DGDC Meeting Minutes - DRAFT
May 13, 2021

Attendance List:

Jennifer Anderson-Reno	Historic Preservation
Stephen Bayer	OMB
Lori Brown	DNREC-NPS
Anna Cava Grosso	DEMA
Luis Cetina	Tom-Tom
Kim Cloud	DTI
Carol Conroy	
Adam Crosby	Delaware Greenways
Justin Cusick	Esri
Tim DeSchepper	City of Middletown
Andrew Falker	Esri
Lauren Frick	Dept. of Agriculture
Meghan Garrett	DFM
Jeremy Gibb	City of Dover
Jay Hodny	City of Newark
John Inkster	DNREC
Jimmy Kroon	Dept. of Agriculture
Matt Laick	Div. Comm.
Brian Laws	City of Newark
Tim Loftus	Esri
Joel Marshall	Sussex County
Thomas Matich	Town of Smyrna
Dawn McCall	Control Point
Morgan McGee-Solomon	DNREC
Erica McMaster	Washington College
Nicole Minni	UD/IPA
Megan Nehrbas	Sussex County
Stacy Norland	OMB
Colton Phillips	DelDOT
Miriam Pomilio	OSPC
Mark Prettyman	DNREC
Jason Sealy	Cyclomedia
Justin Shawler	DNREC
Olena Smith	Univ. of Delaware
Sigrid Smith	Delaware State University
Bill Stephens	Stephens Environmental
Bradley Strittmatter	McKim & Creed, Inc.
Debbie Sullivan	DTI
Mike Townshend	DTI
Helen Tripp	Delaware State University
Sharon Ungerer	DNREC
Seth VanAken	Esri
Devin Waggoner	
Lillian Wang	Delaware Geological Survey
Daniel Warner	Delaware Geological Survey
Darin Windsor	
Julia Wolanski	Pennoni
George Yocher	DHSS-DPH

Welcome & Introductions

Miriam Pomilio started the meeting at 9:32 am. She welcomed everyone to the meeting and introductions were made.

February 11, 2021 Meeting Minutes

Mike Townsend made a motion to approve the February 11, 2021 Meeting Minutes. The motion was seconded by Lori Brown and it passed unanimously.

Geospatial Education Committee

Nicole Minnie reported for the Geospatial Education committee. The Geospatial Education site will host a virtual event for GIS Day. The committee will be reaching out for assistance as we get closer.

If you know of resources, you think could be included for teachers let Nicole Minni and Miriam Pomilio know. We continue to need additional GeoMentors, if you're interested in volunteering some of your time to schools and/or special educational events, please contact Nicole Minni.

FirstMap 2.0 Update & G-TAC

Mike reported about the G-TAC meeting held last week. FirstMap 2.0 will require changing URL's in your applications. There is a spreadsheet on the FirstMap website that provides URLS to help with updating the URLs. The old servers are going away in the future and if content is not updated, it will be lost.

Delmarva GIS Conference Update

Joel Marshall reported that the Delmarva GIS 2022 Conference: A Wave of Recovery will be held at the Hyatt Place in Dewey Beach, DE on May 12, 13 and 14th. The 12th will be the pre-conference workshop and a Mappy Hour; the 13th will be the full conference day and the 14th will be for post conference activity. Visit Delmarva GIS 2022 Conference – A Wave of Recovery (degis.org) for more information.

Presentations

Esri presented on Working with LiDAR in ArcGIS. A copy of their presentation is attached.

Bill Stephens presented on his work with Drones, Photogrammetry & Survey Control Points. A copy of his presentation is attached.

Federal Update

USDA – Art Walker is working on aerial imagery from the 1980's and will share when completed.

Open Comment Period

Miriam – Data survey results available, contact her if you'd like a copy. She will be working on preparing an RFP for imagery, LiDAR, and Land Use Land Cover. Funding remains an issue, so if your agency has funds that can be earmarked for these data updates, contact Miriam.

OSPC has published the Development trends data (building permits and development applications) to FirstMap 2.0. This data covers from 2008 through 2020.

Justin Shaler – Utility of commercial satellite imagery, would like advice and feedback of quality and RFI.

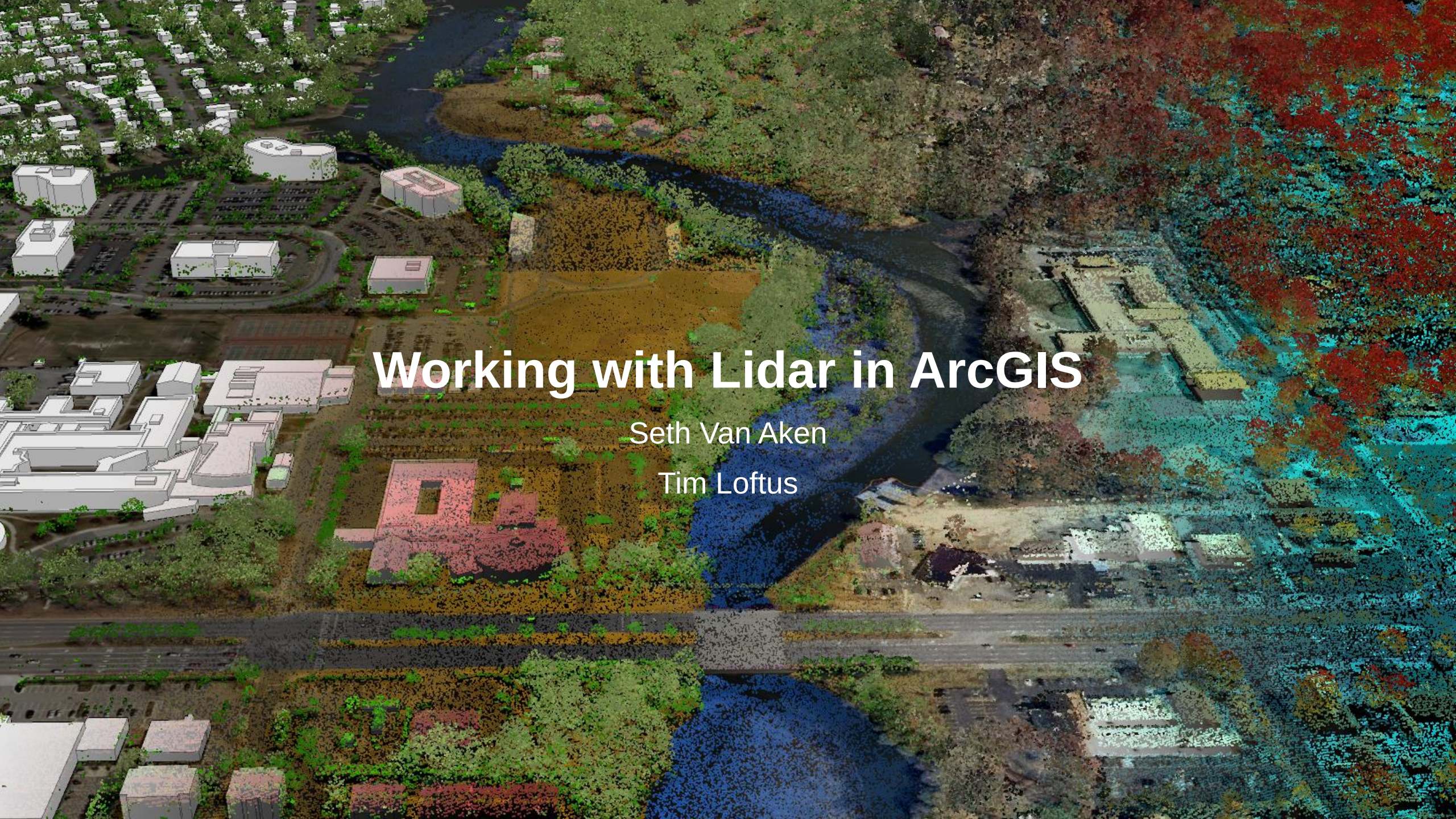
Matthew Laick –Pictometry imagery was flown this spring and will be available soon for public safety use.

Next Quarterly Meeting

The next quarterly meeting will be held on August 12, 2021 from 9:30 until noon. Depending upon COVID restrictions, it may be at the Dept. of Ag conference room, with additional access via Zoom. See the DGDC website for information and updates as they are available.

Adjournment

Olena Smith made a motion to adjourn the meeting and it was seconded by Jason Sealy. The DGDC Business meeting was adjourned at 11:24 am.



Working with Lidar in ArcGIS

Seth Van Aken

Tim Loftus

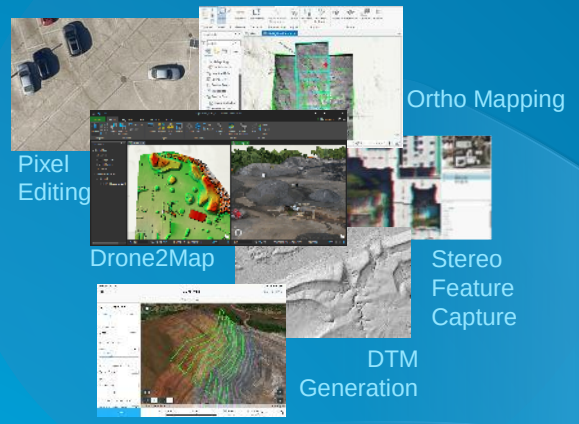
Agenda

- ArcGIS System Capabilities
- FirstMap Lidar Point Cloud
- ArcPro – Working w/ Lidar
- ArcGIS Solutions – 3D Basemaps
- Demonstration
- Resources

Imagery and Remote Sensing

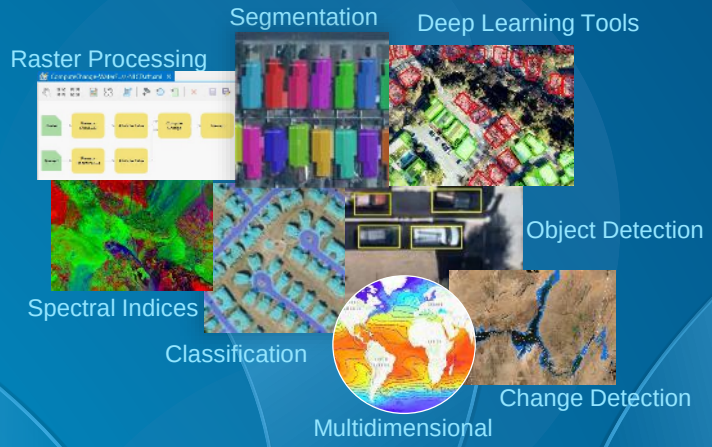
ArcGIS is a comprehensive imagery platform

Map Production



Pixel Editing
Ortho Mapping
Drone2Map
Stereo Feature Capture
DTM Generation
Site Scan

Analysis



Segmentation
Deep Learning Tools
Raster Processing
Object Detection
Spectral Indices
Classification
Change Detection
Multidimensional

Visualization & Exploitation

Web
Pro
Voxels
Motion Imagery
Oriented Imagery
Excalibur

Image Management

Streaming Multiband Tiles

Imagery & Raster Content

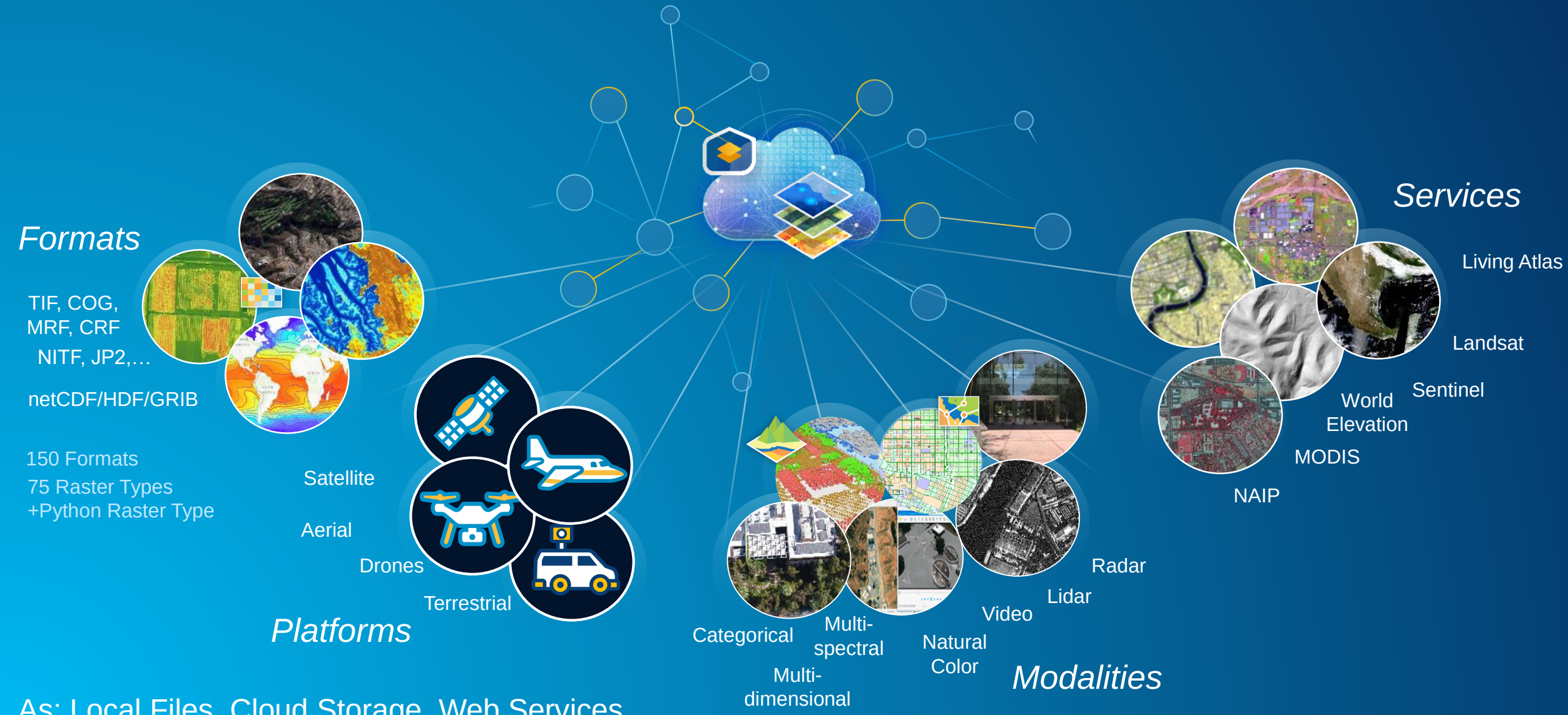
All Types:
Formats
Platforms
Modalities
Services

Cloud Storage
On Prem Storage

Mosaic Datasets
Dynamic

Time
Image Cubes
Pre-Processed

Support for All Imagery and Rasters

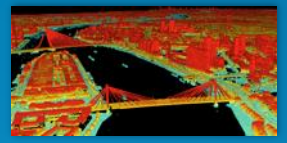


As: Local Files, Cloud Storage, Web Services

3D GIS Visualization & Data Management

3D Information Model

Scene Layers



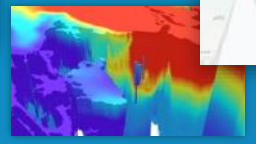
Point Clouds / Lidar

BIM

3D Objects

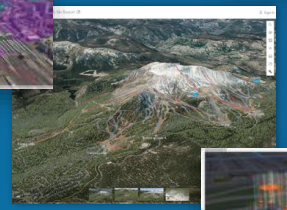
Mesh

Extrusion



Voxels

Smart Mapping



New & Improved

- Voxel Layers
- BIM
- Interactive Mesh Tools
- Rendering and Symbols
- Mobile and Offline Workflows
- Integration with Game Engines

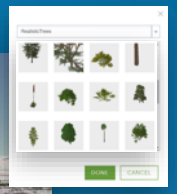
Advanced Visualization

AR & VR

Game Engines

Symbology and Visual Effects

3D Symbols



Realism

Power Lines

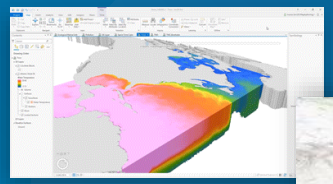
Global Visualization

ArcGIS Earth

Available Across the Platform

3D GIS Analysis

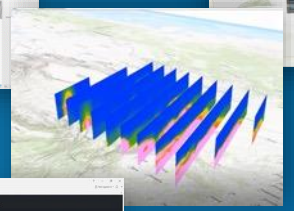
Volumetrics



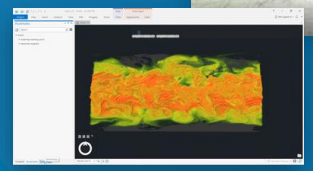
Time Enabled

Interactive Slice

Voxels

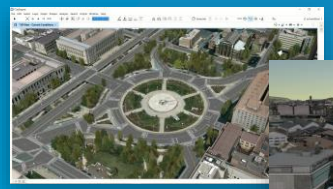


Voxel Layers API



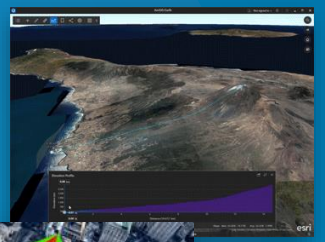
Interpolated Values

Analytics

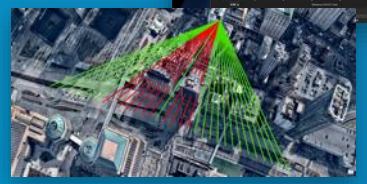


Viewshed

Flood Impact



Elevation Profile



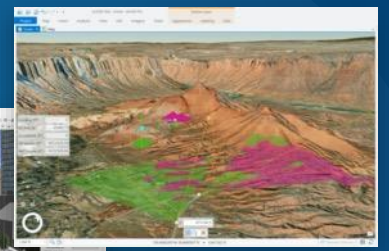
Interactive Line of Sight

Measurement

Feature Extraction

Apps

Pro



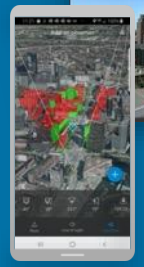
3D GIS

Urban

Procedural Modeling

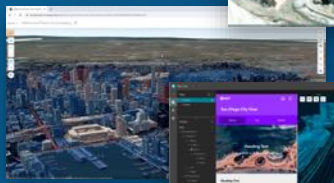
Earth

3D Visualization and Analytics



Mobile

Scene Viewer



Experience Builder

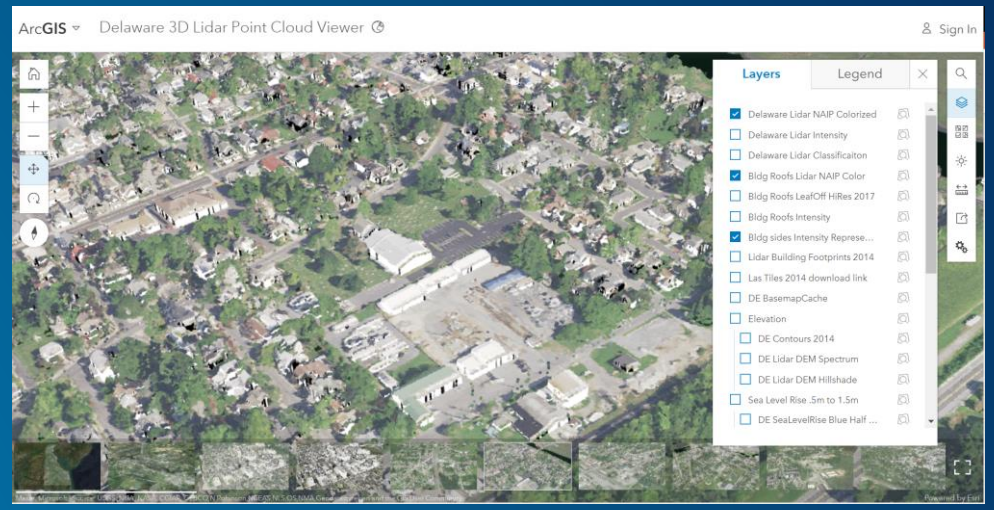
StoryMaps

New & Improved

- Voxel Sections, Slices and Isosurfaces
- Machine Learning in 3D
- Mesh Processing
- Performance

FirstMap – Lidar Point Cloud

- State Lidar hosted in ArcGIS Online
- Stored as a point cloud scene layer
- Developed w/ the Living Atlas Team
- Colorized Lidar Points
- Includes a 3D Web Viewer
  - Measure Length, Height & Area
  - Includes download capability
- Preview & explore the data before you download

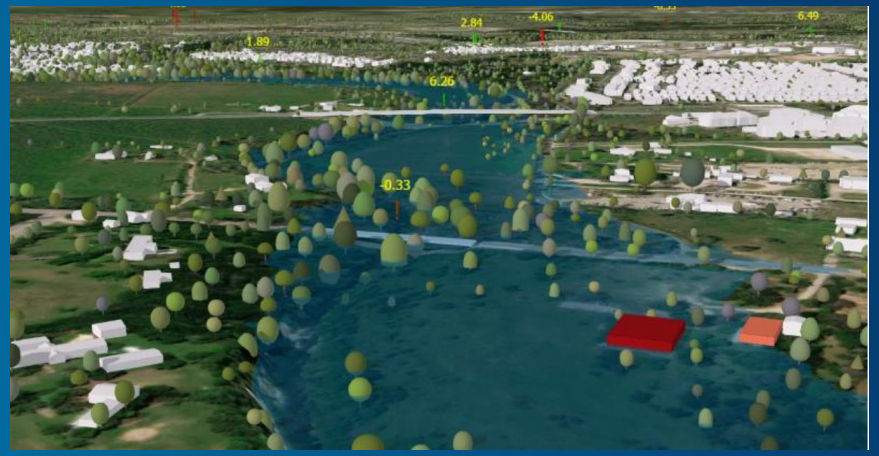


ArcGIS Pro – Working With Lidar

- Supports LAS or Optimized LAS(.ZLAS)
- Work with native LAS, mosaic data set or a point cloud scene layer
- Native LAS
  - View LAS in 2D and 3D
  - Visualize using elevation, slope, aspect or contour lines
  - Edit LAS data
  - Input to 3D Analysis
- Mosaic Dataset
  - View Lidar as raster
  - Use it as a DEM
  - Orthorectify imagery
- Point Cloud Scene Layer
  - Fast display of large volumes
  - Symbolized and filtered point cloud data
  - Geoprocessing – ‘Share Package’ to publish to ArcGIS Online or ArcGIS Enterprise

ArcGIS Solutions – 3D Basemaps

- Solution Template to Create 3D Basemaps Utilizing Lidar, Building Footprints & Utilities
- Provides a series of workflows that helps streamline the creation and maintenance of 3D Basemaps
- Requires ArcGIS Online or ArcGIS Enterprise 10.6 or later, ArcGIS Pro Advanced, 3D Analyst and Spatial Analyst
- Storymap on 3D Basemaps Solution



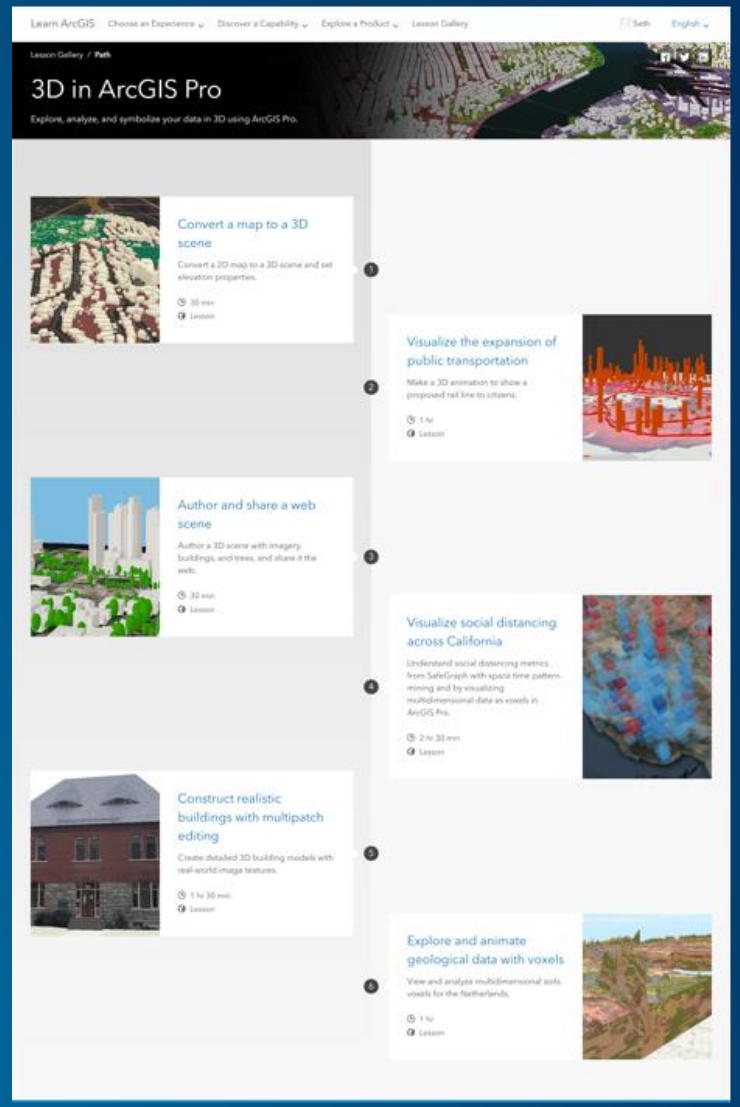
Demonstration

Tim Loftus

Resources

- **3D Basemaps Solution**
- **Esri Academy**
  - **Instructor Led – Working with Lidar in ArcGIS**
  - **Web Courses – Managing Lidar using LAS & Mosaic Datasets**
  - **Video – Lidar in ArcGIS**
- **3D Tutorials at Learn.arcgis.com**

QR 3D Basemaps Solution



Webinar – Today, 2-3PM

How to work with Imagery & Lidar in ArcGIS Online

Thu, May 13, 2021 2:00 PM - 3:00 PM EDT

Show in My Time Zone

Working with imagery and lidar in ArcGIS just got much easier. "ArcGIS Image" is a new addition for ArcGIS Online designed to greatly simplify how organizations store, access and analyze remotely sensed content from satellites, aircraft, and drones. It's a great starting point for Reality Capture, GeoAI feature extraction, 3D mapping, and land cover analysis. And to make things real simple, we can even pre-load high resolution aerial imagery and elevation data into ArcGIS Image for you from our premium content partner Hexagon. Please join us to see how ArcGIS Image can modernize your GIS with the power of imagery.

*Required field

First Name*

Last Name*

Email Address*

By clicking this button, you submit your information to the webinar organizer, who will use it to communicate with you regarding this event and their other services.

Register

svanaken@esri.com

&

tloftus@esri.com

High Resolution High Accuracy Site Specific Orthomosaics Using Drone-Acquired Nadir Images With Surveyed Ground Control Points

By: Bill Stephens, PG, President

Stephens Environmental Consulting, Inc.

What's Involved: Think it through!

The Drone Flight Planning & Image Capture Process & Software

- Drone must be capable of capturing nadir images of sufficient quality & pixel density to attain the desired orthoimage quality and capable of being driven by software.
- Camera should have at least 65d FOV
- Adjust Camera settings before flight.
- Manual adjustments to camera desirable
- Software must be compatible with drone, up-loadable flight plan
- Pick your AOI polygon and upload it to the flight planning software
- Overlap typically >/= 70% forward, >/= 65% Side
- Decide on flight altitude, GSD, home point position, buffer, number of flights, etc.

Survey Planning-Ats/GCPs

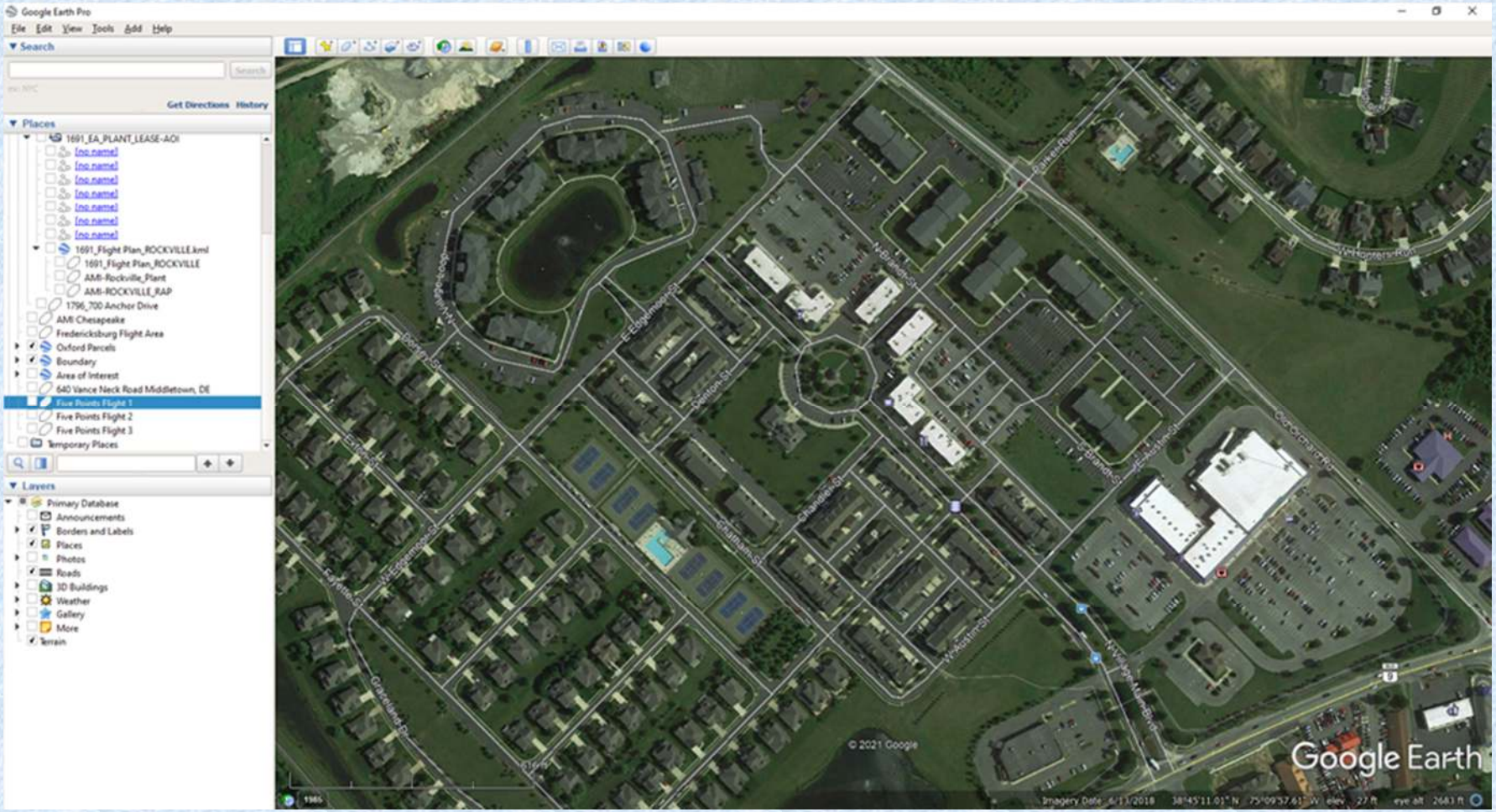
- Most GCPs will be set with survey grade Network or other GPS Equipment, or Conventional location from GPS control
- GCPs must be out in the open
- GCPs must be captured in not less than 4 images, but preferably 8 or more.
- The accuracy of the points should be 1-2cm (<1" or 0.08'). Lower accuracy may warp the ortho.
- Software AI drives preferred target style.
- Must have checkpoints for evaluation of solution

Setting Ground Control Points (GCPs)

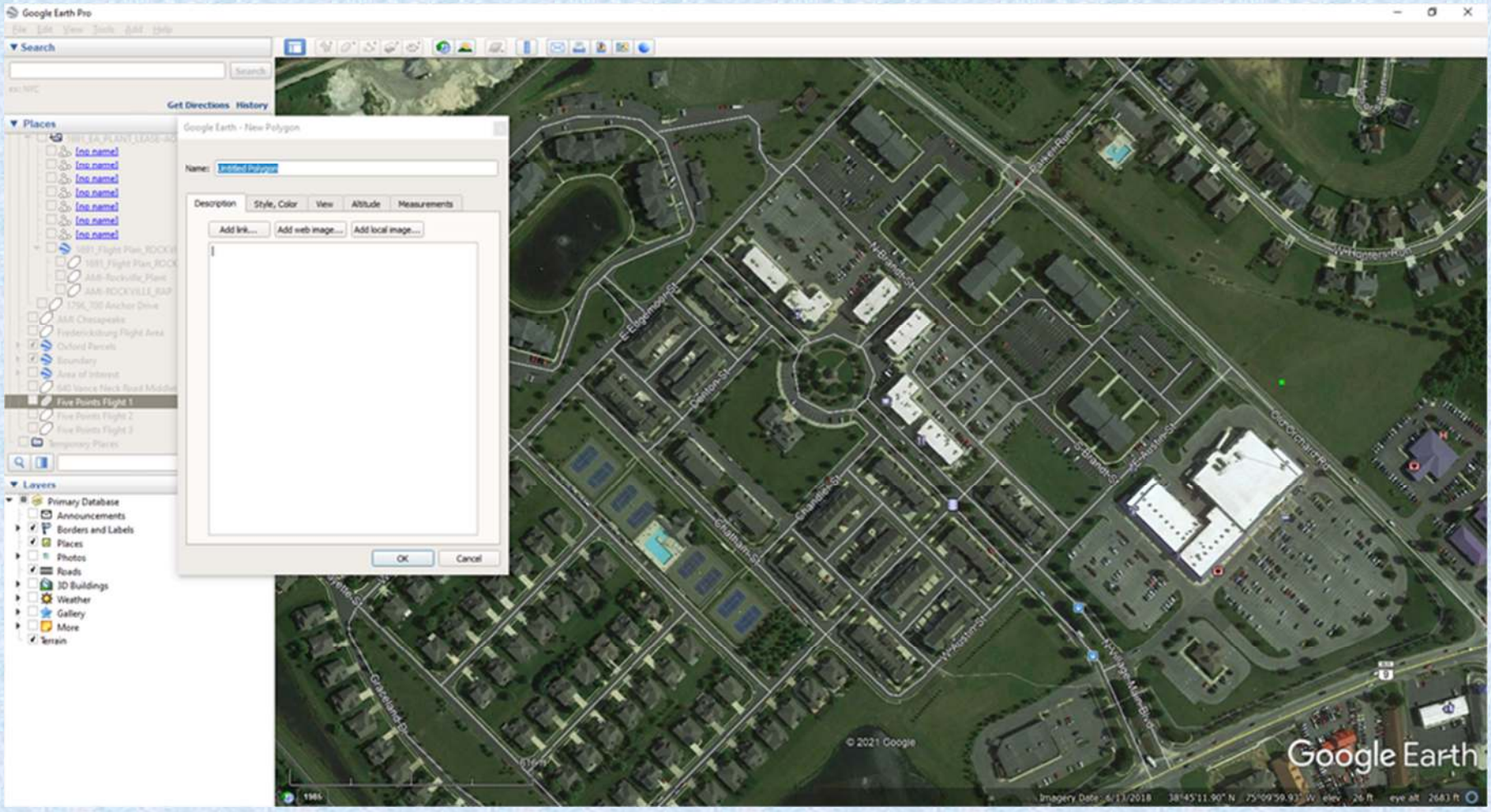
12” Target, Style ideal for Drone Deploy AI. Cheap floor tile and printed paper target

Always set the targets OUTSIDE the area of interest and then add 15m buffer to assure plenty of overlap at edges

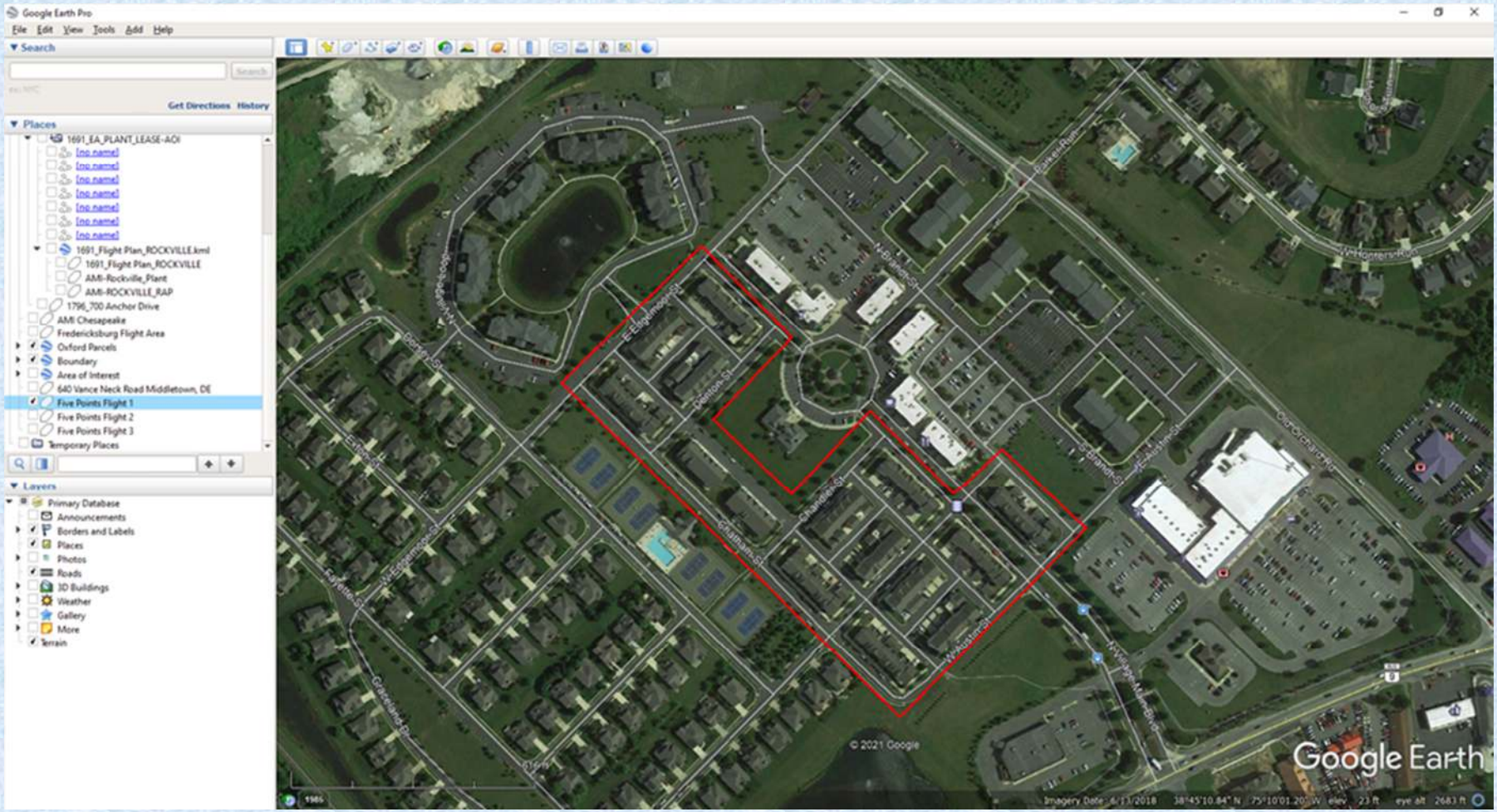
Our Flight Planning Starts by Navigating to the Area of Interest (AOI) in Google Earth Pro for the latest publicly available imagery



Create a New Polygon that will serve as your Flight AOI to be imported into the Flight Planning Software (DJI Pilot)



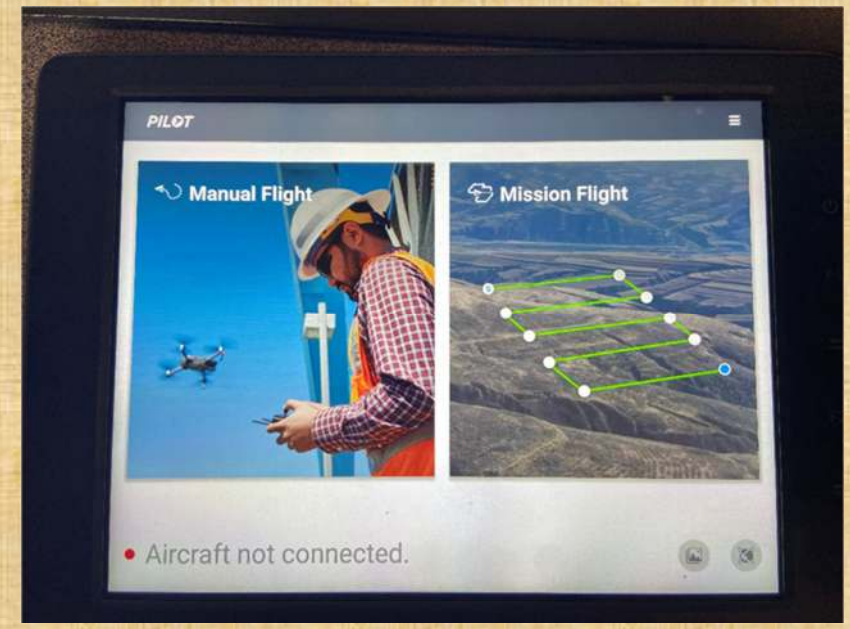
Once you are done, right click on the polygon and click “Save As” to the folder of your choice. Save as a .KML file



Flight Planning (Cont'd)

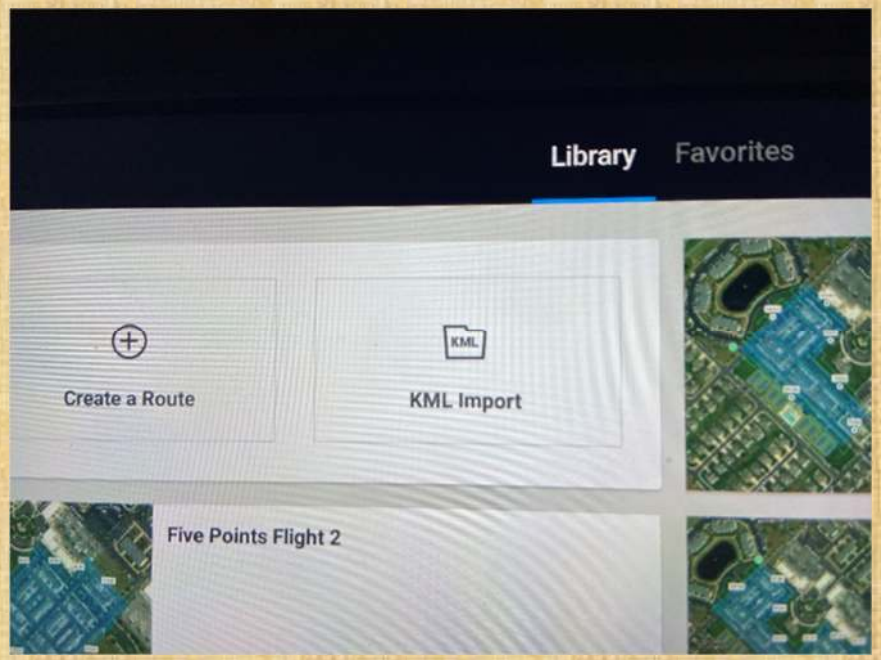
Copy/Transfer the .KML from your computer onto a flash drive or SD card and plug into your tablet or Smart Controller

Navigate to DJI Pilot and click "Mission Flight"

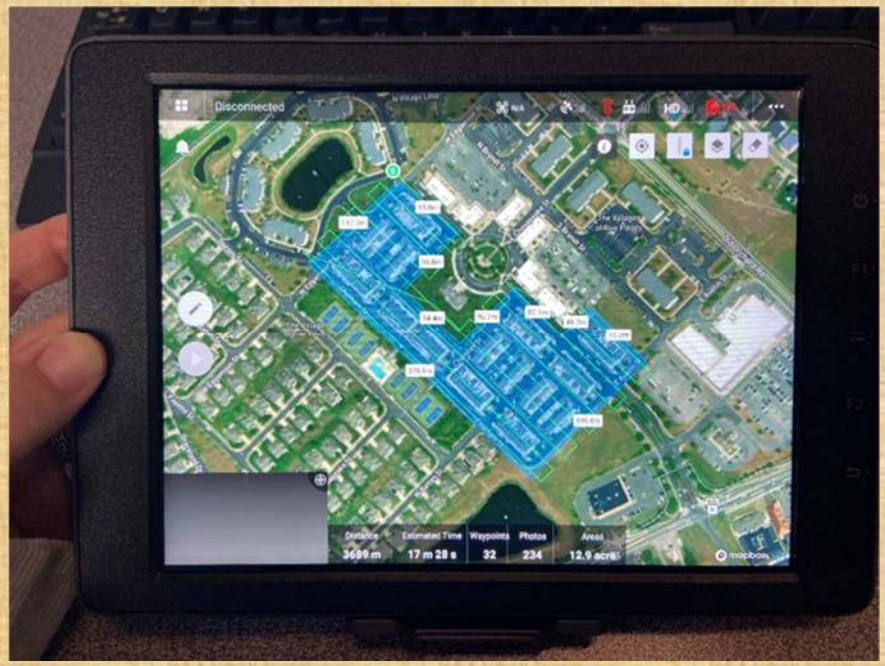


Flight Planning (Cont'd)

Select "KML Import" and upload the file from the flash drive. This part of mission planning is best done in the office with strong WiFi.



The Polygon should appear in the correct mapping area. (no camera image as the drone is disconnected from the controller)



Flight Planning (Cont'd)

This enlarged view shows the actual flight paths in green along which individual camera shots/images will be acquired. Also shows the length of the individual flight lines.

Now select the flight properties: Camera type, altitude, take-off speed, speed. Note the GSD is computed and the SOG is automatically set. The GSD here is 1.31cm/pixel, about ½".

LET'S GO FLY!!

POST-FLIGHT ACTIVITIES
Pre-Processing Data Management

Drone Images "Cameras"

- The "cameras" or individual image frames are captured on a micro-SD card and must be transferred to your computer for further processing. The Micro's come with a "sled" that fits most computer SD card slots.
- Transfer the images to a single folder in the location of your choice on your computer or server. Don't mix other images!!!!
- Clean the SD card before the next use.

Survey Data Prep.

- Export the ascii or csv file format from your survey data collection device to the folder of your choice.
- Use the appropriate template required by the software. Make sure points are sequentially numbered and checkpoints are coded as such.

Reformatting the surveyed GCPs

Typical output from Survey device:

PNEZD format with no header.

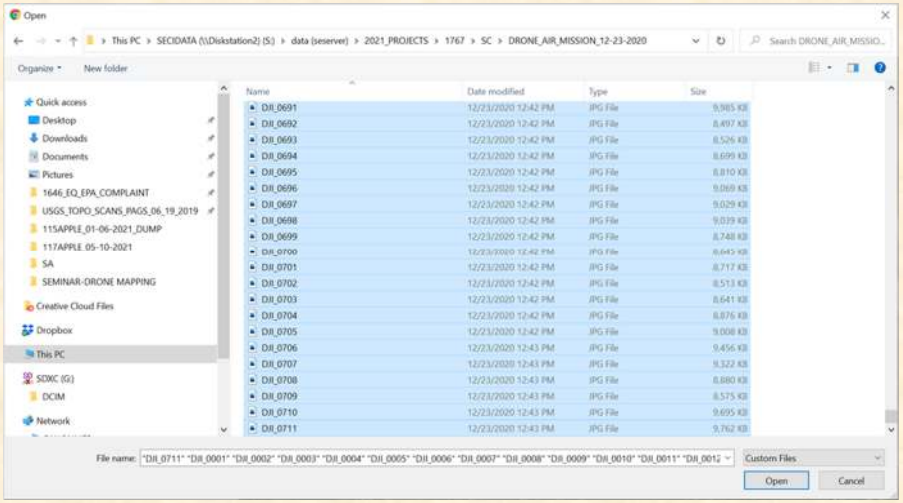
201	274476.1226	726100.7724	23.4851	GCT MN
202	274541.3537	726204.6067	23.9101	GCT MN
203	274274.7609	726023.3464	22.8405	GCT MN
204	274106.3098	725994.5605	22.0419	GCT MN
205	274421.7352	725675.5377	21.7501	GCT MN
206	274418.7071	725867.6119	22.7717	GCT MN
207	274739.9042	725997.7629	22.4671	GCT MN
208	274057.4335	726218.3219	23.6382	GCT MN
209	273844.6529	726261.0817	23.3768	GCT MN
210	273627.4091	726505.0224	23.5514	GCT MN
211	273851.3503	726552.8559	23.992	GCT MN
212	273850.975	726732.9954	24.0429	GCT MN
213	274065.0543	726942.4724	23.9622	GCT MN
214	274244.6227	726747.2027	22.931	GCT MN
215	274319.3362	726429.3482	23.668	GCT MN
216	274201.3267	726386.8305	24.0858	GCT MN
217	274019.7642	726381.0686	23.7958	GCT MN
218	274019.165	726547.985	24.1869	GCT MN
219	274079.8546	726735.0966	23.6141	GCT MN

Reformatted per Drone Deploy Template.

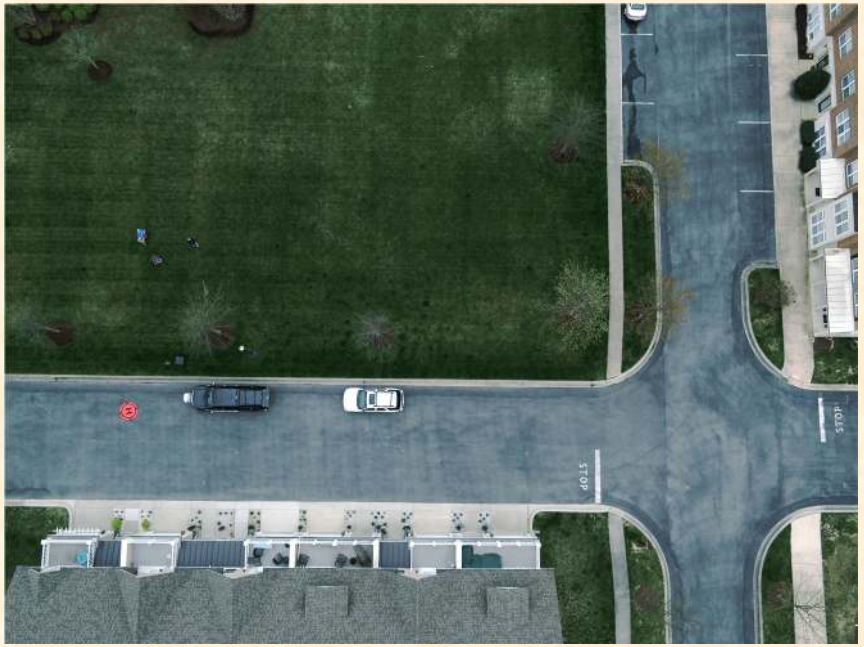
GCP Label	Northing	Easting	Elevation (ft)
201	274476.1226	726100.7724	23.4851
202	274541.3537	726204.6067	23.9101
203	274274.7609	726023.3464	22.8405
204	274106.3098	725994.5605	22.0419
205	274421.7352	725675.5377	21.7501
206	274418.7071	725867.6119	22.7717
207	274739.9042	725997.7629	22.4671
208	274057.4335	726218.3219	23.6382
209	273844.6529	726261.0817	23.3768
210	273627.4091	726505.0224	23.5514
211	273851.3503	726552.8559	23.992
212	273850.975	726732.9954	24.0429
213	274065.0543	726942.4724	23.9622
214	274244.6227	726747.2027	22.931
215	274319.3362	726429.3482	23.668
216	274201.3267	726386.8305	24.0858
217	274019.7642	726381.0686	23.7958
218	274019.165	726547.985	24.1869
219	274079.8546	726735.0966	23.6141

Drone Deploy Image Upload

Grab all the nadir images previously compiled in a single file. Do not include any images not part of the same flight or part of multiple back-to-back flights from the same home point with the same altitude setting/camera settings, etc.

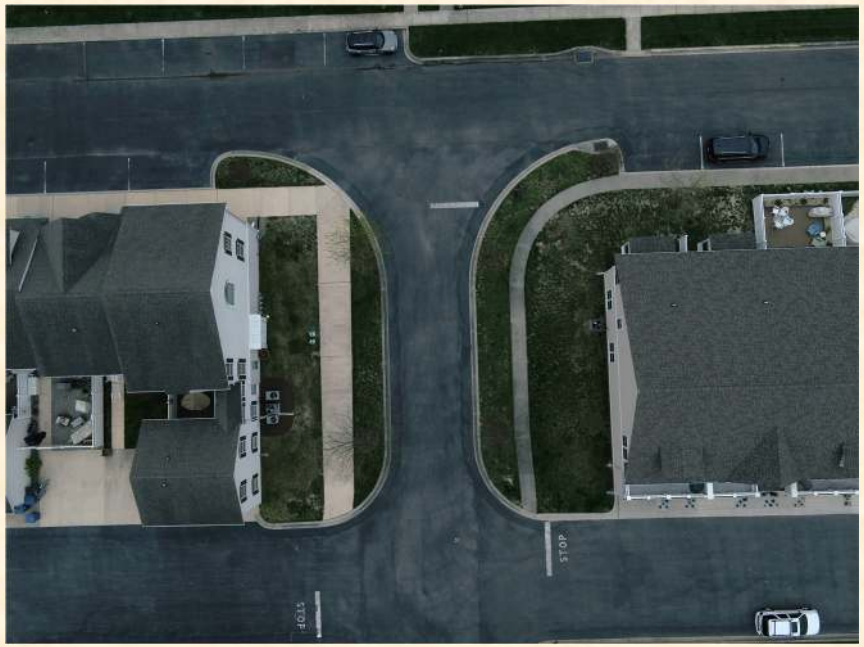


Sample single “camera” from Five Points showing the home point helipad.

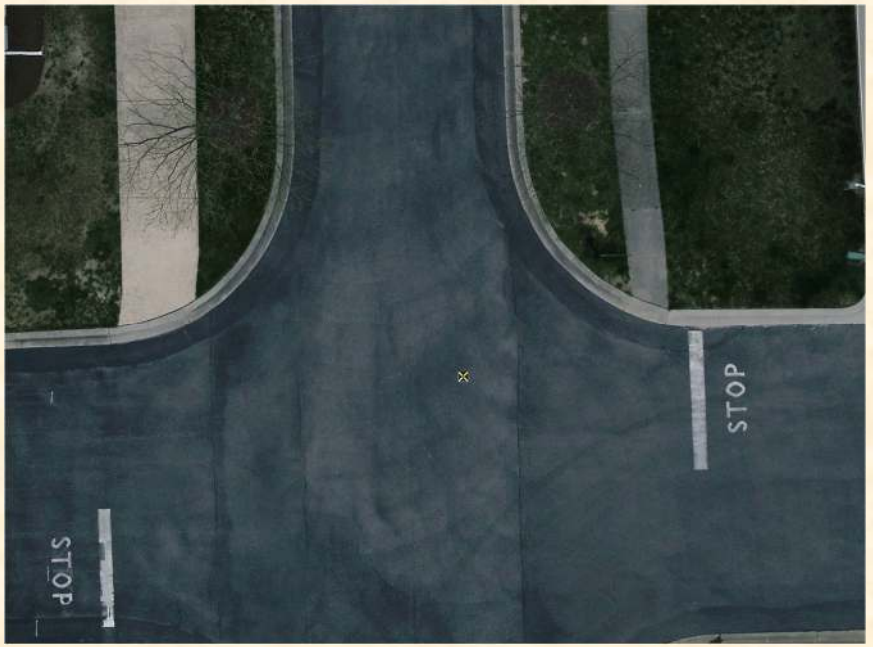


Drone Deploy Image Upload

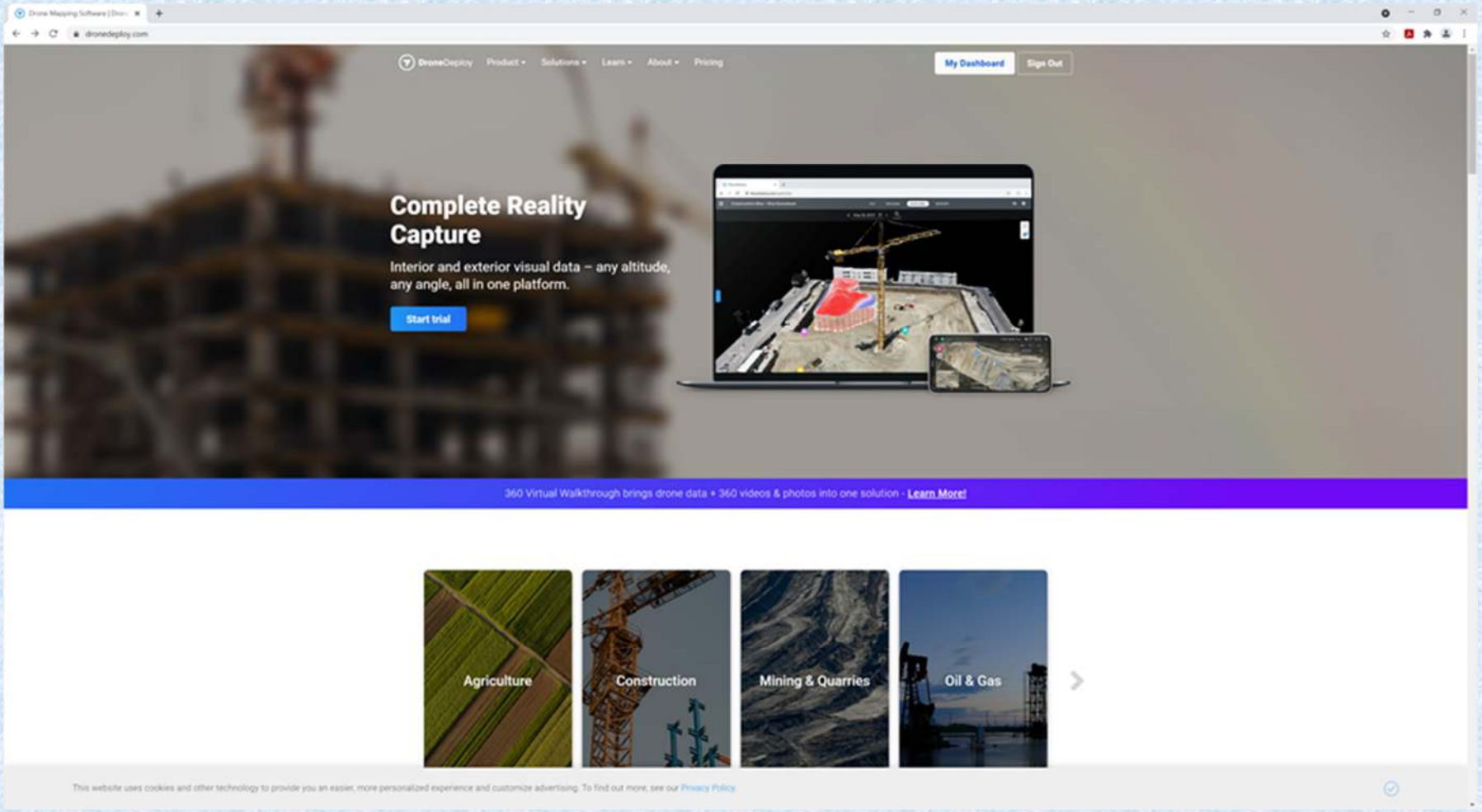
Grab all the nadir images previously compiled in a single file. Do not include any images not part of the same flight or part of multiple back-to-back flights from the same home point with the same altitude setting/camera settings, etc.



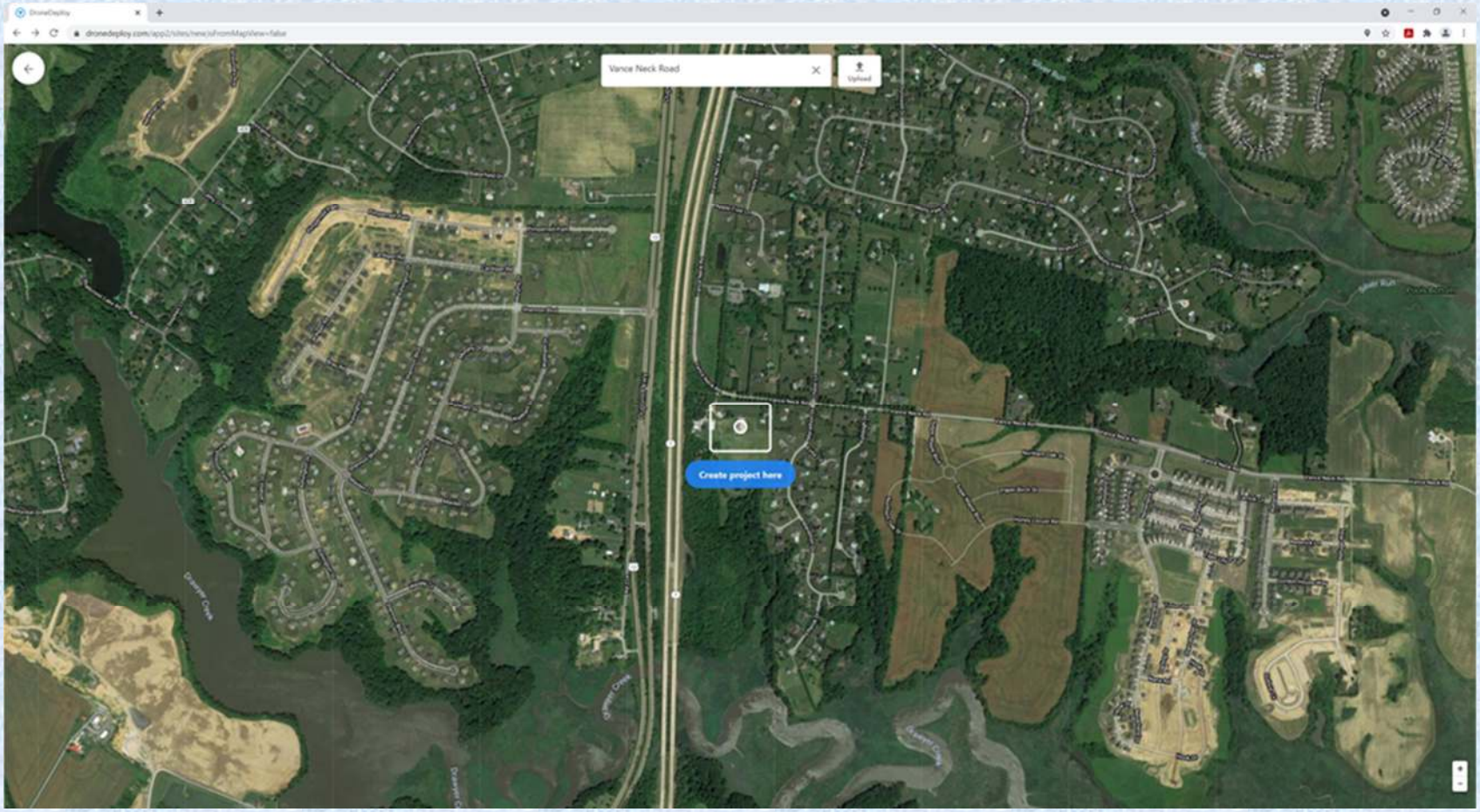
Zoomed in version of the same image showing target. There were a total of 422 images for the flights to be uploaded.



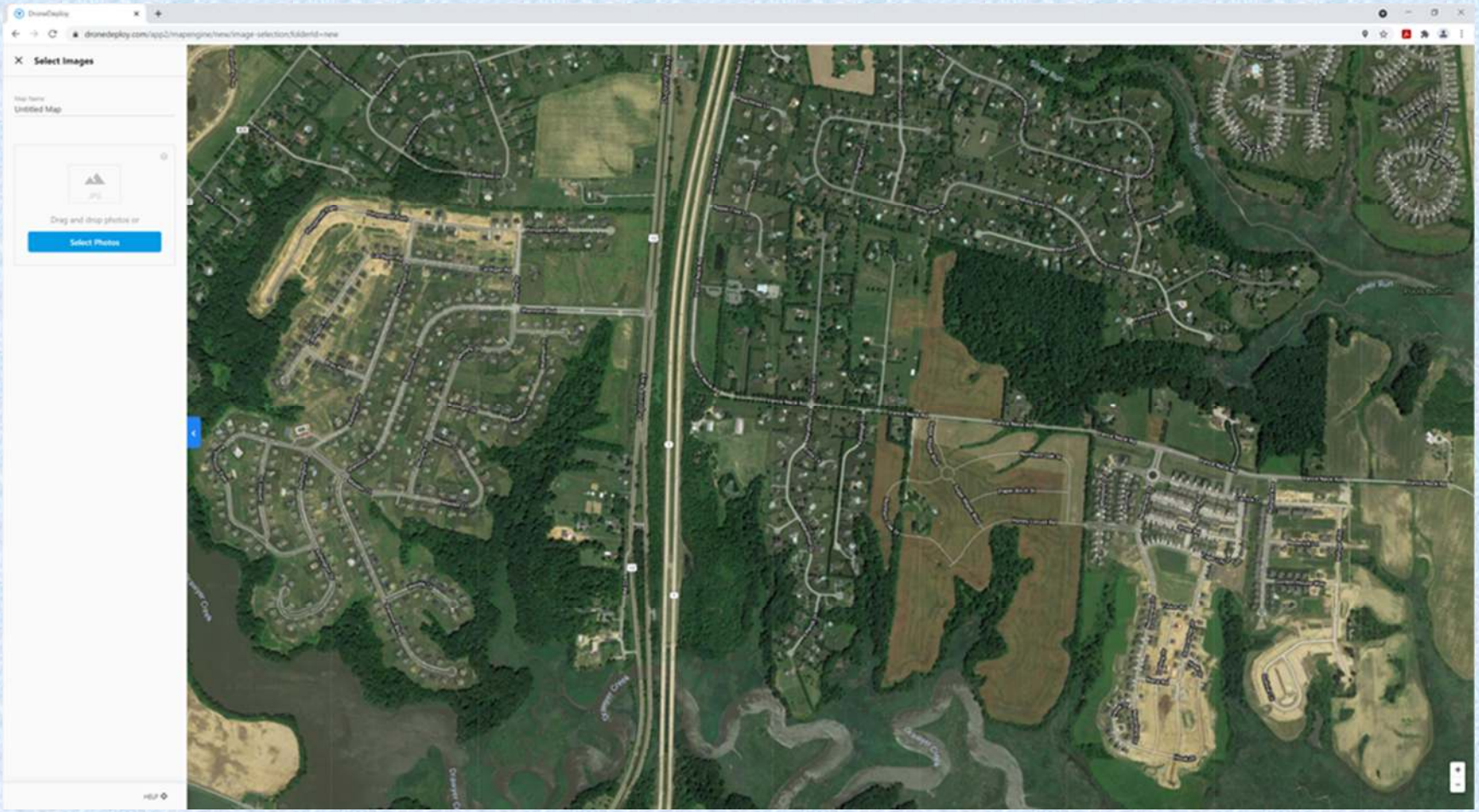
Log into Done Deploy and go to “My Dashboard”. You must have an account (monthly fee) to process a real project.



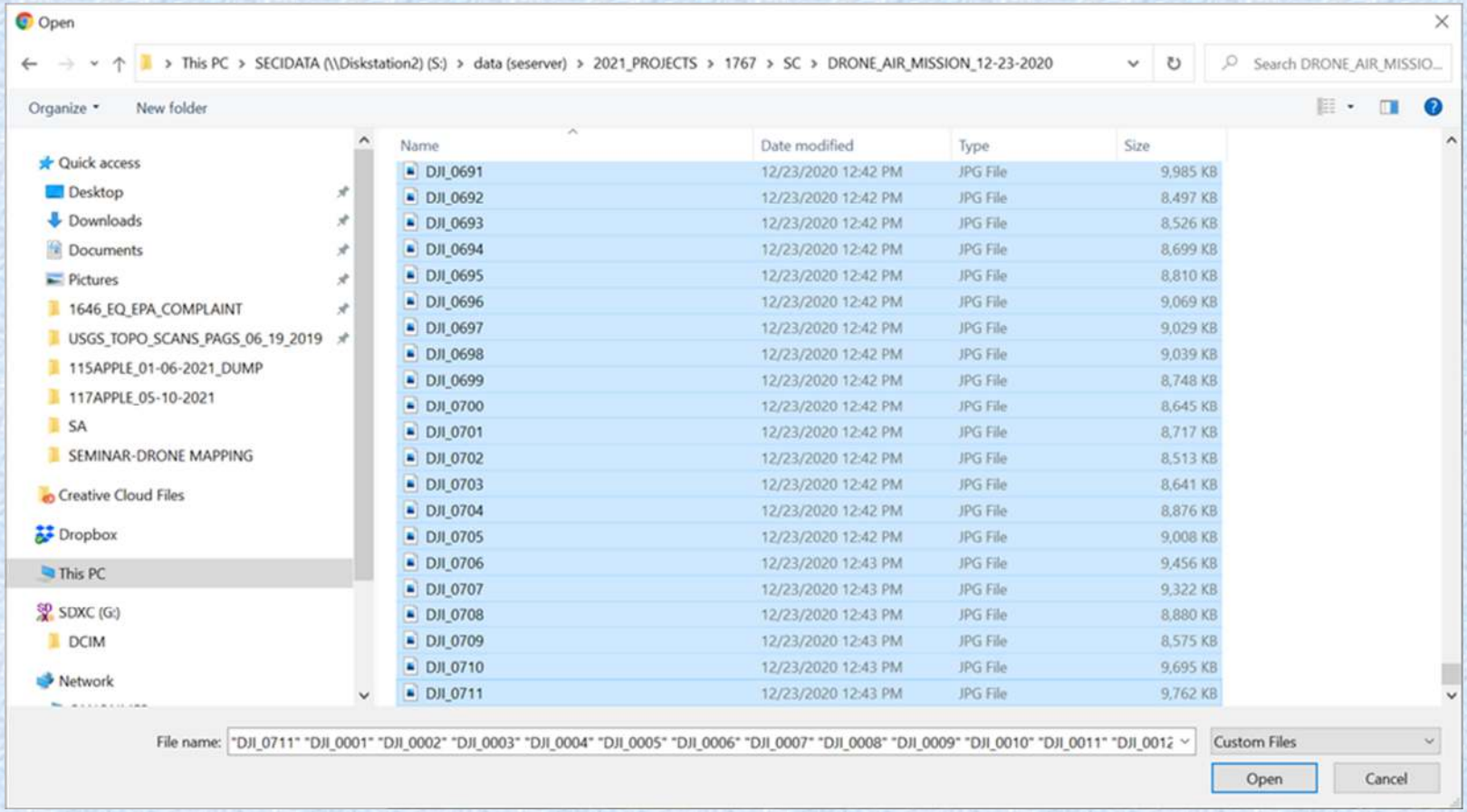
Create a new project.



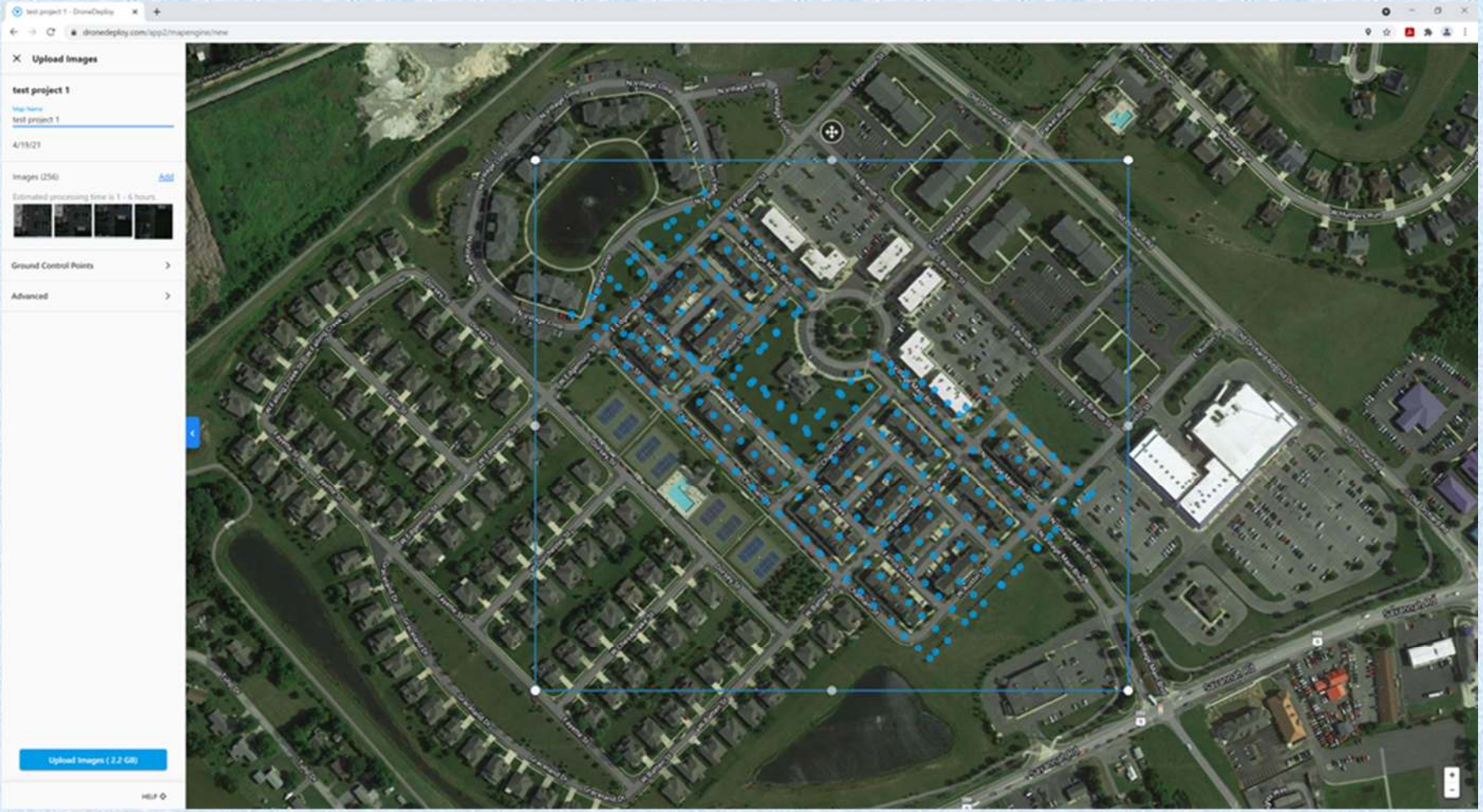
Upload the flight images by selecting them from the file as shown.



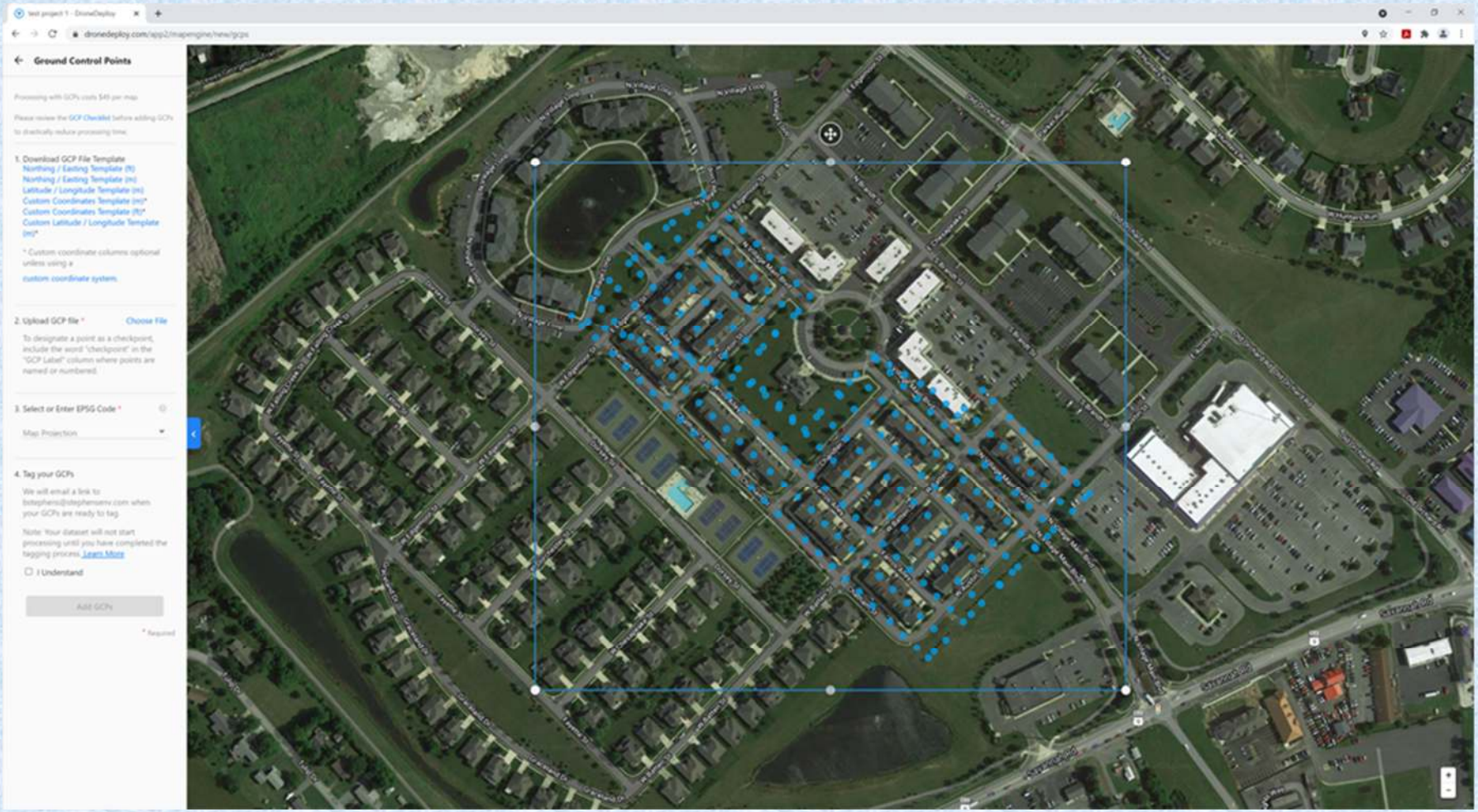
Select and upload all at once. This might take a minute.



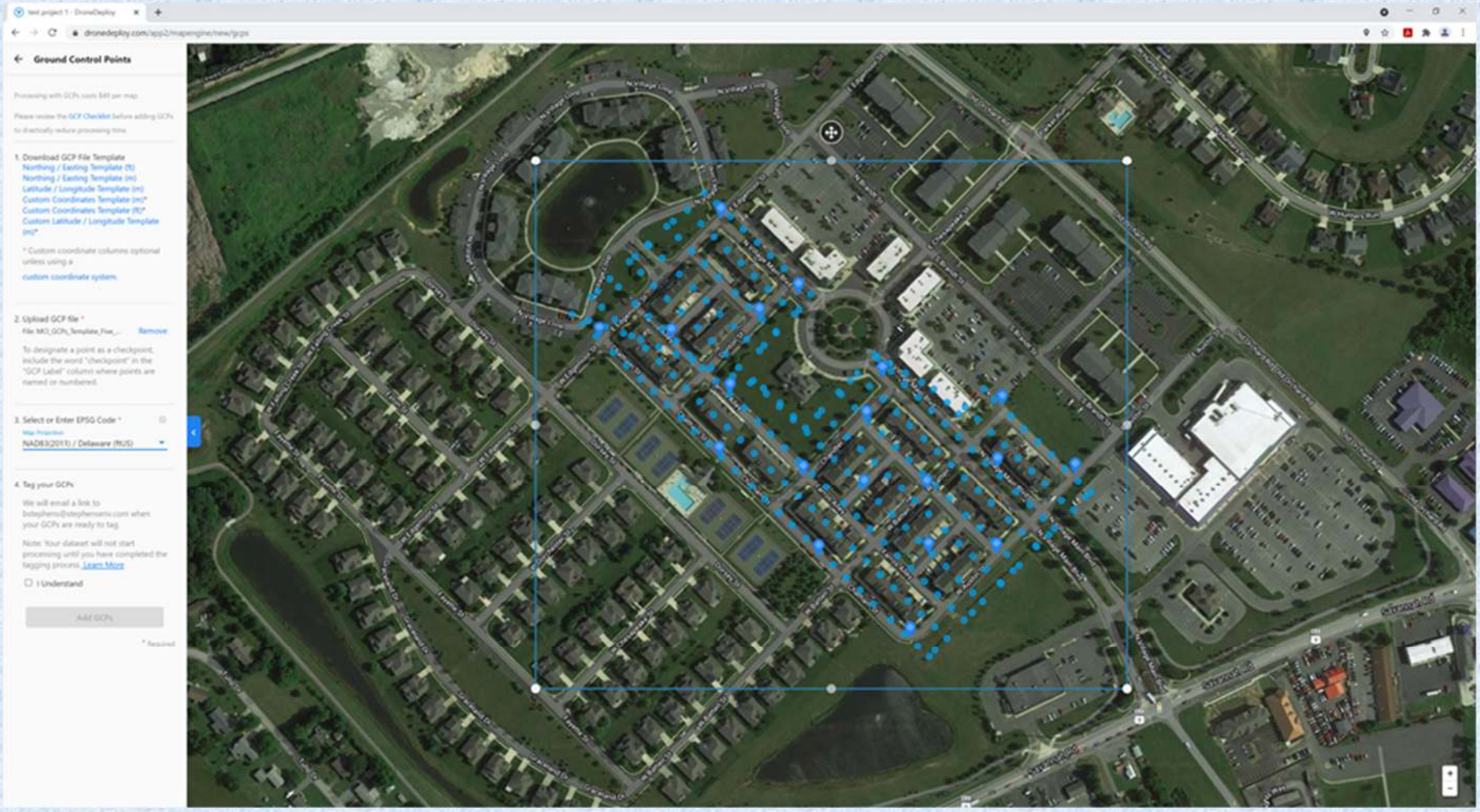
Once the initial upload is complete, you can see the locations of the images per onboard GPS.



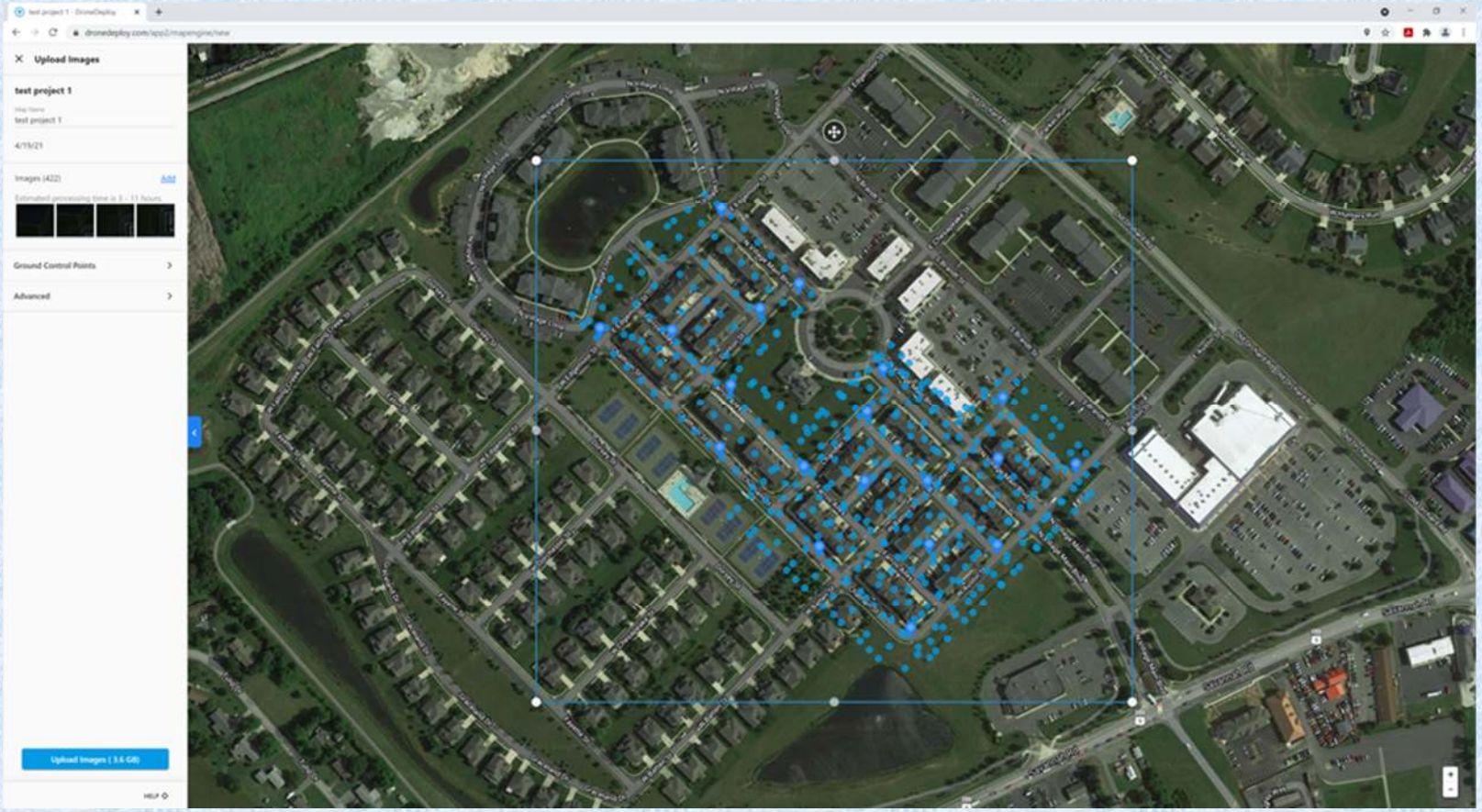
Now upload the GCP file as saved in the template.



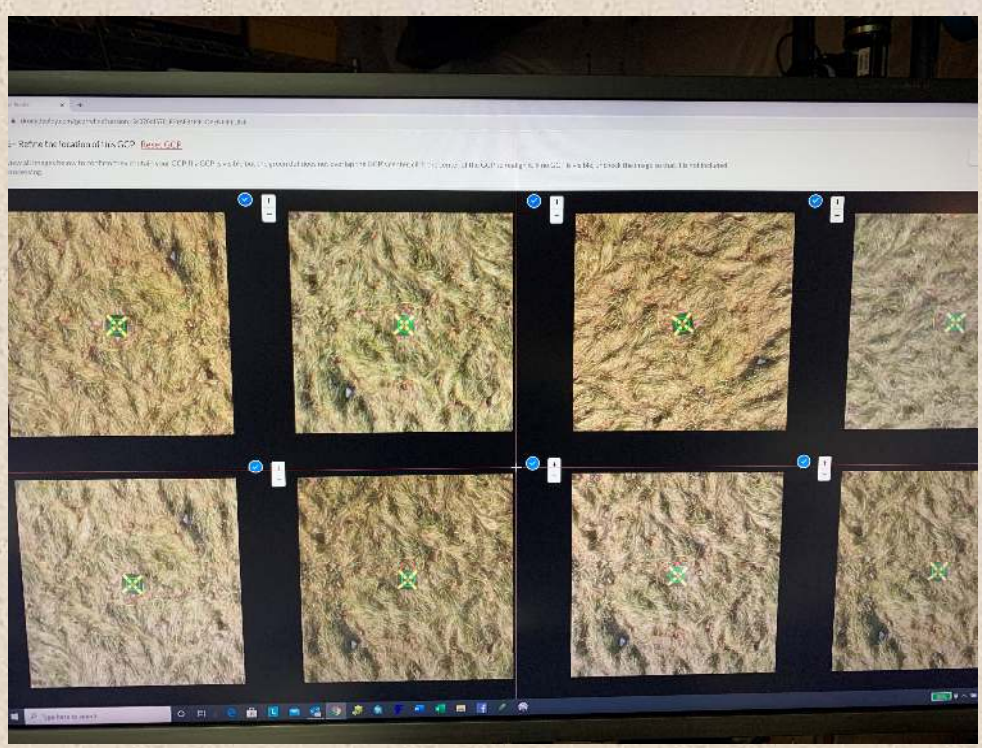
If accepted, the GCPs will automatically appear as blue balloons.



Add any additional cameras from any additional flights. The upload and wait for an email. It will ask you to pay for a map that has GCPs before you continue.



Double click on the “View Map” button in the email you get back from Drone deploy and it will open automatically. You must then verify and/or match the GCPs as identified in all images within which each occurs. Sample provided below. Once all the GCPs are matched, resubmit and await another email with the processed map.



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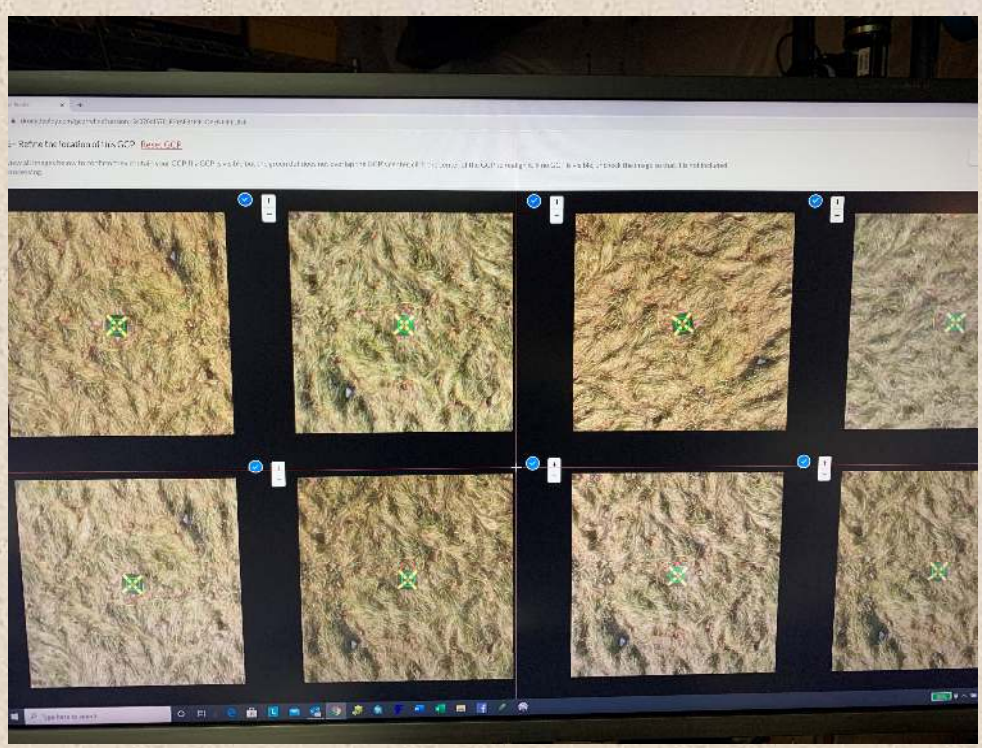
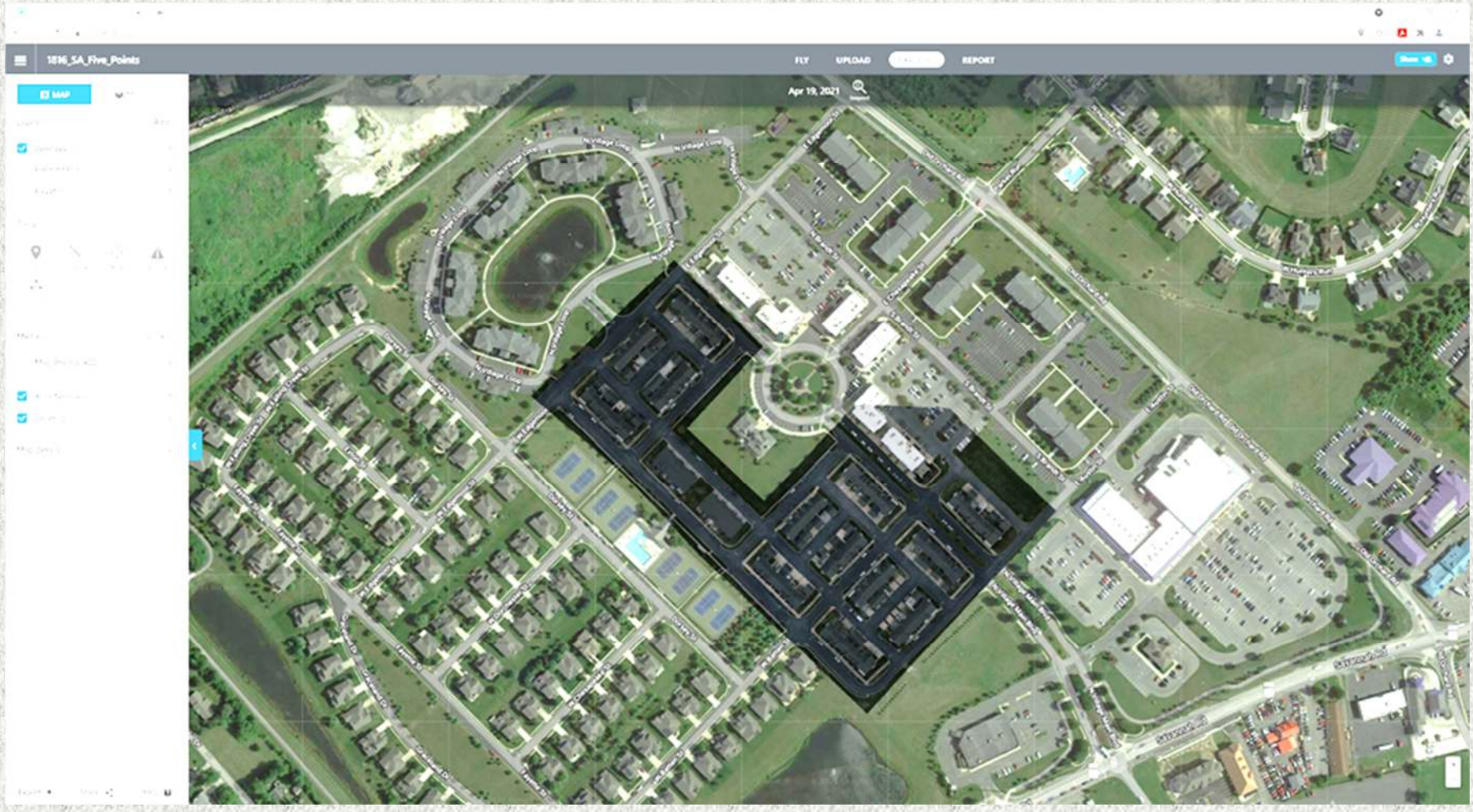
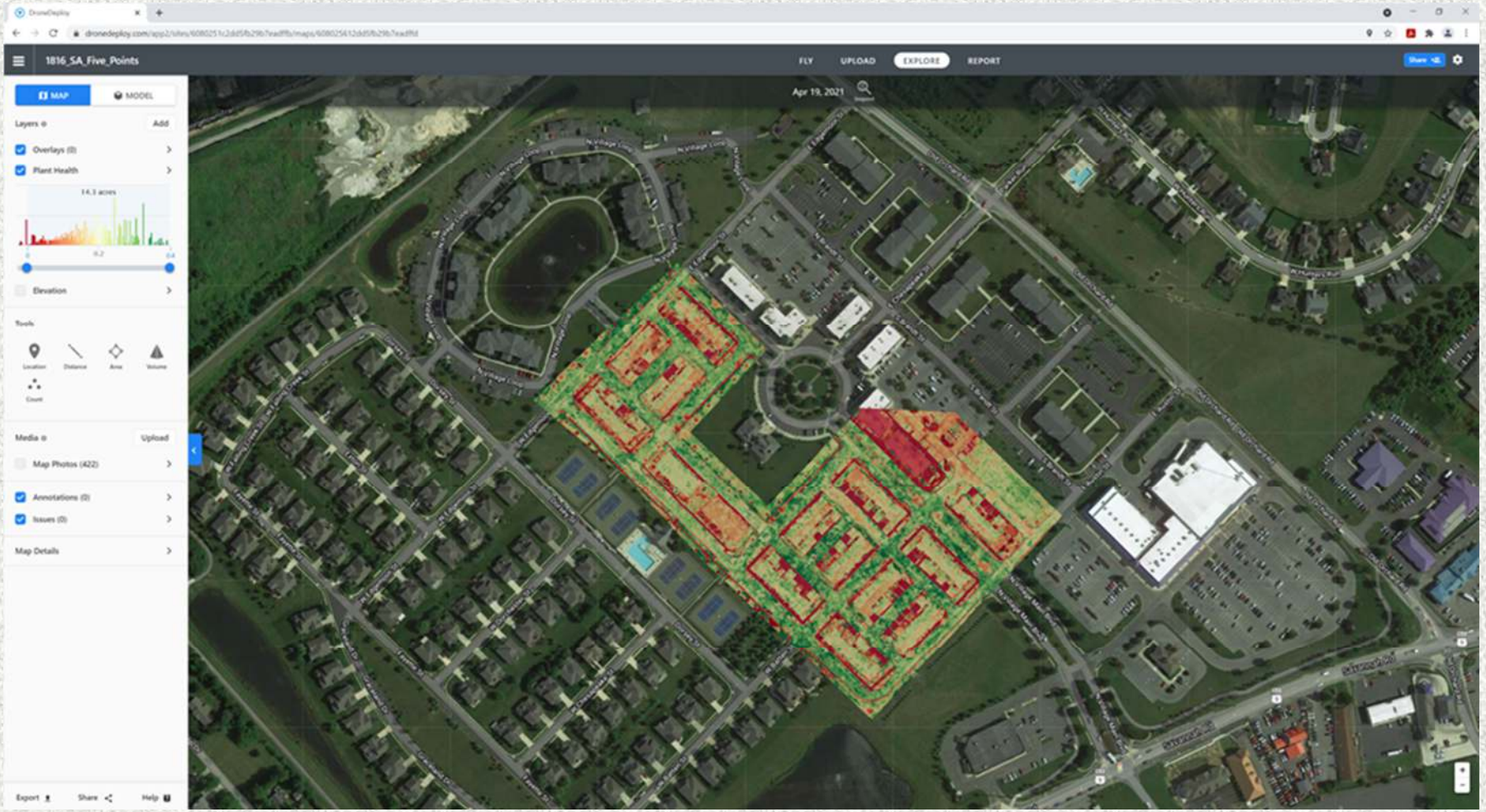


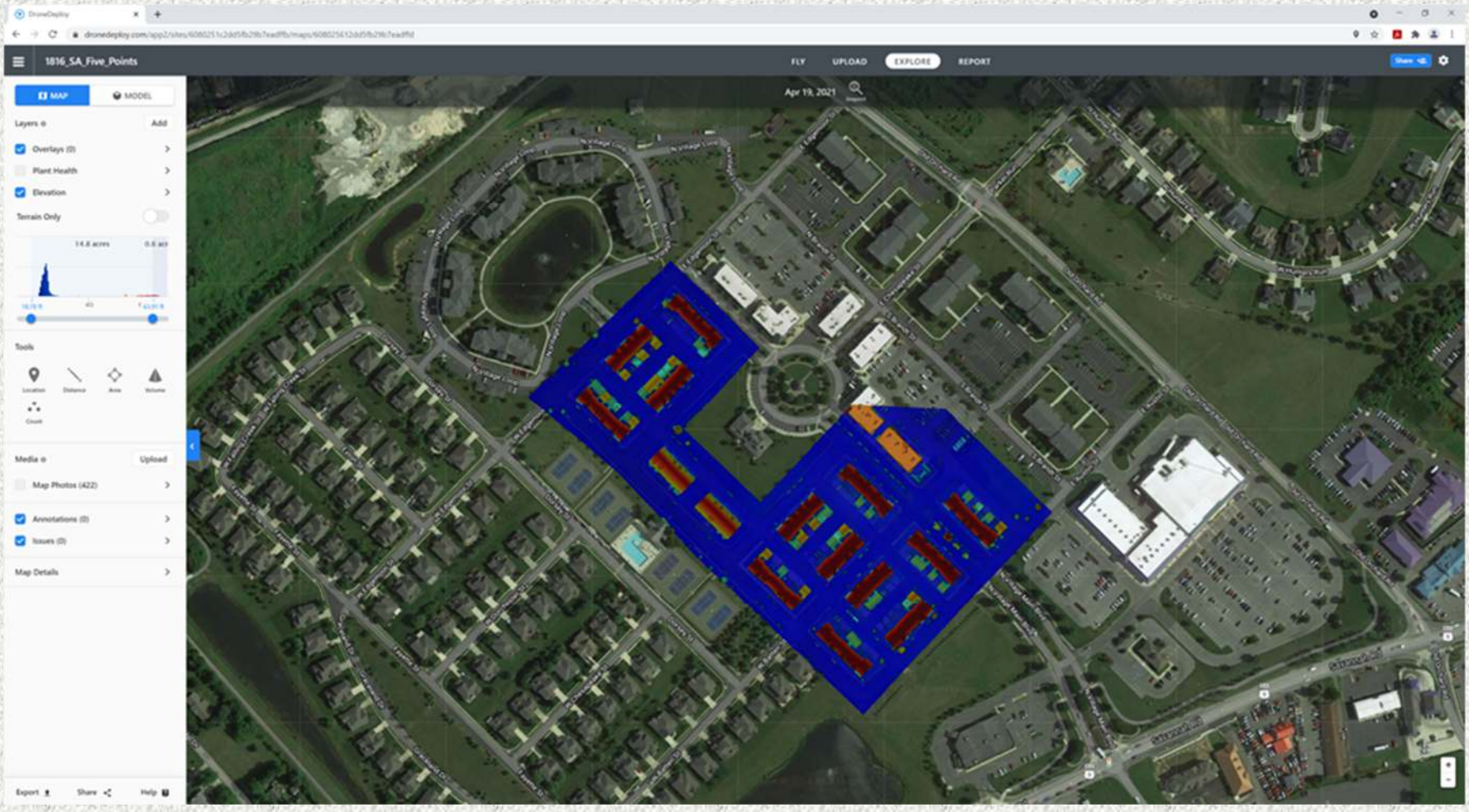
Finished Orthomosaic in Drone Deploy.



Plant Health in Drone Deploy.



Elevation Model in Drone Deploy.



Drone Deploy Quality Report

1816_SA_Five_Points - 1816_SA_Five_Points

Captured: Apr 19, 2021, Processed: Apr 21, 2021

Map Details Summary

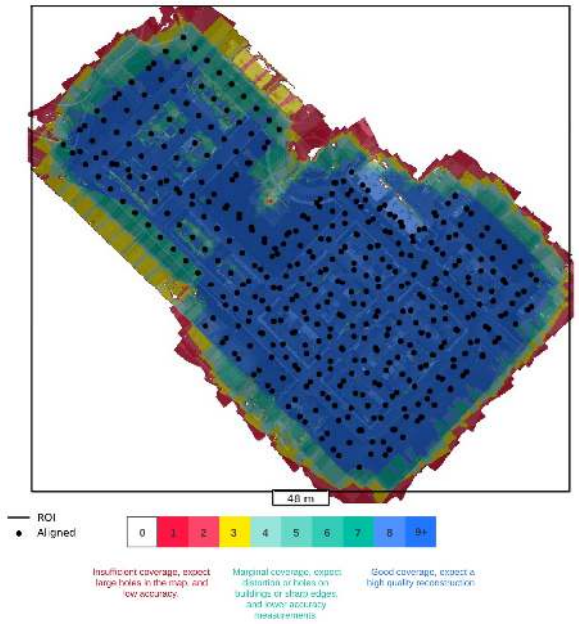
Project Name	1816_SA_Five_Points - 1816_SA_Five_Points
Photogrammetry Engine	DroneDeploy Proprietary
Date Of Capture	Apr 19, 2021
Date Processed	Apr 21, 2021
Processing Mode	Standard
GSD Orthomosaic (GSD DEM)	0.46in/px (DEM 1.64in/px)
Area Bounds (Coverage)	22.7809 ft^2 (56%)
Image Sensors	DJI - FC6520

Quality & Accuracy Summary

Image Quality	High texture images
Median Shutter Speed	1/1000
Processing Mode	[Standard Mode - Designed to produce the best photogrammetry output based on the input imagery. Include predominantly nadir imagery for most efficient mapping of large fields and crops, natural open terrain, and generating topographical maps. Entirely nadir collects are not recommended for reconstructing the sides of buildings, overhangs, or complex equipment. Include horizontal and oblique imagery to optimize processing for high resolution 3D reconstruction of buildings, pipework & conveyors.]
Images Uploaded (Aligned %)	422 (100%)
Camera Optimization	0.02% variation from reference intrinsics
GCP & Checkpoint count	19 GCPs - Mean RMS Error 0.91in

Preview

Orthomosaic Coverage



Sensor(s) Used	DJI - FC6520
Image Count (by sensor)	422
Image Resolution	5280x3956 (~21MP)
Orthomosaic coverage (% of area of interest)	56.70
Average Orthomosaic Image Density within Structured Area	11 images/pixel
Median Shutter Speed	1/1000

Drone Deploy Quality Report

Visualisation of the expected absolute position error within the checkpoint area.

GCP Input

EPSG Code	EPSG-6436 - NAD83(2011) / Delaware (ftUS)

GCP Geolocation Error

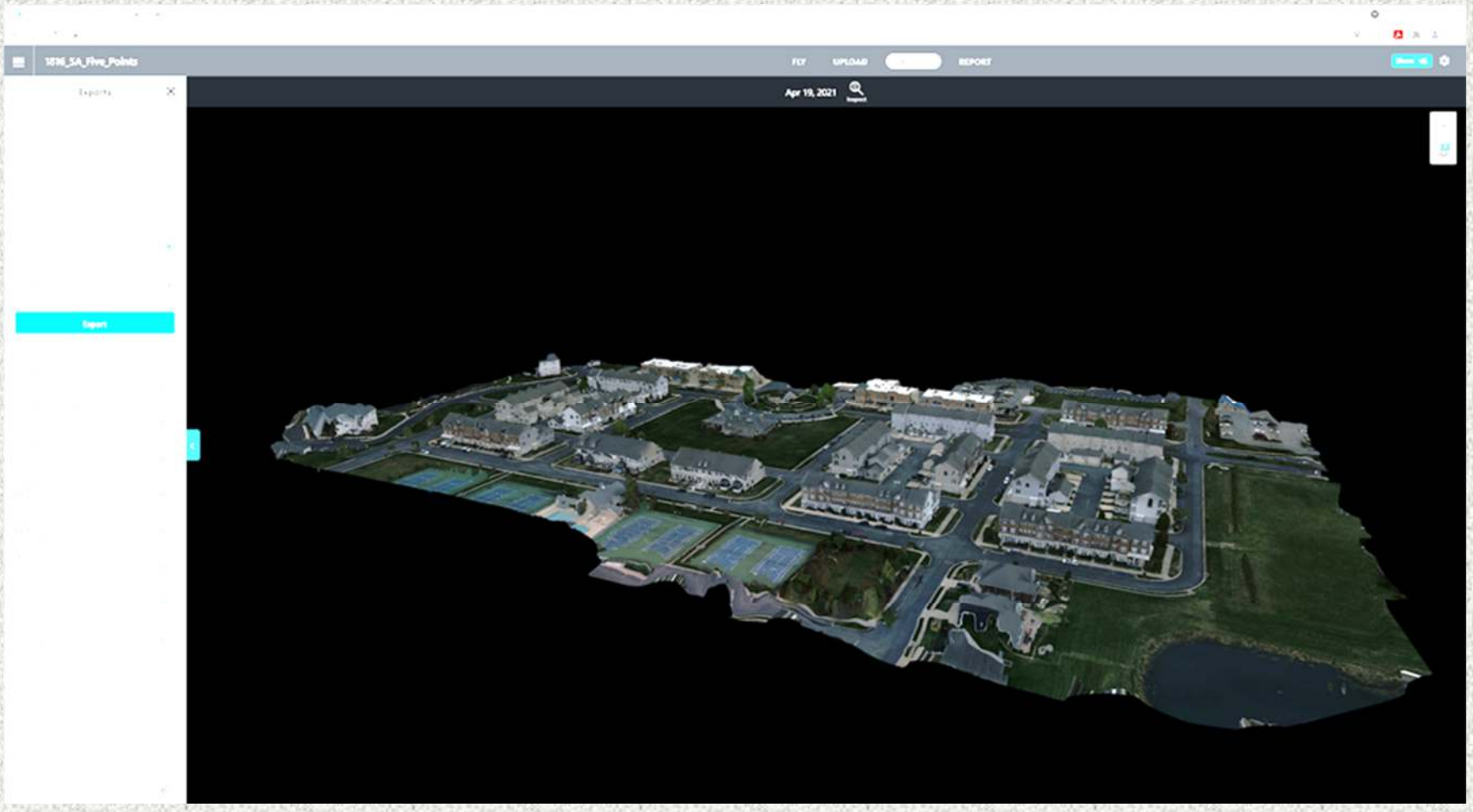
GCP data is used to constrain the map reconstruction, so real world error between GCPs can ONLY be evaluated using Checkpoints. Error on GCPs is NOT representative of map error, instead it allows you to identify GCPs that have issues - for example incorrect survey locations, or that have been improperly tagged. Typical error should be less than a few centimeters for well tagged GCPs.

GCP Label	X Error (in)	Y Error (in)	Z Error (in)
201	0.5906	-0.7598	-0.3150
202	0.6378	-0.5882	1.1929
203	1.2362	0.2047	0.2913
204	1.6732	1.1890	1.3307
205	0.3307	1.0276	1.3307
206	0.5551	1.5268	-1.7441
207	1.8071	0.5591	0.3858
208	0.9724	-1.3661	-0.2835
209	0.5906	-0.7638	0.3780
210	0.3622	-0.3976	-0.3465
211	0.8898	-0.3189	-0.1693
212	-1.4331	0.5000	2.0433
213	0.6850	0.7165	1.1969
214	-0.2756	0.6260	-0.4055
215	0.2913	-0.5906	-1.4803
216	0.5954	-1.5669	-0.7929
217	0.0748	-0.6260	-1.3976
218	0.3150	-0.0984	0.3819
219	0.4094	1.0276	-0.9055
Total (RMSE) Excludes Outliers	0.8560	0.8400	1.0293

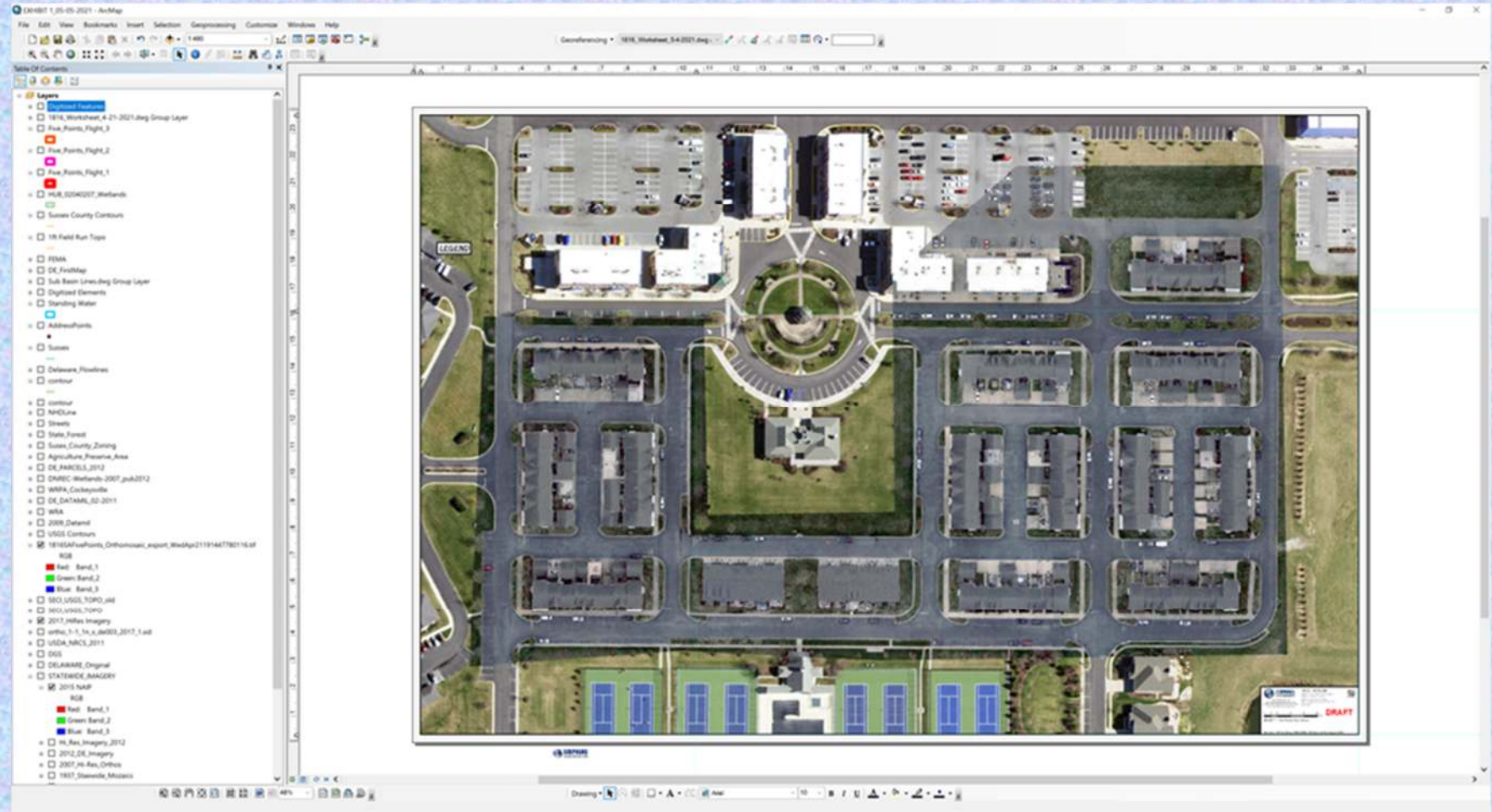
Densification and Meshing

Processing Mode	[Standard Mode - Designed to produce the best photogrammetry output based on the input imagery. Include predominantly nadir imagery for most efficient mapping of large fields and crops, natural open terrain, and generating topographical maps. Entirely nadir collects are not recommended for reconstructing the sides of buildings, overhangs, or complex equipment. Include horizontal and oblique imagery to optimize processing for high resolution 3D reconstruction of buildings, pipework & conveyors.]
Processing Mode Quality	High
Nadir Images	100% Include oblique or horizontal images to improve reconstructions of man-made structures.
Oblique Images	0%
Horizontal Images	0%
Total Points	29.4 million
Point Cloud Density	21.98 points/ft^2
Mesh Triangles	3.8 million

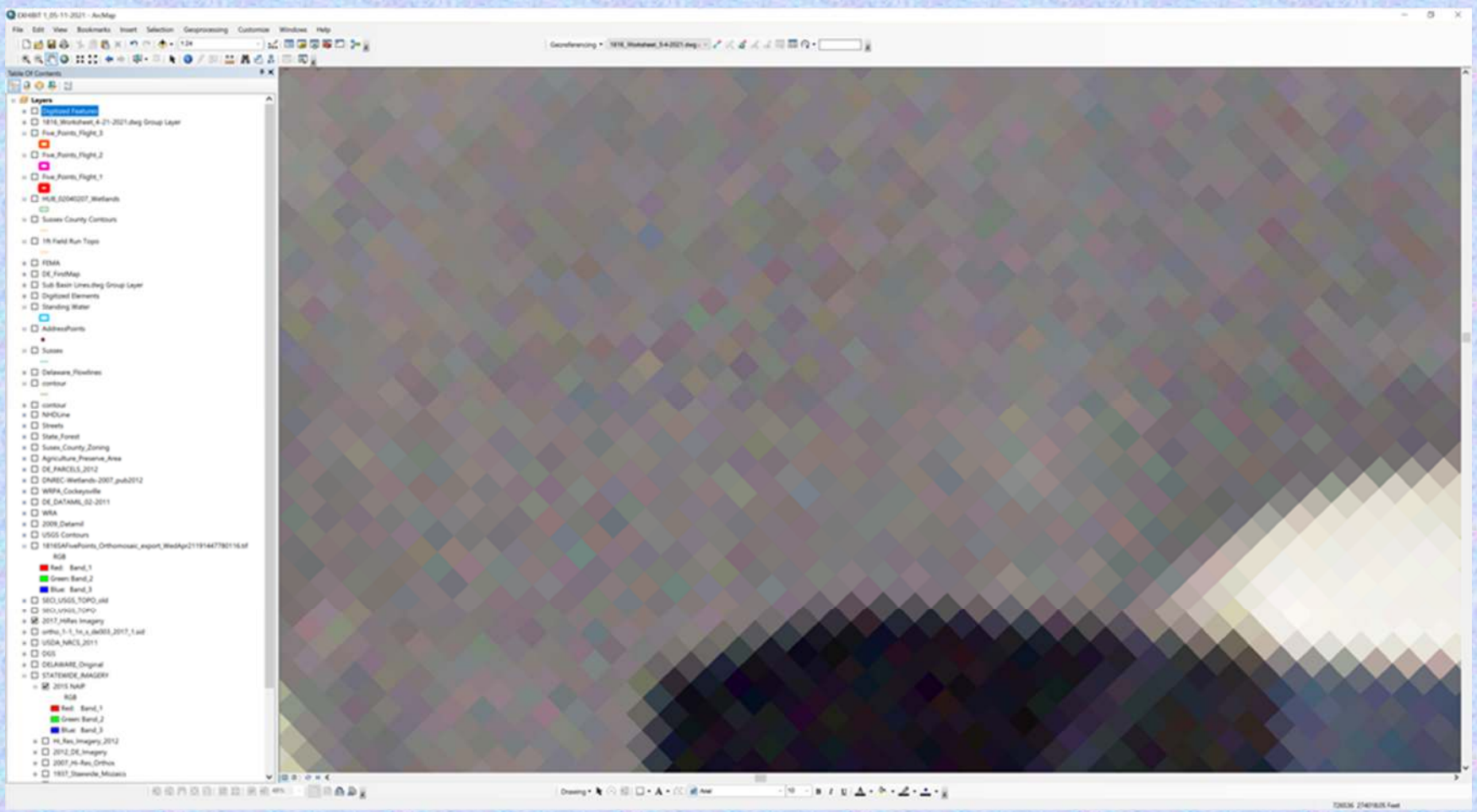
3D Model in Drone Deploy.



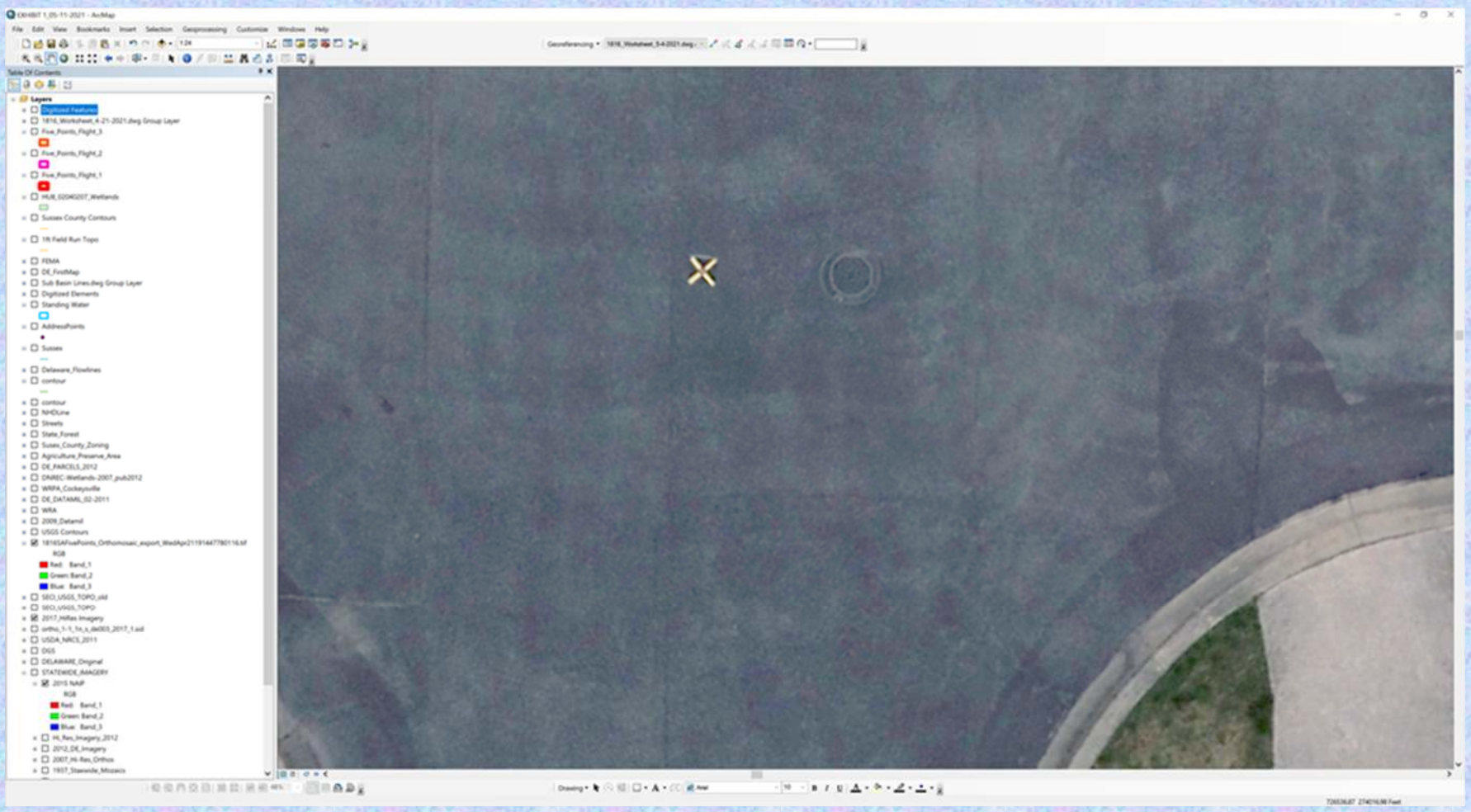
Finished Orthomosaic in ArcGIS.



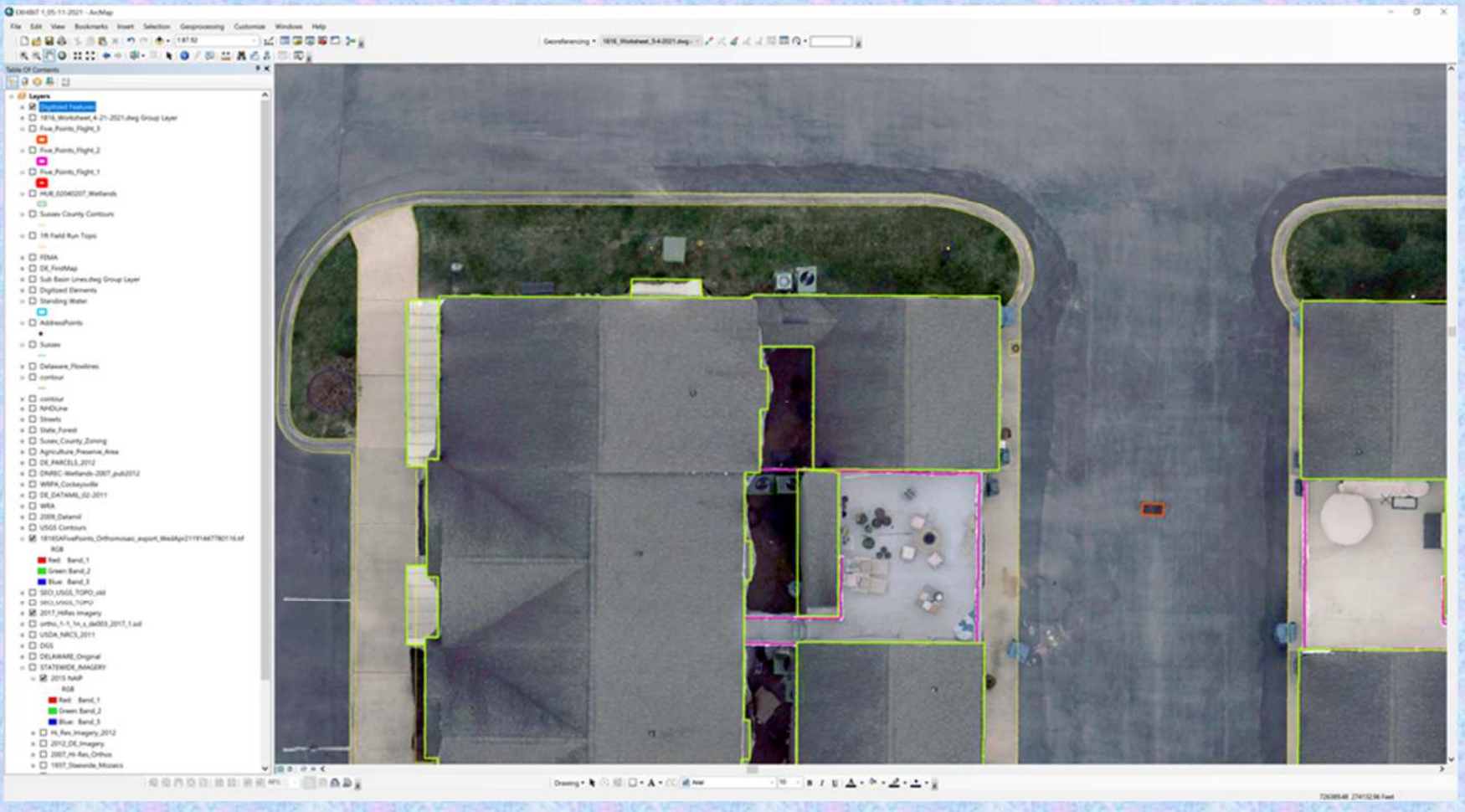
1:24 (1 inch = 2 feet) version of the 2017 1ft Pixel Res Imagery.



1:24 (1 inch = 2 feet) same view, of the Digital Ortho.

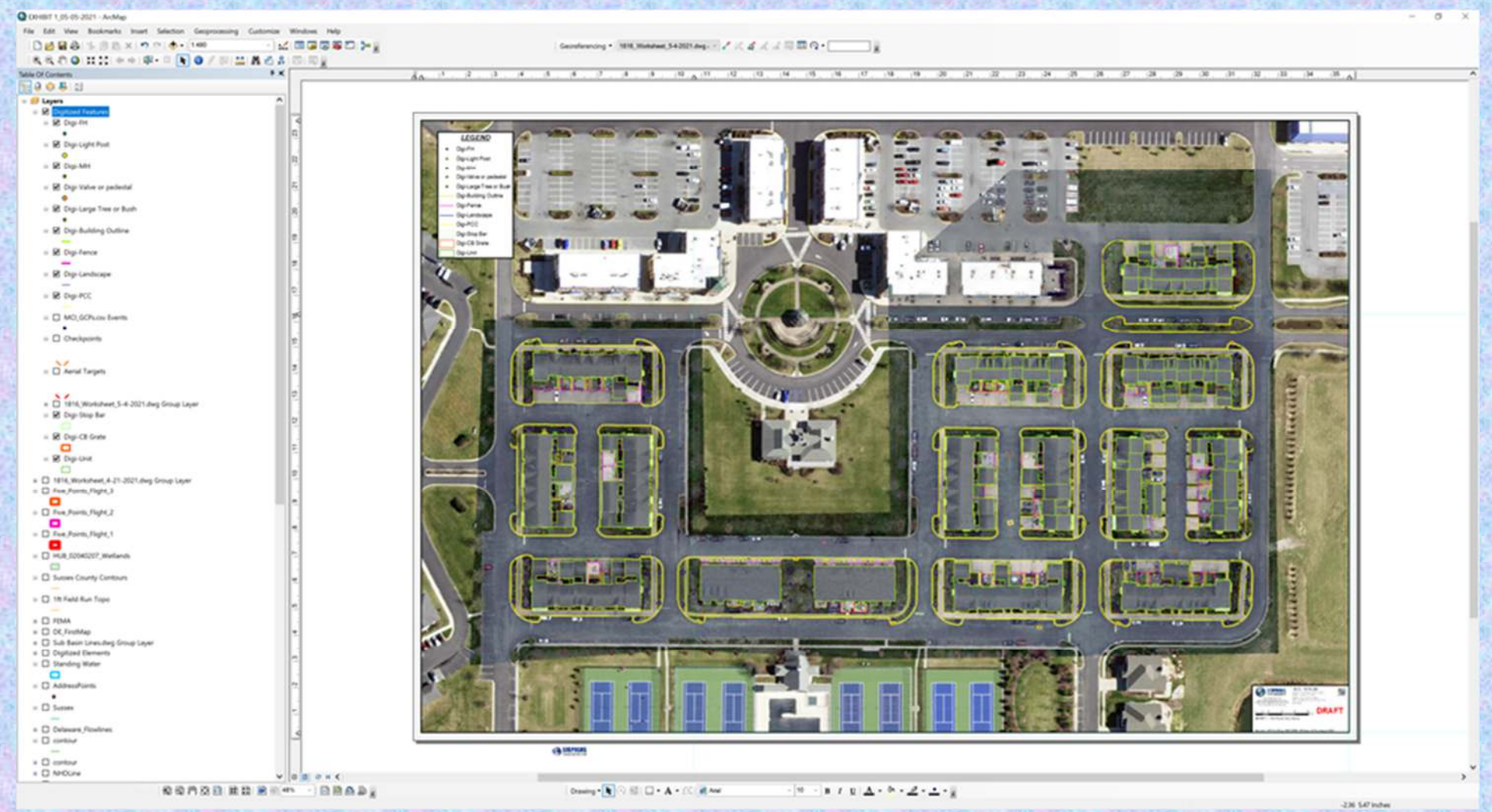


Map View of a portion of the finished work product. Note red-outlined Catch Basin



1” = 1 ft enlargement of surveyed outline over the Inlet as independent check on accuracy of the ortho.

Completed Project




QUESTIONS?