

(Exhibit A)  
**FLORIDA DEPARTMENT OF REVENUE**  
**Mapping and GIS Section**

**PROJECT TITLE:** FY 2010 DIGITAL ORTHOPHOTO **(Project Number)**

**PURCHASE ORDER:** \_\_\_\_\_

**WORK ORDER NAME:** Orthophoto

**WORK ORDER NUMBER:** #

**CONSULTANT NAME:**

**PROJECT MANAGERS:** **(Charles Russell), DOR**  
**(Consultant Project Manager's Name), Consultant**

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## 1 INTRODUCTION

The purpose of this project is to fulfill the Department of Revenue's (DOR) responsibilities of providing aid and assistance to the County Property Appraisers as specified in 195.002(1) F.S. and to at least once every 3 years furnish such aerial photographs and nonproperty ownership maps to the property appraisers as necessary to ensure that all real property within the state is listed on the roll. The Department of Revenue, for its own use and for the County Property Appraiser's use, is proposing to contract for the acquisition and delivery of digital ortho photography products. The Department intends to acquire ortho-rectified digital image data to support the development and analysis of the tax rolls for all 67 counties in Florida. The Department wants both Natural Color and Color Infrared (CIR) captured. The Consultant is only required to deliver Natural Color to DOR under this task order.

## 2 PROJECT AREA

The project area is comprised of a collection of 5,000 by 5,000 foot cells that serve as the tiling scheme for orthophoto and topographic data deliverables. The orthophoto area to be mapped consists of cells (approximately square miles) defined in ATTACHMENT C – ORTHOPHOTO PROJECT AREA and in the ArcGIS Shapefile *\_Ortho\_Project\_Area* delivered under separate cover.

## 3 ORTHOPHOTO SPECIFICATIONS

All work must be performed under the supervision of a Florida licensed Professional Surveyor and Mapper and in accordance with the Minimum Technical Standards defined in Rule 61G17, Florida Administrative Code.

### 3.1 Sensor

All imagery will be collected using a Leica ADS40 with sensor heads 51 or 52 (SH51 or SH52) or Zeiss DMC airborne imaging sensor. If the Leica ADS40 sensor is used it must have been retrofitted or originally manufactured to ensure that the infrared band aligns with the green and red bands.

### 3.2 Image Resolution

All imagery will have a ground sampling resolution not to exceed 0.9 feet. The Consultant will deliver images that have been resampled to 1.0 foot pixels as defined in the Deliverables section of this work order.

### 3.3 Horizontal Accuracy

Orthophotogrammetric Mapping will meet or exceed a verified horizontal accuracy of 7.6 feet at the 95% confidence interval (4.4 feet RMSE) as specified in the FGDC Geospatial Positioning Accuracy Standards, Part 3: National Standard for Spatial Data Accuracy (NSSDA). A minimum of thirty independent image checkpoints within the project area will be used for verification. Check points will be distributed so that points are spaced at intervals of at least ten (10) percent of the diagonal distance across the dataset and at least twenty (20) percent of the points are located in each quadrant of the dataset. The Consultant is not expected to correct for "building lean" in urban areas.

### 3.4 Horizontal and Vertical Datum

Horizontal Datum will be referenced to the Florida State Plane Coordinate System, East Zone (0902), Units US Survey Feet, North American Datum of 1983/HARN adjustment. Vertical Datum will be referenced to the North American Vertical Datum of 1988 (NAVD 88).

### 3.5 Flight Season

The flight season will be from December 15, 2009 through March 15, 2010. To the greatest extent possible, the Consultant should attempt to obtain imagery prior to January 30, 2010. Consultant must receive written approval from the DOR before collecting any imagery outside of this flight window.

### 3.6 Image Quality

All images will be obtained under cloud free conditions and will be free of obscuring haze, smoke or other atmospheric conditions. Radiometric and color balancing of the imagery is described in Section 6: Orthophoto Deliverables of this work order. All images must be collected between 10:00 AM to 2:30 PM to minimize shadows.

### 3.7 Photogrammetric Mapping Survey Control

The photogrammetric ground control must be adequate to support the accuracy specifications identified for this project. The Consultant will submit a survey report that documents and certifies the procedures and accuracies of the horizontal and vertical control, aircraft positioning systems and aerial triangulation utilized in the photogrammetric mapping project.

The horizontal and vertical control will be based on direct ties to National Geodetic Survey (NGS) control stations, National Spatial Reference System (NSRS). All geodetic control surveys, both horizontal and vertical, will conform to the Standards and Specifications for Geodetic Control Networks (1984), Federal Geodetic Control Committee (FGCC). The horizontal control will reference the North American Datum of 1983/ High Accuracy Reference Network (NAD83/HARN). Procedures used to establish horizontal photogrammetric ground control using Global Positioning System (GPS) measurements will meet or exceed Second Order Horizontal Control as set forth by the FGCC, Geometric Geodetic Accuracy Standards and Specifications for using GPS Relative Positioning Techniques, Version 5.0, May 1988. The vertical control will reference the North American Vertical Datum of 1988 (NAVD88). Procedures used to establish vertical control will meet or exceed Third Order Vertical Control Accuracy Standards and Specifications. Procedures for GPS-Derived elevation differences will meet or exceed Guidelines for Establishing GPS-Derived Ellipsoid Heights (Standards: 2 centimeters and 5 centimeters), NGS-58, November 1997, and/or Guidelines for Establishing GPS-Derived Orthometric Heights (Standards: 2 centimeters and 5 centimeters), NGS-59, October 2005.

All photogrammetric mapping procedures will meet or exceed FEMA FLOOD HAZARD MAPPING PROGRAM, GUIDELINES AND SPECIFICATIONS FOR FLOOD HAZARD MAPPING PARTNERS, Appendix A, section A.5 Ground Control, and section A.6 Ground Surveys.

#### 4 PROJECT MANAGEMENT AND REPORTING

The Consultant will provide the following minimum project management and tracking reports:

Except where noted all reporting will be done on a monthly basis. The reports via email will document the percent complete on the following minimum items:

- o Geodetic Control Survey
- o Image Acquisition Status – **Weekly Status Reports are Required**
- o Aerial Triangulation
- o Horizontal Accuracy Assessment
- o DEM Creation Status
- o Orthophoto Production Status

#### 5 INFORMATION PROVIDED BY THE DOR AND COUNTIES

##### 5.1 Digital Elevation Models

The Digital Elevation Model (DEM) must be adequate to support accuracy specifications identified for this project. The Consultant will submit information in the final survey report and metadata which documents the source and accuracy of the DEM utilized in the photogrammetric mapping project.

The DOR will provide the Consultant with any DEMs or Light Detection and Ranging (LiDAR) data available from past projects and overflights as available.

Additionally, the final DEM generated for the development of work order deliverables must be provided to the DOR in either an ASCII XYZ or LAS file format as per LAS Specification 1.1.

##### 5.2 Historical Images

To maintain consistency between images collected during different years, the DOR will provide historical examples of imagery to the Consultant to assist in color balancing.

#### 6 ORTHOPHOTO DELIVERABLES

All deliverables will be the property of the DOR and are considered a public record. The Consultant must receive written permission from the DOR prior to releasing data to any party. Under this work order the Consultant will deliver only the ortho-corrected natural color imagery. Stereoscopic panchromatic and CIR imagery will be collected but not delivered under this work order. The Consultant will keep a copy of the original data for a period of five (5) years and must contact the DOR before destroying the data. Refer to ATTACHMENT A – DELIVERY SUMMARY TABLE for an overview of all required deliverables.

The Consultant will document all data deliveries with an itemized transmittal letter.

## 6.1 File Formats and Image Types

Clarity and quality of the imagery is of the highest importance to the DOR. For all 32-bit images, coloration should be equivocal to conventional natural color. The Consultant will submit samples of each image type representative of the land covers found throughout the project area for approval prior to completing radiometric processing of the entire dataset.

Imagery will be delivered as uncompressed GeoTIFF images with valid projection header information. Refer to ATTACHMENT D – REQUIRED TIFF AND GEOTIFF TAGS AND KEYS AND SAMPLE VALUES for details. One GeoTIFF file per 5,000 x 5,000 foot tile is required.

One 4-band stack that includes 32 bit red, green, blue and infrared bands is the preferred method of delivery for each 5,000 x 5,000 foot tile.

*Natural Color Imagery* – The natural color, RGB, bands will be color balanced across the entire study area to the greatest extent possible to allow viewing of the image tiles as a visually seamless mosaic. Care should be taken during radiometric processing to avoid loss of detail in shadows and overexposure on bright surfaces such as bare ground and light color building roofs.

All orthoimages will be delivered according to the tiling scheme defined in Section 2: Project Area. Tiles will be contiguous and non-overlapping and will be suitable for creating a seamless image mosaic that includes no data void cells or gaps. Tile naming convention is as follows:

OPYYYY\_ *cellnum* \_*bit*.TIF

where:           OP stands for Orthophoto  
                  YYYY is the year  
                  *cellnum* is appropriate CELLNUM values found in the  
                  *ProjectName\_Ortho\_Project\_Area* Shapefile.  
                  *Bit* is the number of bits in the imagery (32)

ex:    OP2008\_279\_32.TIF

## 6.2 Image Outline Shapefile

This Shapefile must contain polygons delineating homogenous image capture data dates for the project area. To the greatest extent possible image cutlines should conform to cell boundaries. The outline shapefile must have one field FLIGHTDATE that identifies the date the imagery was collected.

### 6.3 Metadata

Metadata compliant with the Federal Geographic Data Committee's (FGDC) Content Standard for Spatial Metadata in an ArcCatalog compatible XML format will be delivered. At a minimum the metadata will include the following information:

- Image collection date for each lift
- Sensor description
- DEM source information
- Processing software
- Processing methodology
- Projection information (horizontal and vertical datums)
- Positional accuracy and procedures used to determine accuracy.

Metadata will apply to the project as a whole and to each individual data tile. Preliminary metadata should be delivered with each interim data deliverable. The DOR and Consultant will jointly finalize metadata requirements. Upon acceptance metadata will be uploaded on a USB or firewire drive containing the final deliverables. Refer to Section 6.4: Media for additional details.

### 6.4 Media

All imagery will be delivered on portable USB or Firewire drives that are labeled with project title, purchase order number, work order name, work order number, Consultant name, and project manager's name. The DOR will accept interim data deliverables for the purpose of quality assurance and quality control. Upon acceptance of the deliverables one drive capable of holding all deliverables will become the property of the DOR, and interim drives will be returned to the Consultant.

### 6.5 Survey Report

The Consultant will prepare a Survey Report that documents all photogrammetric ground control, aircraft global positioning system, aerial triangulation, DEM creation, photo identification (horizontal and vertical) check points and orthorectification processes utilized in the project. The Survey Report must also include an accuracy report and statement compliant with FGDC Geospatial Positioning Accuracy Standards, National Standard for Spatial Data Accuracy (NSSDA). The Survey Report must include a map delineating flight line locations and flight dates. This report must be compliant with relevant Minimal Technical Standards for Professional Surveying and Mapping done in Florida and delivered in hardcopy and PDF formats. The Consultant will include a single PDF of the final survey report on the USB or Firewire drive containing the final deliverables. The survey report must include items outlined in ATTACHMENT B – DOR SURVEYING AND MAPPING REPORT GUIDELINES.

The following supporting materials must be delivered with the survey report:

Final deliverable file listing stating filename with extension and delivery date in the appendix of the survey report.

Ground control layout map containing all check points, horizontal and vertical control.

Digital copy of the final GPS least squares adjustment.

Surveyed image checkpoints used for accuracy testing in shapefile (point) format and excel format. The minimum required fields are listed in TABLE 1 – GROUND SURVEY CONTROL POINTS FIELD PROPERTIES.

TABLE 1 – GROUND SURVEY CONTROL POINTS FIELD PROPERTIES

<b>Field Name</b>	<b>Date Type</b>	<b>Description</b>
CONTROLPTNAME	Text	Control point designation.
LATITUDE	Double	Geographic Y-coordinate specifying vertical position.
LONGITUDE	Double	Geographic X-coordinate specifying horizontal position.
ELLIPSOIDHEIGHT	Double	Height above or below the reference ellipsoid.
NORTHING	Double	State Plane Y-coordinate in US Survey Feet.
EASTING	Double	State Plane X-coordinate in US Survey Feet.
NAVD88HEIGHT	Double	Orthometric height in US Survey Feet.
DESCRIPTION	Text	Additional information or details pertaining to the control point.

## 7 ORTHOPHOTO PROJECT SCHEDULE

All final deliverables must be received before June 18, 2010. The Consultant submitted a proposed project schedule and cost plan as defined in ATTACHMENT E. The Consultant will notify the DOR when aerial images have been collected. All data and products generated for this project must be delivered to the DOR with project title, purchase order number, work order name, work order number. Consultant name, and project manager's names, in addition to fully complying with the standards identified in the preceding sections.

## 8 PROJECT PAYMENT

The Consultant will submit invoices broken down into tasks defined in ATTACHMENT E – COST PLAN.

## ATTACHMENT A – DELIVERABLE SUMMARY TABLE

<b>Copies</b>	<b>Description</b>	<b>Resolution (FT)</b>	<b>Datum (SPF - W)</b>	<b>Format</b>	<b>Notes</b>
1	32 Bit Cells Red, Green, Blue, Infrared bands	1.0	NAD83/HARN	GeoTIFF	All Cells
3	Survey Report			Hardcopy	
1	Survey Report			PDF	
1	Metadata file for each GeoTIFF and Sid file			ArcGIS XML	
1	Cutline Shapefile with Image Dates		NAD83/HARN	ArcGIS Shapefile	
1	DEM for orthophoto generation		NAD83/HARN	ASCII XYZ or LAS 1.1	Vertical NAVD88
1	Imagery compressed in Sid format	1.0	NAD83/HARN	SID	ALL Cells

## ATTACHMENT B – DOR SURVEYING AND MAPPING REPORT GUIDELINES

THE FOLLOWING OUTLINE PRESENTS GUIDANCE AND REQUIREMENTS FOR PROFESSIONAL SURVEYING AND MAPPING IN THE PROCESS OF PHOTOGRAMMETRIC MAPPING SERVICES FOR THE FLORIDA DEPARTMENT OF REVENUE (DOR).

### I. PHOTOGRAMMETRIC MAPPING: GEODETIC (HORIZONTAL AND VERTICAL) GROUND CONTROL SURVEYS

- a. The Professional Surveyor and Mapper (PSM) will prepare a certified report of survey according to FLORIDA ADMINISTRATIVE CODE, CHAPTER 61G17-6, Minimum Technical Standards. The report will include the following items:
- i. DOR project title and reference number
  - ii. Name and address of corporation (certificate of authorization number)
  - iii. Surveyor in responsible charge (contact information)
  - iv. Abbreviations; data sources; etc.
  - v. Introduction, purpose and objective
  - vi. Description and scope of work
  - vii. Describe equipment, software, etc.
  - viii. Describe the accuracy standards and specifications, procedures and methodology for establishing ground control (including the quality control (QC) check points):
    1. FGCC, GEOMETRIC GEODETIC ACCURACY STANDARDS AND SPECIFICATIONS FOR USING GPS RELATIVE POSITIONING TECHNIQUES, VERSION 5.0, AUGUST 1989
    2. NGS-58, GUIDELINES FOR ESTABLISHING GPS-DERIVED ELLIPSOID HEIGHTS (2CM AND 5CM)
    3. NGS-59, GUIDELINES FOR ESTABLISHING GPS-DERIVED ORTHOMETRIC HEIGHTS (2CM AND 5CM)
    4. FGCC STANDARDS AND SPECIFICATIONS FOR GEODETIC CONTROL NETWORKS, 1984
    5. FEMA FLOOD HAZARD MAPPING PROGRAM, GUIDELINES AND SPECIFICATIONS FOR FLOOD HAZARD MAPPING PARTNERS, APPENDIX A
  - ix. Describe and list the geodetic control (existing and newly-established), displaying the horizontal and vertical coordinates, datums used, geoid model and error estimates (95% confidence level)
  - x. Accuracy reporting will be according to FGDC geospatial accuracy standards:
    1. Report the horizontal and vertical (heights) accuracies (local and network) according to the FGDC STANDARDS FOR GEODETIC NETWORKS (FGDC-STD-007.2-1998)
    2. Report the accuracy analysis for the check point data in spreadsheet format according to the FGDC GEOSPATIAL POSITIONING ACCURACY STANDARDS, PART 3: NATIONAL STANDARD FOR SPATIAL DATA ACCURACY (FGDC-STD-007.3-1998)
  - xi. List the field and office personnel
  - xii. Date of field survey
  - xiii. Describe monumentation recovered and set
  - xiv. Professional surveyor and mapper certification will include the following: **“THIS PHOTOGRAMMETRIC MAPPING GROUND CONTROL SURVEY IS CERTIFIED TO THE FLORIDA DEPARTMENT OF REVENUE AS MEETING OR EXCEEDING, IN QUALITY AND PRECISION, THE STANDARDS APPLICABLE FOR THIS WORK, AS SET FORTH IN CHAPTER 61G17-6, FLORIDA ADMINISTRATIVE CODE.”**

- xv. Existing geodetic control recovery/to-reach descriptions, sketches, field notes, photographs, etc
- xvi. Newly-established photogrammetric control location descriptions, sketches, field notes, photographs, etc
- xvii. Copies of Global Positioning System (GPS) data logs and a listing of GPS occupations
- xviii. All GPS data observed and produced during the survey (digital format), including the raw observation data, processed baselines, loopclosures and least squares adjustments (free and fixed)
- xix. Report will include a map overlay which will display the following items:
  - 1. GPS baseline network, indicate repeated measurements
  - 2. Existing horizontal and vertical geodetic control
  - 3. Newly-established photogrammetric control
  - 4. QC check points
  - 5. Base map features (DOR boundaries, county boundaries, major roads, major hydrography/ water bodies, township/range lines, cities)

## II. PHOTOGRAMMETRIC MAPPING: AERIAL TRIANGULATION, DIGITAL ORTHOPHOTOGRAPHY AND LIDAR TOPOGRAPHIC MAPPING REPORT

- a. The PSM will prepare a certified report of survey according to FLORIDA ADMINISTRATIVE CODE, CHAPTER 61g17-6, Minimum Technical Standards. The report will contain the following items:
  - i. DOR project title and reference number
  - ii. Name and address of corporation (certificate of authorization number)
  - iii. Surveyor in responsible charge (contact information)
  - iv. Abbreviations, definitions; data sources; etc.
  - v. Introduction, purpose, objectives
  - vi. Scope of work
  - vii. Describe all equipment, software, etc.
  - viii. Imaging sensor description and calibration report
  - ix. Airborne GPS report
  - x. Aerial triangulation control coordinates and aerial triangulation blocks along with statistical summaries
  - xi. Digital orthophoto image acquisition dates and logs
  - xii. Digital orthophoto image production specifications
  - xiii. Digital elevation model acquisition (identify source and accuracy)
  - xiv. Digital orthophotography image accuracy analysis (photo id QC vs photogrammetric derived) according to the FGDC NATIONAL STANDARD FOR SPATIAL DATA ACCURACY (FGDC-STD-007.3-1998)
  - xv. LiDAR data acquisition dates and logs
  - xvi. LiDAR sensor description and calibration report
  - xvii. LiDAR specifications and procedures
  - xviii. LiDAR QC accuracy analysis according to the FGDC NATIONAL STANDARD FOR SPATIAL DATA ACCURACY (FGDC-STD-007.3-1998)
  - xix. List the field and office personnel
  - xx. Professional surveyor and mapper certification **“THIS PHOTOGRAMMETRIC MAPPING DATA AND REPORT IS CERTIFIED TO FLORIDA DEPARTMENT OF REVENUE AS MEETING OR EXCEEDING, IN QUALITY AND PRECISION, THE STANDARDS APPLICABLE FOR THIS WORK, AS SET FORTH IN CHAPTER 61G17-6, FLORIDA ADMINISTRATIVE CODE.”**

- xxi. FGDC Metadata in digital XML file format
- xxii. Photogrammetric identification quality control point sketches, descriptions, photographs
- xxiii. Report will include a map overlay which will display the following items:
  - 1. Ground control
  - 2. Aerial triangulation blocks
  - 3. Digital ortho image cut lines and dates associated with the strips
  - 4. Digital ortho image tile limits and layout
  - 5. Digital orthophotography QC Check Point Locations
  - 6. LiDAR QC accuracy locations
  - 7. Base map features (USGS quad, DOR boundaries, county boundaries, major roads, major hydrography/ water bodies, township/range lines, basin boundaries, cities)

Purchase Order #: \_\_\_\_\_

ATTACHMENT C – OTHOPHOTO PROJECT AREA

## ATTACHMENT D – REQUIRED TIFF AND GEOTIFF TAGS AND KEYS AND SAMPLE VALUES

**TIFF Tags Required**

<u>Tag Name</u>	<u>Decimal</u>	<u>Hex</u>	<u>Type</u>	<u>Sample Value</u>
ImageWidth	256	100	Short or Long	5000
ImageLength	257	101	Short or Long	5000
BitsPerSample	258	102	Short	8 8 8
Compression	259	103	Short	1
PhotometricInterpretation	262	106	Short	2
Orientation	274	112	Short	1
StripOffsets	273	111	Short or Long	8 510008 . . .
SamplesPerPixel	277	115	Short or Long	3
RowsPerStrip	278	116	Short or Long	34
StripByteCounts	279	117	Short or Long	510000 510000 . . .
ImageDescription	270	10E.H	ASCII	Florida Dept. Revenue DOR Digital Orthophoto
DocumentName	269	10D.H	ASCII	<Cell Number> <Zone> <State>

**Tiff Tags Defined by GeoTIFF:**

<u>Tag Name</u>	<u>Decimal</u>	<u>Hex</u>	<u>Type</u>	<u>Sample Value</u>
ModelPixelScaleTag	33550	830E	Double	1.0 1.0 0
ModelTiePointTag	33922	8482	Double	0 0 0 525000 188000 0
GeoAsciiParamsTag	34737	87B1	ASCII	Florida Department of Revenue DOR One Foot Resolution <start flight date> - <end flight date> NAD 1983 HARN StatePlane Florida East FIPS 0902 Feet
GeoKeyDirectoryTag	34735	87AF	Short	1 1 0 6 1024 0 1 0 1025 0 1 1 1026 34737 78 0 3072 0 1 26959 3073 34737 53 78 3076 0 1 9003

**GeoKeys Defined by GeoTIFF:**

<u>Tag Name</u>	<u>Decimal</u>	<u>Hex</u>	<u>Type</u>	<u>Sample Value</u>
GTModelTypeGeoKey	1024	400	Short	0
GTRasterTypeGeoKey	1025	401	Short	1
GTCitationGeoKey	1026	402	ASCII	Florida Department of Revenue DOR One Foot Resolution <start flight date> - <end flight date>
ProjectedCSTypeGeoKey	3072	C00	Short	26959
PCSCitationGeoKey	3073	C01	ASCII	NAD 1983 HARN StatePlane Florida East FIPS 0902 Feet
ProjLinearUnitsGeoKey	3076	C04	Short	9003