGS Lidar Base Specification Version 1.2 for detailed discussion. , Lidar Base Specification

Delivery of the breaklines generated during hydro-flattening is a standard requirement for SOM lidar projects if Hydro-flattening was completed. If hydro-flattening is achieved through other means, this section may not apply. Breakline (and/or polygon) deliverables include the following items:

- Breaklines defining the limits and elevations of the water bodies shall be developed to the limit of the Buffered Project Area.
- All breaklines developed for use in hydro-flattening shall be delivered as an ESRI feature class (PolylineZ or PolygonZ format, as appropriate to the type of feature represented and the methodology used by the data producer). Shapefile or geodatabase is required.
- Each feature class or shapefile will include properly formatted and accurate georeference information in the standard location. All shapefiles must include a correct and properly formatted *.prj file.
- Breaklines must use the same coordinate reference system (horizontal and vertical) and units as the lidar point delivery.
- Breakline delivery may be as a continuous layer or in tiles, at the discretion of the data producer. In the case of tiled deliveries, all features must edge-match exactly across tile boundaries in both the horizontal (*X*-*Y*) and vertical (*Z*) spatial locations.
- If Hydro-flattening is selected as an upgrade, the Classified Point Cloud Data (7.3) must include Water points.

7.6 Hydro-Enforced Digital Elevation Model (DEM) and Breaklines/Polygons

Delivery of a Hydro-enforced DEM in both Raster and ASCII format is an optional product for SOM lidar projects. Deliverables include the following items:

- Hydro-enforced DEM, generated to the limits of the Buffered Project Area.
- Hydro-enforced DEM resolution as shown in the table “Digital elevation model cell size, Quality Level 0–Quality Level 3” (table 7).

Table 7. Digital elevation model cell size, Quality Level 0–Quality Level 3. [m, meter; ft, feet]

Quality Level	Minimum cell size (m)	Minimum cell size (ft)
QL0	0.5	1
QL1	0.5	1
QL2	1	2
QL3	2	5

- Raster data file with cell size per Table 7 in an industry-standard, GIS-compatible, 32-bit floating point raster format (ERDAS .IMG preferred).
- ASCII text file with cell size per Table 7.
- Georeference information shall be included in each raster and ASCII file.
- Tiled delivery, without overlap.
- Hydro-enforced DEM tiles will show no edge artifacts or mismatch. A quilted appearance in the overall project DEM surface, whether caused by differences in processing quality or character between tiles, swaths, lifts, or other non-natural divisions, will be cause for rejection of the entire deliverable.
- Void areas (for example, areas outside the Buffered Project Area but within the tiling scheme) shall be coded using a unique NODATA value. This value shall be identified in the appropriate location within the raster file header or external support files (for example, .aux).
- Vertical accuracy of the DEM must match the vertical accuracy of the point data.

Note: Reference Appendix 3 of this document for Hydrologically-Enforced definition, and requirements.

Delivery of the breaklines generated during hydro-enforcement is a standard requirement for SOM lidar projects if Hydro-enforcement was completed. Breakline (and/or polygon) deliverables include the following items:

- Breaklines defining the limits and elevation of water bodies shall be developed to the limit of the Buffered Project Area.
- All breaklines developed for use in hydro-enforcement shall be delivered as an ESRI feature class (PolylineZ or PolygonZ format, as appropriate to the type of feature represented and the methodology used by the data producer). Shapefile or geodatabase is required.
- Each feature class or shapefile will include properly formatted and accurate georeference information in the standard location. All shapefiles must include a correct and properly formatted *.prj file.
- Breaklines must use the same coordinate reference system (horizontal and vertical) and units as the lidar point delivery. Breakline delivery may be as a continuous layer by Area of Interest or in tiles, at the discretion of the data producer. In the case of tiled deliveries, all features must edge-match exactly across tile boundaries in both the horizontal (*X*-*Y*) and vertical (*Z*) spatial locations.

If Hydro-enforcement is selected as an upgrade, the Classified Point Cloud Data (7.3) must include Water points.

7.7 Lidar Intensity Images

Lidar intensity images are georeferenced raster files with each pixel representing the intensity of the Lidar return.

- Lidar intensity image, generated to the limits of the Buffered Project Area.
- Raster data file with cell size equal to the QL value in Table 7.
- 8-bit GeoTIFF file format required.
- Georeference information shall be included in each raster file.
- Tiled delivery, without overlap.
- Void areas (for example, areas outside the Buffered Project Area but within the tiling scheme) shall be coded using a NODATA value.

7.8 Delivery Schedule

Delivery schedules will be defined upon finalization of each season's Statement of Work. Deliverables identified in a project Statement of Work shall begin within 4 months of the end of the applicable acquisition season.

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Appendix 1. Common Data Upgrades

- Independent 3rd-Party QA/QC by another Architecture & Engineering (AE) Contractor (encouraged)
- Lower NPS (greater point density)
- Increased Vertical Accuracy
- Full Waveform collection and delivery
- Additional Environmental Constraints
  - Interpolation based on 1st-Returns
  - Interpolation based on All-Returns, summed
- Detailed Classification (additional classes; e.g., vegetation levels)
- Hydro-Enforced DEMs as an additional deliverable
- Hydro-Conditioned DEMs as an additional deliverable
- Breaklines (PolylineZ and PolygonZ) for single-line hydrographic features
  - Narrow streams not collected as double-line, culverts, and other similar features, including appropriate integration into delivered DEMs
  - Breaklines (PolylineZ and PolygonZ) for other features (to be determined)
  - Including appropriate integration into delivered DEMs
  - Extracted Buildings (PolygonZ)
- Footprints with maximum elevation or height above ground as an attribute
- Other products as defined by requirements and agreed upon in advance of funding commitment

Appendix 2. Guidelines

Scan Angle

For oscillating mirror lidar systems, the total field of view should not exceed 40 degrees (within 20 degrees of nadir). State of Michigan (SOM) quality assurance on collections performed using scan angles wider than 34 degrees will be particularly rigorous in the edge-of-swath areas. Lidar systems that use rotating mirrors/prisms may be exempted from this guideline.

Swath Size

The processing report shall include detailed information on swath segmentation sufficient to allow reconstruction of the original swaths if needed.

Non-Tidal Boundary Waters

The elevation along the edge or edges should behave consistently throughout the project. May be a single elevation (for example, a lake) or gradient (for example, a river), as appropriate. If unusual changes in water surface elevation occur during the course of the collection, then the surface may be treated as a tidal boundary, as described in the next section. The reason for the changes must be documented in the project metadata.

Breaklines and Hydro-Flattening

The SOM does not require any particular process or methodology be used for hydro-flattening or for breakline collection, extraction, or integration. However, if breaklines are developed, the following general guidelines must be adhered to:

- Bare-earth lidar points that are in close proximity breaklines should be excluded from the DEM generation process. This is analogous to the removal of masspoints for the same reason in a traditional photogrammetrically compiled digital terrain model (DTM). The proximity threshold for reclassification as Ignored Ground is at the discretion of the data producer, but in general should not exceed the nominal pulse spacing (NPS). These points are to be retained in the delivered lidar point dataset and shall be reclassified as Ignored Ground (class value = 10) so that they may be subsequently identified.
- Delivered data must be sufficient for the SOM to effectively recreate the delivered DEMs using the lidar points and breaklines without substantial editing.
- The goal of hydro-flattening is to produce a topographic DEM that, with respect to water surfaces, resembles a DEM derived from traditional photogrammetric methods. Best professional judgment should be used to achieve this end.

Appendix 3. Hydro-Flattening Reference

The subject of modifications to lidar-based digital elevation models (DEM) is somewhat new and there is substantial variation in the understanding of the topic across the industry.

The information presented here is not meant to supplant other reference materials and it should not be considered authoritative beyond its intended scope.

Hydro-flattening is a new term, first coined in the USGS Lidar Base Specification Version 1.0. It conveys the need of users to have a specific type of functional surface. Hydro-flattening of DEMs is accomplished predominantly through the use of breaklines, and this method is considered standard. Although other techniques may exist to achieve similar results, this section assumes the use of breaklines. The SOM does not require the use of any specific technique.

The Digital Elevation Model Technologies and Applications: The DEM User's Manual, 2nd Edition (Maune, 2007) provides the following definitions related to the adjustment of DEM surfaces for hydrologic analyses.

- *Hydrologically Conditioned (Hydro-Conditioned)* Processing of a DEM or TIN so that the flow of water is continuous across the entire terrain surface, including the removal of all spurious sinks or pits. The only sinks that are retained are the real ones on the landscape. Whereas hydrologically-enforced is relevant to drainage features that are generally mapped, hydrologically-conditioned is relevant to the entire land surface and is done so that water flow is continuous across the surface, whether that flow is in a stream channel or not. The purpose for continuous flow is so that relations/links among basins/catchments can be known for large areas. This term is specifically used when describing Elevation Derivatives for National Applications (EDNA), the dataset of NED derivatives made specifically for hydrologic modeling purposes.

- *Hydrologically-Enforced (Hydro-Enforced)* Processing of mapped water bodies so that lakes and reservoirs are level and so that streams flow downhill. For example, a DEM, TIN or topographic contour dataset with elevations removed from the tops of selected drainage structures (bridges and culverts) so as to depict the terrain under those structures. Hydro-enforcement enables hydrologic and hydraulic models to depict water flowing under these structures, rather than appearing in the computer model to be dammed by them because of road deck elevations higher than the water levels. Hydro-enforced TINs also use breaklines along shorelines and stream centerlines, for example, where these breaklines form the edges of TIN triangles along the alignment of drainage features. Shore breaklines for streams would be 3-D breaklines with elevations that decrease as the stream flows downstream; however, shore breaklines for lakes or reservoirs would have the same elevation for the entire shoreline if the water surface is known or assumed to be level throughout. See also the definition for hydrologically conditioned that has a slightly different meaning.

Whereas these are important and useful modifications, they result in surfaces that differ substantially from a traditional DEM. A hydro-conditioned surface has had its sinks filled and may have had its water-bodies flattened. This is necessary for correct flow modeling within and across large drainage basins. Hydro-enforcement extends this conditioning by requiring water bodies be leveled and streams flattened with the appropriate downhill gradient, and also by cutting through road crossings over streams (culvert locations) to allow a continuous flow path for water within the drainage. These treatments result in a surface on which water behaves as it physically does in the real world, and they are invaluable for specific types of hydraulic and hydrologic (H&H) modeling activities. Neither of these treatments is typical of a traditional DEM surface.

A traditional DEM, on the other hand, attempts to represent the ground surface more the way a bird, or person in an airplane, sees it. On this surface, natural depressions exist, and roadways create apparent sinks because the roadway is depicted continuously without regard to the culvert beneath, making it an apparent dam. Bridges, it should be noted, are removed in most all types of DEMs because they are man-made, above-ground structures that have been added to the landscape.

Note: DEMs developed solely for orthophoto production may include bridges, as their presence can prevent the smearing of structures and reduce the amount of post-production correction of the final orthophoto. These are special use DEMs and are not relevant to this discussion.

For years, raster DEMs have been created from a digital terrain model (DTM) of masspoints and breaklines, which in turn were created through photogrammetric compilation from stereo imagery. Photogrammetric DTMs inherently contain breaklines defining the edges of water bodies, coastlines, single-line

streams, and double-line streams and rivers, as well as numerous other surface features.

Lidar technology, however, does not inherently collect the breaklines necessary to produce traditional DEMs. Breaklines have to be developed separately through a variety of techniques, and either used with the lidar points in the generation of the DEM, or applied as a correction to DEMs generated without breaklines.

Supplemental Information

USGS Lidar Base Specification Version 1.2:
Heidemann, Hans Karl, 2014, Lidar Base Specification (ver. 1.2, November 2014): U.S. Geological Survey Techniques and Methods, book 11, chap. B4, 67 p. with appendixes.

Final Report; National Enhanced Elevation Assessment:
http://www.dewberry.com/Consultants/GeospatialMapping/FinalReport-NationalEnhancedElevationAssessment

USGS National Elevation Dataset (NED) Web site:
http://ned.usgs.gov/

National Digital Elevation Program Guidelines for Digital Elevation Data
http://www.ndep.gov/NDEP_Elevation_Guidelines_Ver1_10May2004.pdf

ASPRS LAS Specification
http://asprs.org/Committee-General/LASer-LAS-File-Format-Exchange-Activities.html

USGS Center for Lidar Information Coordination and Knowledge (CLICK) Web site:
http://lidar.cr.usgs.gov/

MP-Metadata Parser:
http://geology.usgs.gov/tools/metadata/

National Institute of Standards and Technology (NIST) Percentile Information:
http://itl.nist.gov/div898/handbook/prc/section2/prc252.htm

Attachment 2: Optional Imagery Hosting Service

1. Optional Imagery Hosting Service

1.1 Characteristics

Provide a hosting and service solution capable of supporting multiple Terabytes of SOM imagery.

Solution to provide both hosting and service capabilities, including but not limited to; data discovery, review, retrieval, metadata search, etc.

Hosting services must comply with all State IT standards, policies and procedures as listed below:

ENVIRONMENT

The links below provide information on the State's Enterprise Information Technology (IT) policies, standards and procedures which includes security policy and procedures, eMichigan web development, and the State Unified Information Technology Environment (SUITE).

The State has methods, policies, standards and procedures that have been developed over the years. Contractors are expected to provide proposals that conform to State IT policies and standards. All services and products provided as a result of this RFP must comply with all applicable State IT policies and standards. Contractor must review all applicable links provided below and state compliance in their response.

Enterprise IT Policies, Standards and Procedures:
http://michigan.gov/dtmb/0,4568,7-150-56355_56579_56755---,00.html

All vendor proposals, services, and products must conform to State IT policies and standards located here. If a vendor is awarded a contract, DTMB will provide additional policy information as may be necessary.

Software and hardware provided by the Contractor (if any) must be compatible with DTMB's Standard Information Technology Environment. Non-standard development tools may not be used unless approved in writing by DTMB.

Any change to DTMB's Standard IT Environment must be approved in writing by the DTMB and the State's Project Manager before work may proceed based on the changed environment.

Enterprise IT Security Policy and Procedures:

The State's security environment includes:

- DTMB Single Login,
- SQL security database,
- Secured Socket Layers, and
- RSA SecurID.

Look and Feel Standard

All software items provided by the Contractor must be ADA compliant and adhere to the Look and Feel Standards, found at: www.michigan.gov/somlookandfeelstandards.

ADA Compliance. Contractor shall comply with and adhere to the Accessibility Standards of Section 508 of the Rehabilitation Act of 1973, including any more specific requirements set forth in an applicable Statement of Work. See DTMB Policy at

http://www.michigan.gov/documents/dmb/1650.00_209567_7.pdf?20151026134621.

The State Unified Information Technology Environment (SUITE):
Includes standards for project management, systems engineering, and associated forms and templates – must be followed: http://www.michigan.gov/suite

1.2 Accessibility

Data must be stored in a secure environment such that it is only available to SOM employees, SOM internet mapping applications, SOM approved partners and SOM approved vendors.

At time of request, vendor must complete, and SOM must approve, a SOM Enterprise Architecture Solution Assessment (EASA) and Information Technology Security Assessment (DTMB 170).

Solution must provide data access via mutually agreed upon standard Services (WMTS, WMS, WFS, WCS, etc.).

1.3 SOM Administrative Access

Solution must provide secure administrative access to approved SOM users to accomplish the following administrative functions:

- Grant user access permissions
- Upload data to the host

1.4 Proposed Solution

In the event that hosting is purchased; contractor must provide detail regarding the following:

- Operating System
- Software / Licensing
- Storage
- Network Accessibility
- Service Level Agreement
- Disaster Recovery
- Security
- Administrative Access

To be reviewed and approved by Enterprise Architecture (EA) and Enterprise Security (ES)

Schedule B - Pricing

Sanborn - Onshore Structure

Cost Table

Table 1: IMAGERY PRICING, per Exhibit A - Statement of Work, Services and Deliverables, Section A
12" GSD, 4-band, per square mile price based on the following TOTAL ANNUAL project square miles, AOIs defined by County boundaries. Detailed specifications in Attachment 1 - Imagery Specifications

Square Miles	Cost per sq. mile
<4,000	$ 42.09
4,000 - 5,999	$ 39.72
6,000 - 7,999	$ 39.35
8,000 - 10,000	$ 38.99
>10,000	$ 38.39

% Reduction for contiguous AOIs (sq. miles). Contiguous defined as two or more AOIs touching at any one point. AOIs can be of various GSDs.

Contiguous Square Miles	% Reduction
1,000 – 2,500	0%
2,501 – 5,000	17.2%
>5,000	21.6%

6" GSD, 4-band, per square mile price based on the following High Resolution Areas (HRA) values. Detailed specifications in Attachment 1 - Imagery Specifications - Section 6.1

Square Miles	Cost per sq. mile
10-100	$ 212.49
101-500	$ 75.16
>500	$ 48.31

3” GSD, 4-band, per square mile price based on the following High Resolution Areas (HRA) values. Detailed specifications in Attachment 1 - Imagery Specifications - Section 6.1

Square Miles	Cost per sq. mile
10-100	$ 371.75
101-500	$ 193.45
>500	$ 149.31

Table 2: LIDAR PRICING, per Exhibit A - Statement of Work, Services and Deliverables, Section B
Base product collected using specifications defined in Sections 4, 5, and 6 of Attachment B - Lidar Specification and QL 2 specifications section 5, per square mile

Deliverable Option 1

Raw Point Cloud - Calibrated-unclassified Section 7.2

square miles	Cost per sq. mile	% Increase for QL 1	% Reduction for QL 3
<100	$ 270.16	64%	12%
101-500	$ 119.36	68%	30%
501-1000	$ 107.72	70%	35%
1001-5000	$ 78.23	75%	36%
>5000	$ 69.57	79%	37%

Deliverable Option 2			
Classified Point Cloud - Section 7.3			
square miles	Cost per sq. mile	% Increase for QL 1	% Reduction for QL 3
<100	$ 47.01	1%	13%
101-500	$ 30.17	1%	20%
501-1000	$ 26.85	1%	22%
1001-5000	$ 24.29	1%	25%
>5000	$ 23.26	1%	26%

Deliverable Option 3			
Bare-Earth Surface - Section 7.4			
square miles	Cost per sq. mile	% Increase for QL 1	% Reduction for QL 3
<100	$ 2.35	1%	13%
101-500	$ 1.51	1%	20%
501-1000	$ 1.34	1%	22%
1001-5000	$ 1.21	1%	25%
>5000	$ 1.16	1%	26%

Deliverable Option 4			
Hydro-flattened Bare-Earth Surface, including Breaklines - Section 7.5			
square miles	Cost per sq. mile	% Increase for QL 1	% Reduction for QL 3
<100	$ 37.16	0%	0%
101-500	$ 32.08	0%	0%

501-1000	$	28.71	0%	0%
1001-5000	$	28.09	0%	0%
>5000	$	25.82	0%	0%
Deliverable Option 5				
Hydro-Enforced Digital Elevation Model (DEM) - Section 7.6				
square miles	Cost per sq. mile		% Increase for QL 1	% Reduction for QL 3
<100	$	13.69	0%	0%
101-500	$	11.74	0%	0%
501-1000	$	9.39	0%	0%
1001-5000	$	8.61	0%	0%
>5000	$	7.43	0%	0%
Deliverable Option 6				
Lidar Intensity Images - Section 7.7				
square miles	Cost per sq. mile		% Increase for QL 1	% Reduction for QL 3
<100	Included with production above		0%	0%
101-500	Included with production above		0%	0%
501-1000	Included with production above		0%	0%
1001-5000	Included with production above		0%	0%
>5000	Included with production above		0%	0%

*** Contiguous** defined as two or more AOIs touching at any one point. AOIs can be of various GSDs

Table 3: Optional Oblique, per Exhibit A - Statement of Work, Optional Services and Deliverables

12" GSD, 4-band, per square mile price based on the following TOTAL ANNUAL project square miles, AOIs defined by County boundaries. Detailed specifications in Attachment 1 - Imagery Specifications

Square Miles	Cost per sq. mile
<4,000	$ 91.15
4,000 - 5,999	$ 89.89
6,000 - 7,999	$ 88.82
8,000 - 10,000	$ 87.85
>10,000	$ 86.91

% Reduction for contiguous AOIs (sq. miles). Contiguous defined as two or more AOIs touching at any one point. AOIs can be of various GSDs.

Contiguous Square Miles	% Reduction
1,000 – 2,500	0%
2,501 – 5,000	22%
>5,000	23%

6" GSD, 4-band, per square mile price based on the following High Resolution Areas (HRA) values. Detailed specifications in Attachment 1 - Imagery Specifications - Section 6.1

Square Miles	Cost per sq. mile
10-100	$ 292.39

101-500	$	104.60
>500	$	97.24

3" GSD, 4-band, per square mile price based on the following High Resolution Areas (HRA) values. Detailed specifications in Attachment 1 - Imagery Specifications - Section 6.1

Square Miles	Cost per sq. mile	
10-100	$	430.28
101-500	$	260.76
>500	$	197.03

Table 4: Optional Hosting

Flat Annual Rate	Cost per year	
Flat Annual Rate Year 1	$ 165,082.00	20 TB of Imagery Cache
Flat Annual Rate Year 2	$ 153,516.00	25 TB of Imagery Cache
Flat Annual Rate Year 3	$ 157,692.00	30 TB of Imagery Cache
Flat Annual Rate Year 4	$ 161,868.00	35 TB of Imagery Cache

Additional Pricing Items

Ortho Imagery - Compressed Mosaics	$400	per county	
Oblique Viewer And Hosting			
Sanborn Oblique Analyst (SOA -Viewer)	$ 14,500.00	per installation, this is a one time fee in year 1	
Optional SOA Maintenance	$ 2,900.00	for each installed, not charged until year 2	

Optional Sanborn Hosting of Oblique Data	$ 500.00	per month fee per county	
Google Imagery	$5/km for RGB, $7/km for RGBIR, minimum order of $25,000		

Sanborn - Offshore Structure

Cost Table

Table 1: IMAGERY PRICING, per Exhibit A - Statement of Work, Services and Deliverables, Section A **12" GSD, 4-band, per square mile price based on the following TOTAL ANNUAL project square miles, AOIs defined by County boundaries. Detailed specifications in Attachment 1 - Imagery Specifications**		
Square Miles	Cost per sq. mile	
<4,000	$	37.88
4,000 - 5,999	$	35.47
6,000 - 7,999	$	35.14
8,000 - 10,000	$	34.82
>10,000	$	34.25

% Reduction for contiguous AOIs (sq. miles). Contiguous defined as two or more AOIs touching at any one point. AOIs can be of various GSDs.

Contiguous Square Miles	% Reduction
1,000 – 2,500	0%
2,501 – 5,000	18.1%
>5,000	20.1%

6” GSD, 4-band, per square mile price based on the following High Resolution Areas (HRA) values. Detailed specifications in Attachment 1 - Imagery Specifications - Section 6.1

Square Miles	Cost per sq. mile
10-100	$ 187.32
101-500	$ 64.14
>500	$ 40.99

3” GSD, 4-band, per square mile price based on the following High Resolution Areas (HRA) values. Detailed specifications in Attachment 1 - Imagery Specifications - Section 6.1

Square Miles	Cost per sq. mile
10-100	$ 321.01
101-500	$ 162.79
>500	$ 122.94

Table 2: LIDAR PRICING, per Exhibit A - Statement of Work, Services and Deliverables, Section B
Base product collected using specifications defined in Sections 4, 5, and 6 of Attachment B - Lidar Specification and QL 2 specifications section 5, per square mile

Deliverable Option 1			
Raw Point Cloud - Calibrated-unclassified Section 7.2			
square miles	Cost per sq. mile	% Increase for QL 1	% Reduction for QL 3
<100	$ 270.16	64%	12%
101-500	$ 119.36	68%	30%
501-1000	$ 107.72	70%	35%
1001-5000	$ 78.23	75%	36%
>5000	$ 69.57	79%	37%

Deliverable Option 2			
Classified Point Cloud - Section 7.3			
square miles	Cost per sq. mile	% Increase for QL 1	% Reduction for QL 3
<100	$ 35.26	1%	13%
101-500	$ 22.63	1%	20%
501-1000	$ 20.14	1%	22%
1001-5000	$ 18.22	1%	25%
>5000	$ 17.45	1%	26%

Deliverable Option 3			
Bare-Earth Surface - Section 7.4			
square miles	Cost per sq. mile	% Increase for QL 1	% Reduction for QL 3
<100	$ 1.76	1%	13%
101-500	$ 1.13	1%	20%
501-1000	$ 1.01	1%	22%

1001-5000	$	0.91	1%	25%
>5000	$	0.87	1%	26%
Deliverable Option 4				
Hydro-flattened Bare-Earth Surface, including Breaklines - Section 7.5				
square miles	Cost per sq. mile		% Increase for QL 1	% Reduction for QL 3
<100	$	27.87	0%	0%
101-500	$	24.06	0%	0%
501-1000	$	21.53	0%	0%
1001-5000	$	21.06	0%	0%
>5000	$	19.36	0%	0%
Deliverable Option 5				
Hydro-Enforced Digital Elevation Model (DEM) - Section 7.6				
square miles	Cost per sq. mile		% Increase for QL 1	% Reduction for QL 3
<100	$	10.27	0%	0%
101-500	$	8.80	0%	0%
501-1000	$	7.04	0%	0%
1001-5000	$	6.45	0%	0%
>5000	$	5.57	0%	0%
Deliverable Option 6				
Lidar Intensity Images - Section 7.7				
square miles	Cost per sq. mile		% Increase for QL 1	% Reduction for QL 3

<100	Included with production above	0%	0%
101-500	Included with production above	0%	0%
501-1000	Included with production above	0%	0%
1001-5000	Included with production above	0%	0%
>5000	Included with production above	0%	0%

*** Contiguous** defined as two or more AOIs touching at any one point. AOIs can be of various GSDs

Table 3: Optional Oblique, per Exhibit A - Statement of Work, Optional Services and Deliverables
12" GSD, 4-band, per square mile price based on the following TOTAL ANNUAL project square miles, AOIs defined by County boundaries. Detailed specifications in Attachment 1 - Imagery Specifications

Square Miles	Cost per sq. mile	
<4,000	$	91.15
4,000 - 5,999	$	89.89
6,000 - 7,999	$	88.82
8,000 - 10,000	$	87.85
>10,000	$	86.91

% Reduction for contiguous AOIs (sq. miles). Contiguous defined as two or more AOIs touching at any one point. AOIs can be of various GSDs.

Contiguous Square Miles	% Reduction
1,000 – 2,500	0%
2,501 – 5,000	22%
>5,000	23%

6” GSD, 4-band, per square mile price based on the following High Resolution Areas (HRA) values. Detailed specifications in Attachment 1 - Imagery Specifications - Section 6.1

Square Miles	Cost per sq. mile	
10-100	$	292.39
101-500	$	104.60
>500	$	97.24

3” GSD, 4-band, per square mile price based on the following High Resolution Areas (HRA) values. Detailed specifications in Attachment 1 - Imagery Specifications - Section 6.1

Square Miles	Cost per sq. mile	
10-100	$	430.28
101-500	$	260.76
>500	$	197.03

Table 4: Optional Hosting

Flat Annual Rate	Cost per year	
Flat Annual Rate Year 1	$	165,082.00

Flat Annual Rate Year 2	$	153,516.00
Flat Annual Rate Year 3	$	157,692.00
Flat Annual Rate Year 4	$	161,868.00

Additional Pricing Items			
Ortho Imagery - Compressed Mosaics	$400	per county	
Oblique Viewer And Hosting			
Sanborn Oblique Analyst (SOA -Viewer)	$ 14,500.00	per installation, this is a one time fee in year 1	
Optional SOA Maintenance	$ 2,900.00	for each installed, not charged until year 2	
Optional Sanborn Hosting of Oblique Data	$ 500.00	per month fee per county	
Google Imagery	$5/km for RGB, $7/km for RGBIR, minimum order of $25,000		