



# Know Before You Fly

Drones Advancing Watershed Work



# Panel Outline

- Introductions
  - Outagamie County – Jeremy Freund
  - NEW Water – Jeff Smudde
  - City of Appleton – Heath Anderson
  - RA Smith – Jonathon Chapman
- Presentations
- Q&A



# Takeaways:

- Policy considerations
- Training
- Certification
- Hardware
- Software
- Case Studies
- Lessons Learned

# Outagamie County Drone Policy

- Policy Committee:
  - Development & Land Services
  - Execs Office
  - Airport
  - Sheriff
  - Risk Management
  - Corp Counsel
  - Emergency Management
  - Solid Waste
  - Land Conservation
- Users vs. Consumers



<b>XXX</b>	<b>SUBJECT: UNMANNED AERIAL SYSTEM (UAS) OPERATIONS</b>
<b>XXX.01</b>	<b>POLICY PURPOSE AND SCOPE</b>
<b>XXX.02</b>	<b>DEFINITIONS</b>
<b>XXX.03</b>	<b>POLICY</b>
<b>XXX.04</b>	<b>PRIVACY</b>
<b>XXX.05</b>	<b>PROGRAM COORDINATOR</b>
<b>XXX.06</b>	<b>USE OF UAS</b>
<b>XXX.07</b>	<b>PROHIBITED USE</b>
<b>XXX.08</b>	<b>RETENTION OF UAS DATA</b>
<b>XXX.09</b>	<b>TRAINING</b>
<b>XXX.10</b>	<b>APPROVED UAV'S</b>
<b>XXX.11</b>	<b>PRE-FLIGHT OPERATIONS CHECKLIST</b>
<b>XXX.12</b>	<b>GRIEVANCES</b>
<b>XXX.13</b>	<b>UPDATES OF THE POLICY</b>

# Remote Pilot License



The screenshot shows the FAA website's navigation and content for the Small UAS Rule. The top navigation bar includes the FAA logo, 'Federal Aviation Administration', and links for 'FAA Home', 'Jobs', 'News', and 'About FAA'. A search bar is located on the right. Below this is a secondary navigation bar with categories: 'Aircraft', 'Airports', 'Air Traffic', 'Data & Research', 'Licenses & Certificates', and 'Regulations & P'. The main content area is titled 'Unmanned Aircraft Systems' and features a breadcrumb trail: 'FAA Home > Unmanned Aircraft Systems > Getting Started > Fly under small UAS rule (Part 107)'. The primary heading is 'Fly under the Small UAS Rule'. Below it, a text block states: 'To fly under the FAA's Small UAS Rule (14 CFR part 107), you must:'. This is followed by a list of three requirements: 'Get a Remote Pilot Certificate from the FAA', 'Register your UAS as a "non-modeler"', and 'Follow all part 107 rules'. A horizontal line separates this from the 'Remote Pilot Certification' section, which contains a bulleted list of requirements: 'Be at least 16 years old', 'Pass an aeronautical knowledge test at an FAA-approved knowledge testing center\*', and 'Undergo Transportation Safety Administration (TSA) security screening'. At the bottom, a text block provides a link to 'Remote Pilot Certification' for more information.

**Federal Aviation Administration**

FAA Home Jobs News About FAA

Search

Aircraft Airports Air Traffic Data & Research Licenses & Certificates Regulations & P

**Unmanned Aircraft Systems**

Getting Started

Fly under the Special Rule for Model Aircraft

**Fly under small UAS rule (Part 107)** →

Becoming a Pilot

UAS Registration

Emergency Operations Approval

Beyond the Basics

Where to Fly

Frequently Asked Questions

Programs, Partnerships and Opportunities

Research & Development

Resources

FAA Home > Unmanned Aircraft Systems > Getting Started > Fly under small UAS rule (Part 107)

## Fly under the Small UAS Rule

To fly under the FAA's Small UAS Rule (14 CFR part 107), you must:

- ↓ [Get a Remote Pilot Certificate from the FAA](#)
- ↓ [Register your UAS as a "non-modeler"](#)
- ↓ [Follow all part 107 rules](#)

---

## Remote Pilot Certification

- Be at least 16 years old
- Pass an aeronautical knowledge test at an FAA-approved knowledge testing center\*
- Undergo Transportation Safety Administration (TSA) security screening

For more information about how to get a Remote Pilot Certificate, visit [Remote Pilot Certification](#).

























# File Management

- Raw File Size
- Open Records
- Derivatives
- Sharing

Name	Date modified
 Flight_01_24_2017	6/7/2017 9:56 AM
 Flight_06_01_2017	6/12/2017 12:43 PM
 Flight_06_02_2017	6/16/2017 1:40 PM
 Flight_06_06_2017	7/11/2017 7:24 AM
 Flight_06_07_2017	7/11/2017 7:24 AM
 Flight_07_05_2017	7/13/2017 7:45 AM
 Flight_07_06_2017	7/13/2017 7:45 AM
 Flight_08_12_2017	8/15/2017 8:32 AM
 Flight_08_14_2017	9/27/2017 7:26 AM
 Flight_08_24_2017	9/27/2017 7:26 AM
 Flight_09_05_2017	9/27/2017 7:27 AM
 Flight_09_20_2017	9/27/2017 7:27 AM
 Flight_09_25_2017	9/27/2017 7:27 AM
 Flight_10_02_2017	10/3/2017 7:27 AM
 Flight_10_05_17	10/10/2017 12:50 ...
 Flight_10_10_2017	10/13/2017 9:30 A...
 Flight_10_13_2017	10/13/2017 8:40 A...
 Flight_10_19_2017	10/24/2017 8:22 A...

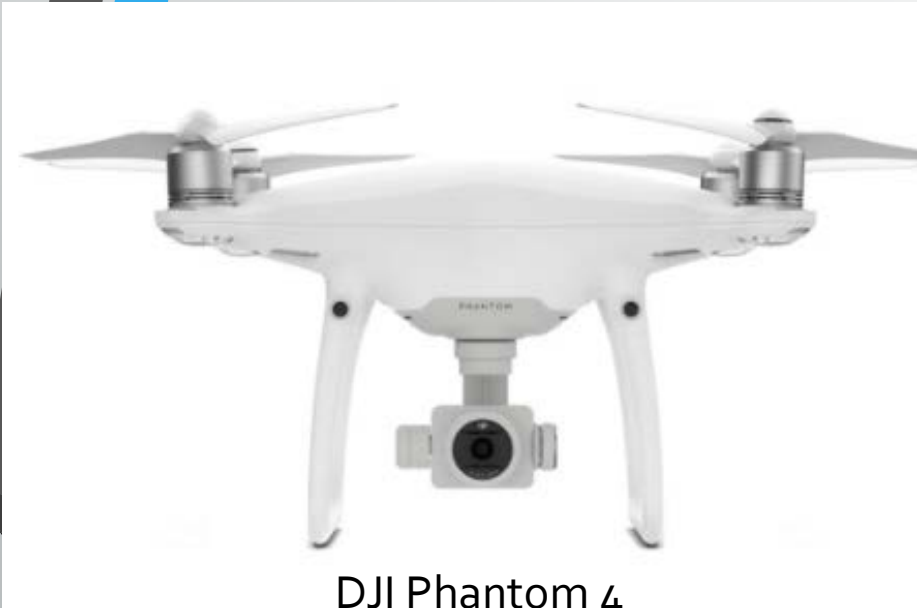
Native (photos and video) 12% average growth over 6 years						
Year	1	2	3	4	5	6
MB	136,080	288,490	611,598	1,296,588	2,748,766	5,827,384
GB	136	288	612	1,297	2,749	5,827
TB	0.1	0.3	0.6	1.3	2.7	5.8

Derivatives (orthophotos, LiDAR, GIS, Video cuts) 12% average growth over 6 years						
Year	1	2	3	4	5	6
GB	1036.8	2198.0	4659.8	9878.8	20943.0	44399.1
TB	1.0	2.2	4.7	9.9	20.9	44.4

Outagame County Backup Growth - All Departments (per IT 4/7/2017) 12% average growth over 6 years						
Year	2012	2013	2014	2015	2016	2017
TB Actual	12	13	14	17	19.0	21.4
TB Calculated	12.00	13.44	15.05	16.86	18.88	21.15



# OC Vehicles



DJI Phantom 4



DJI Matrice 200

# Uses

- Orthophotos
- Promotional Videos
- Cover crop metrics
- Survey Grade point clouds





# **LAMERSTEST**

**SENSORS:** RGB | **ALT:** 200ft | **RES:** 0.97in/px | **SIZE:** 1.88 GB | **AREA:** 15.81 ac | **TIME:** 09/20/17 15:16:00 | **IMAGES:** 58 images  
**DRONE PLATFORM:** DJI Phantom 4 | **SURVEY ID:**  [Copy](#) 4d45...





# ← LAMERSTEST

**SENSORS:** RGB | **ALT:** 200ft | **RES:** 0.97in/px | **SIZE:** 1.88 GB | **AREA:** 15.81 ac | **TIME:** 09/20/17 15:16:00 | **IMAGES:** 58 images  
**DRONE PLATFORM:** DJI Phantom 4 | **SURVEY ID:**  Copy 4d45...

**2D** | 3D

Orthomosaic opacity:

+  
-







# HANKEWATER

**SENSORS:** RGB

**ALT:** 226ft

**RES:** 1.01in/px

**SIZE:** 502 MB

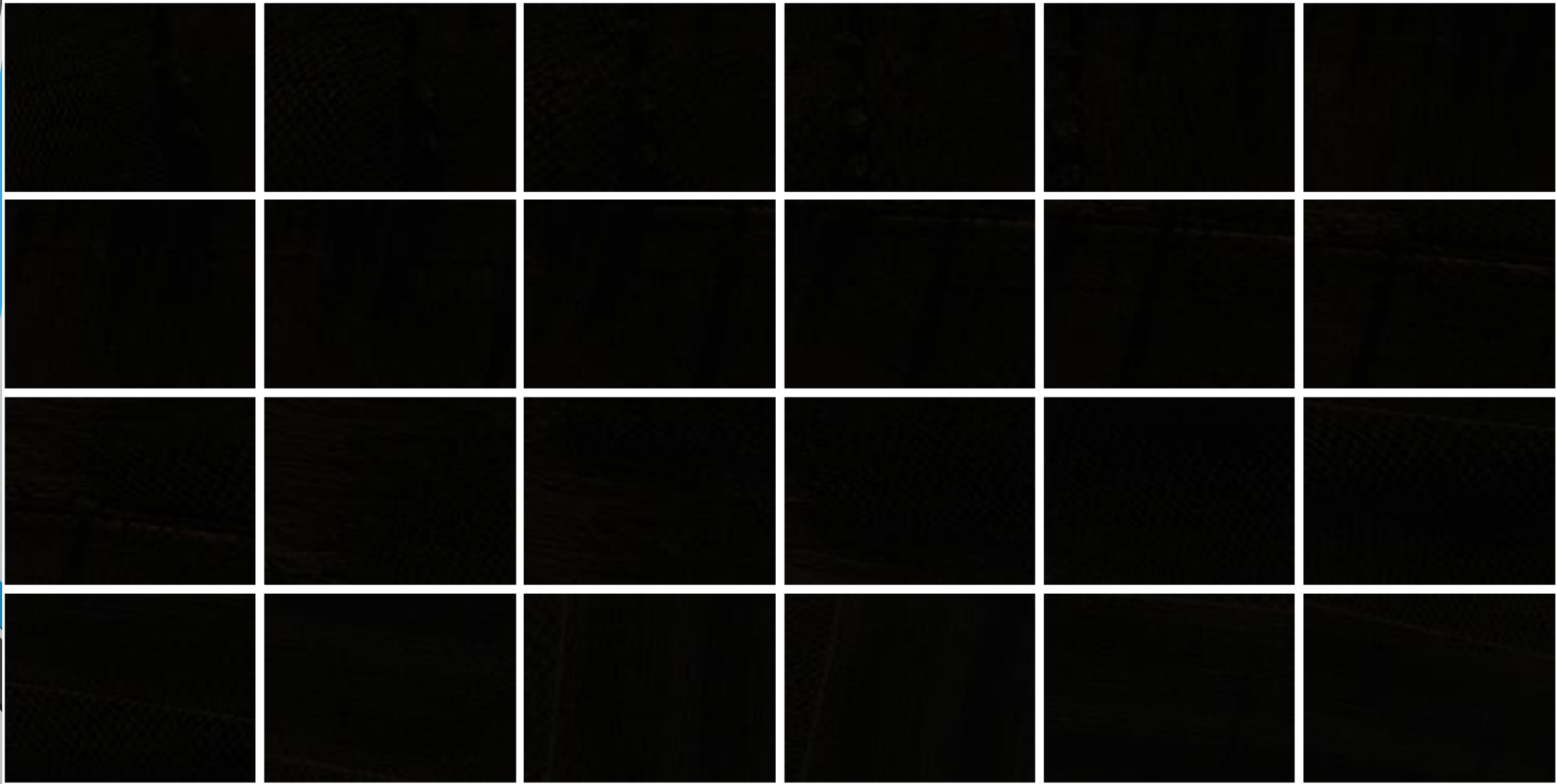
**AREA:** 28.52 ac

**TIME:** 10/01/17 07:23:00

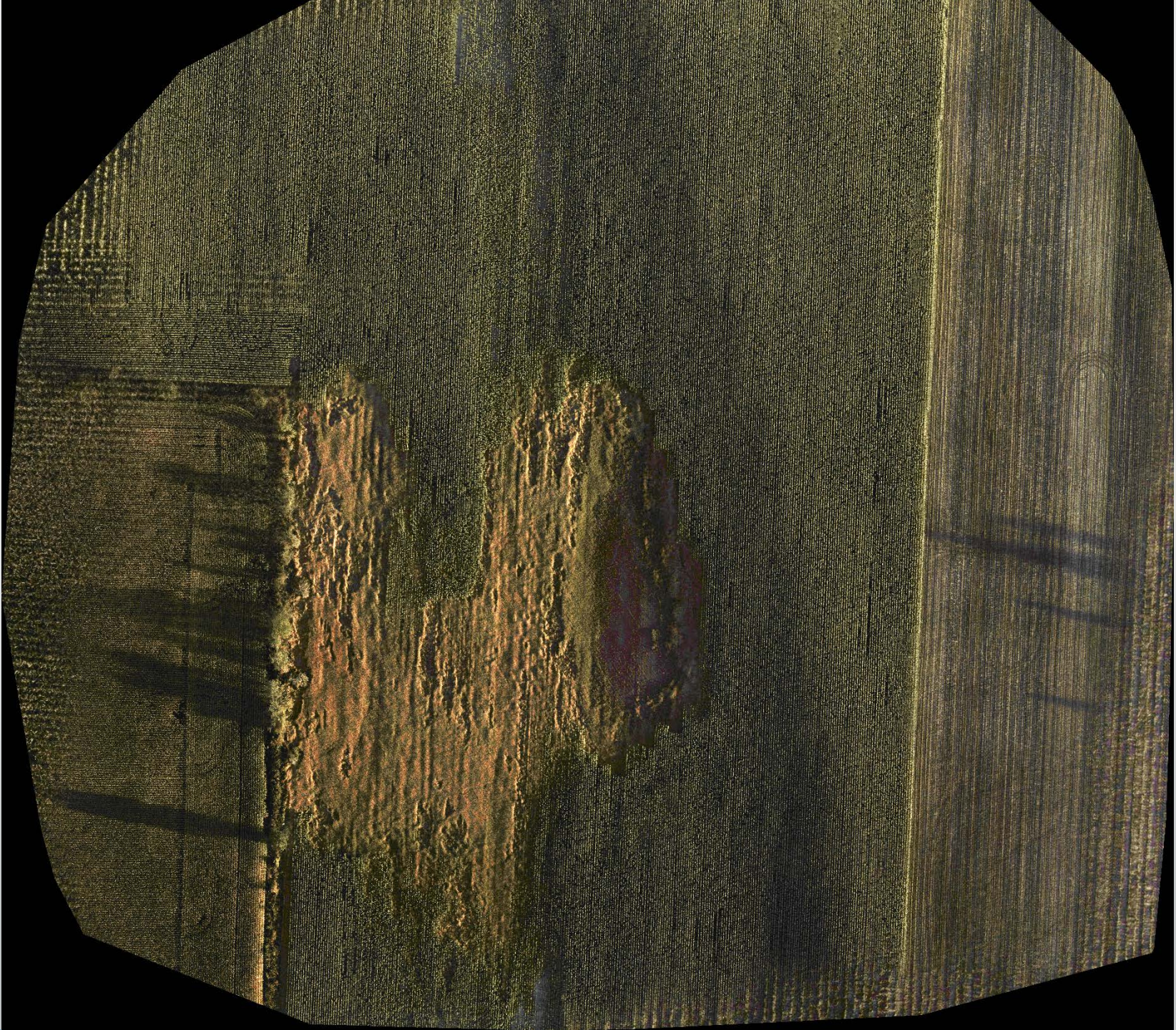
**IMAGES:** 105 images

**DRONE PLATFORM:** DJI Phantom 4

**SURVEY ID:**  [Copy](#) 264d...

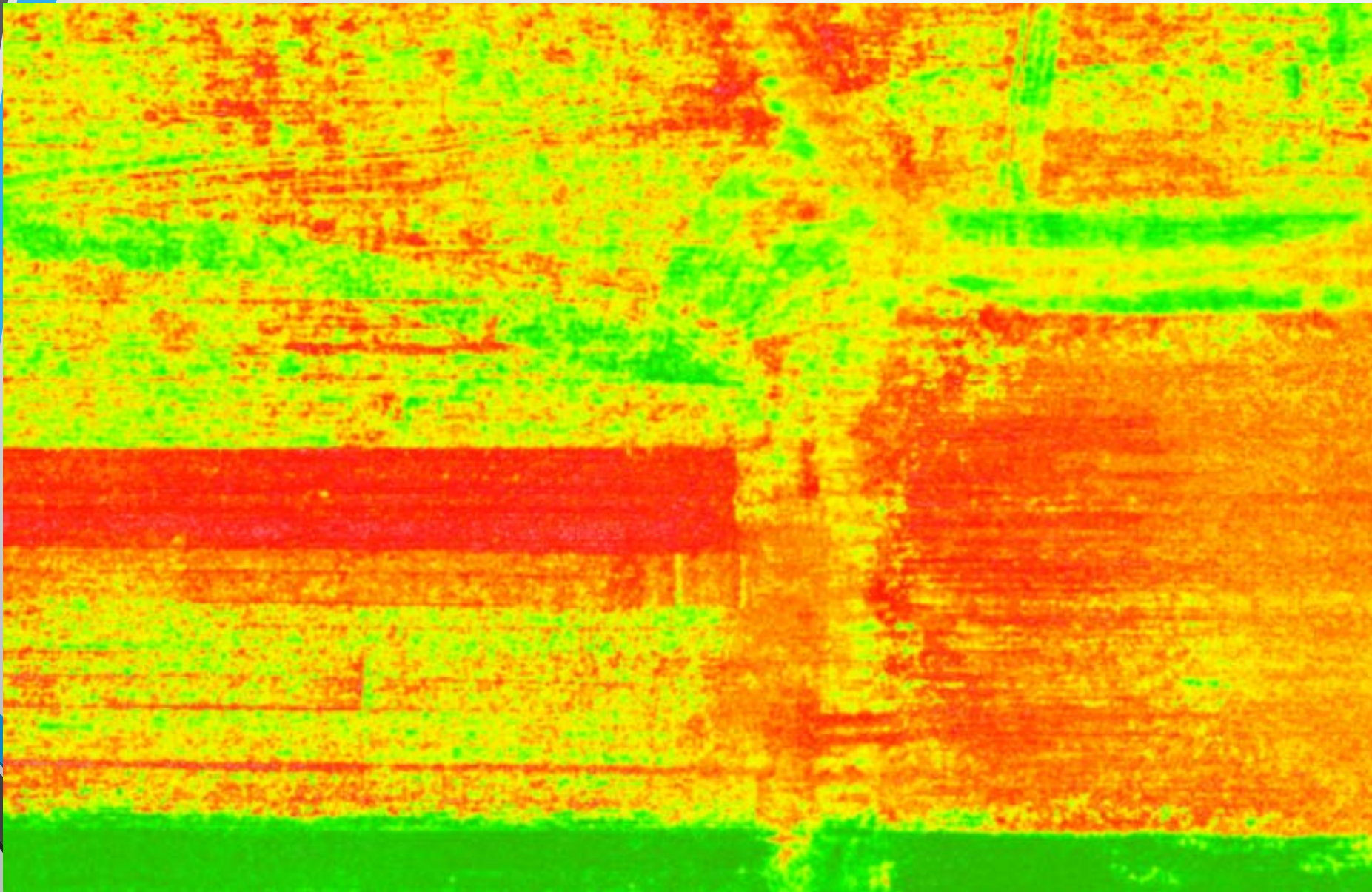








# NDVI



# Silver Creek Project



*Partnering  
for Water Quality*

Jeff Smudde  
Watershed Programs Manager  
[jsmudde@newwater.us](mailto:jsmudde@newwater.us)

**NEW Water**  
The brand of the Green Bay  
Metropolitan Sewerage District

The logo for NEW Water features the text "NEW Water" in a bold, sans-serif font. Below the text is a graphic of three stylized waves in shades of blue and green, flowing from left to right.

# General Operating Guidelines

- Do not fly in adverse weather conditions such as in high winds or reduced visibility.
- Do not fly under the influence of alcohol or drugs.
- Fly no higher than 400 feet and remain below any surrounding obstacles when possible.
- Keep your sUAS in eyesight at all times, and use an observer to assist if needed.
- Remain well clear of and do not interfere with manned aircraft operations at all times.
- Contact the airport or control tower before flying within five miles of an airport.



# General Operating Guidelines

- Do not intentionally fly over unprotected persons or moving vehicles, and remain at least 25 feet away from individuals and vulnerable property.
- Do not fly near or over sensitive infrastructure or property such as power stations, water treatment facilities, correctional facilities, heavily traveled roadways, government facilities, etc.
- Check and follow all local laws and ordinances before flying over private property.
- Do not conduct surveillance or photograph persons in areas where there is an expectation of privacy without the individual's permission (see AMA's privacy policy).

## Pre-Flight Checklist

Pilot In Command: \_\_\_\_\_ FAA Reg. No.: \_\_\_\_\_ Date: \_\_\_\_\_

Observer (Optional): \_\_\_\_\_ Location: \_\_\_\_\_

UAS Model:  
DJI Phantom 3 Pro

Purpose of Flight (check 1):  Recreation  Commercial <sup>(1)</sup>  SAR <sup>(2)</sup>  Other (describe): \_\_\_\_\_

NOTES: (1) - Commercial sUAS license required (2) - Authorization by applicable authority required

Authorization for flight in restricted airspace: \_\_\_\_\_ (Required for flight in restricted airspace only, otherwise NA)

Authorized by: \_\_\_\_\_ Title: \_\_\_\_\_

**A. Pre-Start Checklist**  
Important: Complete all check list items in the order they are presented. If you cannot check off an item **STOP!** and correct the problem before continuing.

No.	Item	Acceptable Condition	Sat.
1	Airspace	Unrestricted airspace or flight authorized	
		Potential obstructions near intended flight path identified	
2	Weather	Visibility >=3 miles/500 ft., Wind <=15mph, Precip. - None	
3	sUAS Airframe/Props	No structural defects visible	
4	sUAS Battery	Sufficient for intended flight, not less than 75%	
5	Controller Battery	Sufficient for intended flight, not less than 75%	
6	Display Device Battery	Sufficient for intended flight	
7	Memory Card	Installed, sufficient memory space available for flight	
8	Observer	Present, briefed and ready (Only if designated, otherwise NA)	
9	Camera Gimbal Lock	Removed	
10	Display Device	On	
11	Controller Power	On	
12	sUAS Power	On	
13	sUAS Status Lights	Flashing GREEN	
14	Camera Check	FPV camera view normal	
15	Compass Calibration	Compass calibrated for current location	
16	Flight Limits Set	Alt. <=120 meters, Dist. <=500 meters	
17	Flight Mode Set to GPS	Controller mode switch in "P", display status GREEN - RTF	
18	Take-Off Location	Clear for >=25ft. radius, no overhead obstructions	

**B. Motor Start Checklist**

No.	Item	Acceptable Condition	Sat
1	sUAS Motor Start	sUAS motors start and run at idle, no abnormal noise	
2	Home Point	Home Point Set	
3	Hover Check	Flight and Camera Gimbal control responses normal	
4	Flight Telemetry	Telemetry normal (Bat, Alt, Dist., etc.)	

**READY FOR FLIGHT**

Notes: \_\_\_\_\_





# Timeline of a Grassed Waterway Project



Aug. 16, 2016



Aug 31, 2016



# Timeline of a Grassed Waterway Project



Oct. 4, 2016



Nov. 29, 2016



# Timeline of a Grassed Waterway Project



June 13, 2017



Oct 9, 2017



# Timeline of a Grassed Waterway Project



Dec 1, 2017



# Timeline of a Grassed Waterway Project



May 31, 2016



June 28, 2016



June 30, 2016



# Timeline of a Grassed Waterway Project



Aug. 26, 2016



Oct. 4, 2016



Nov 29, 2016



# Timeline of a Grassed Waterway Project



Dec 1, 2017



# No-Cost Critical Area Planting





# Filter Strip Projects



Aug. 23, 2017



Dec 1, 2017



# Filter Strip Projects



June 13, 2017



Dec 1, 2017



# Water and Sediment Control Basins (WASCOB)



June 13, 2017



Oct. 9, 2017



Dec. 1, 2017



# Construction Site Documentation









# Wetland Restoration Projects



Sept. 19, 2017



Oct. 9, 2017



Dec 1, 2017



# Site Investigation











# City of Appleton Aircraft

- DJI INSPIRE 1 V2
  - Flight Time - ~18 min
  - Max Speed - ~ 49 mph
- Camera – ZENMUSE X5
  - 16 M
  - 30mm equivalent
  - 4K
  - 60 Mbps (max)



<https://www.dji.com/inspire-1/info#specs>

- DJI Mavic Platinum
  - Flight Time - ~ 30 min
  - Max Speed - ~40 mph
- Camera
  - 12 M
  - 35mm equivalent
  - 4K
  - 60 Mbps (max)



<https://www.dji.com/mavic-pro-platinum/info#specs>

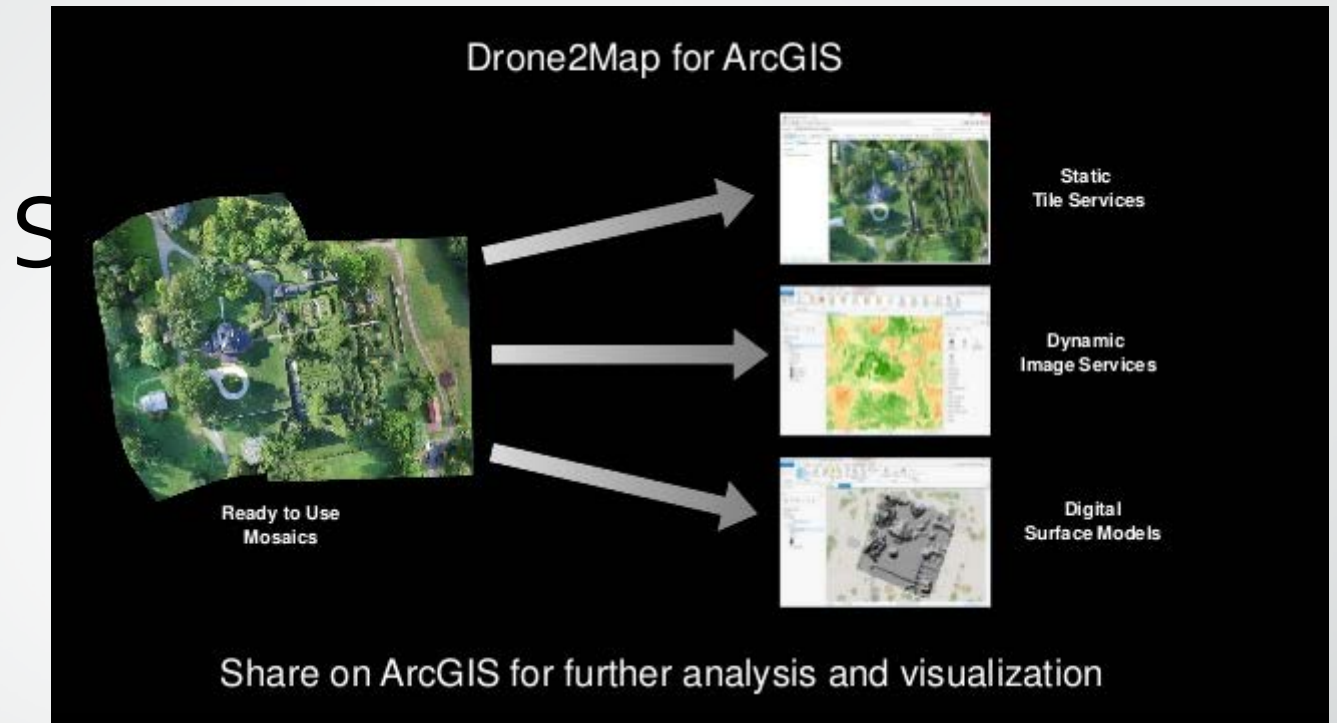


- Capture Software

- DJI GO app (iOS)
- Pix4D Capture (iOS)

- Desktop Software

- ESRI ArcGIS
- ESRI Drone to Map (D2M)
  - Pix4D data processing platform
  - \$1,500 per year/seat

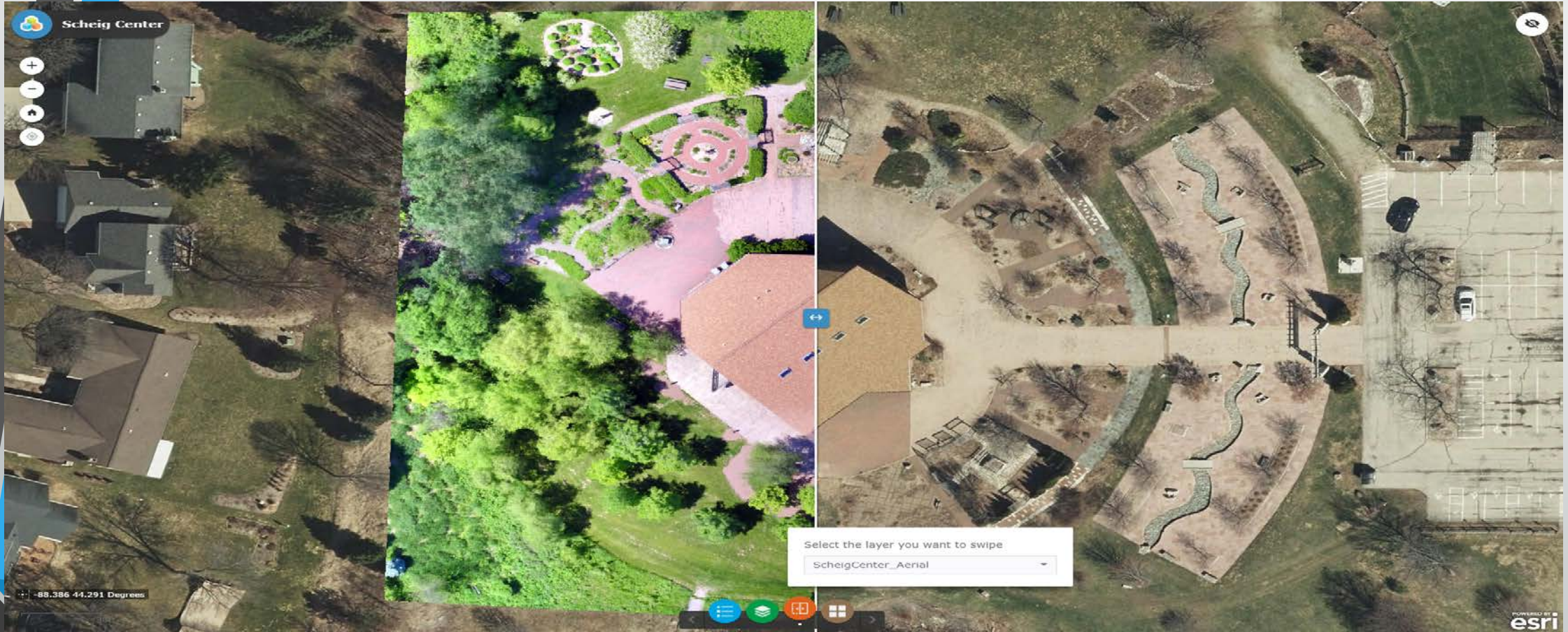


ArcGIS®





# Update Imagery – Scheig Center



<http://appleton.maps.arcgis.com/apps/webappviewer/index.html?id=b5focfba6b574a83916f6fadff593605>



# LiDAR – Eisenhower Dr

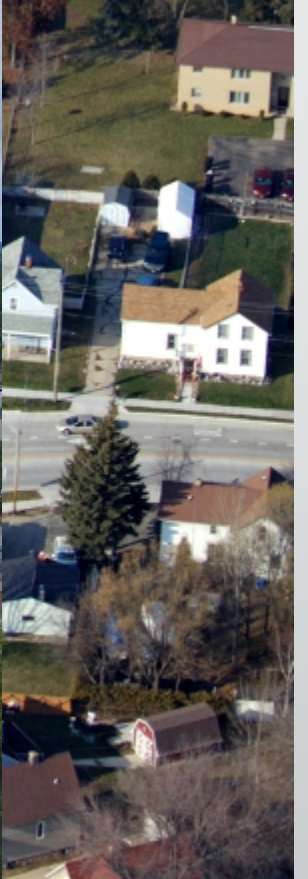


# Inspections



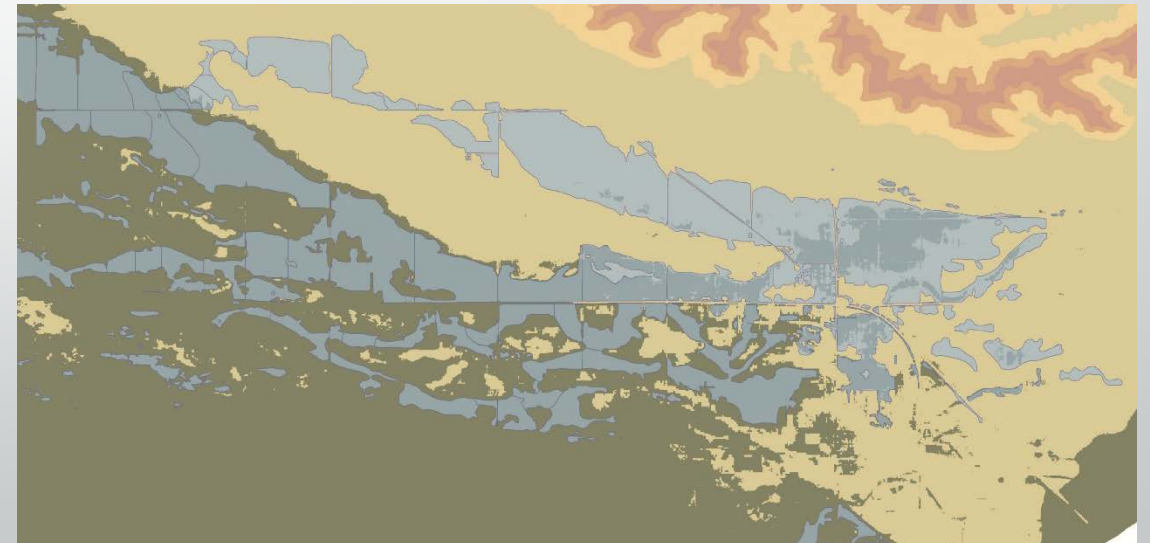
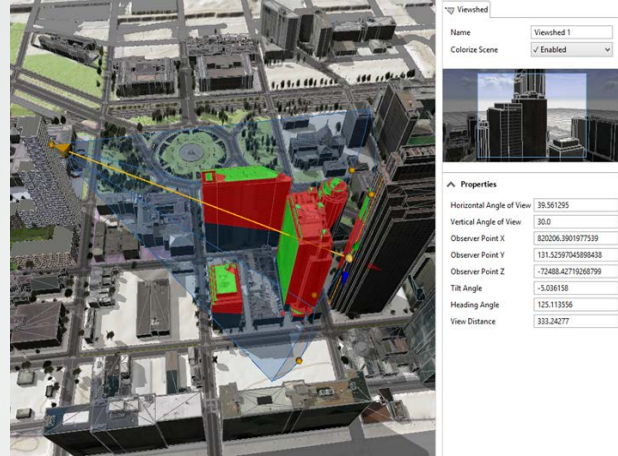
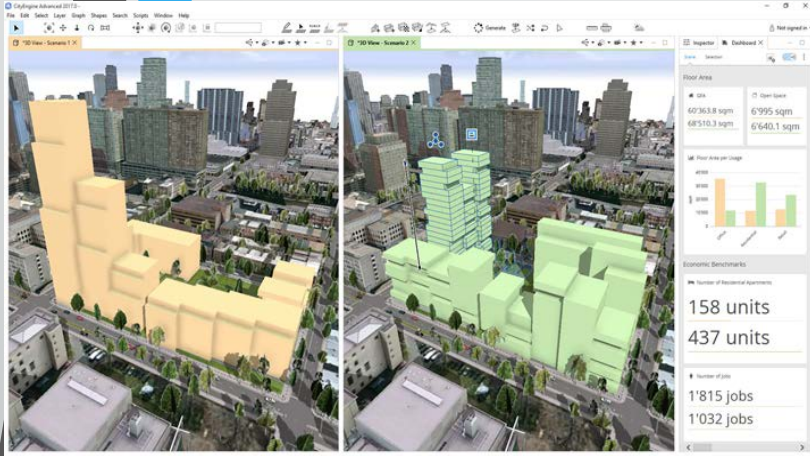


# Additional Uses





# Future





# raSmith Drone Fleet

- UAS
  - Phantom 2
  - Phantom 3A
  - Phantom 4P
  - Altus LRX
- Bathymetric
  - Seafloor
  - HyDrone RCV





# raSmith Drone Operations

- Crew Members
  - 9 total
  - 3 FAA Part 107 Remote Pilots
    - 3 more currently studying
- Handled out of our Survey Division
  - Will eventually have a UAS in every truck





# Drone Operations Procedures

- Preflight / Prelaunch
  - Mission objectives / planning
  - Site risks / obstacles
  - Safety / emergency procedures
  - Landing zone(s)
  - System checks

The screenshot shows a presentation slide titled "LRX Pre Flight" with the "raSmith" logo in the top left. The slide contains a checklist table with the following sections:

LRX Pre Flight	
<b>PRE FLIGHT CHECK</b>	
<u>Visual walk</u>	Identify risk/obstacles that could affect the flight (including airspace risks) Identify public safety and safety of aircraft flight Verify flight conforms to FAA part 107 guidelines and appropriate approvals
<u>Pre-flight Briefing</u>	Agency procedures Mission Objective Home Landing Area Public Safety and Control
<u>Landing position</u>	Identify a level takeoff and landing position that is clear and without obstacles Identify obstacles above like power lines or trees Clear take off and landing area from the public
<b>GROUND CHECK</b>	
<u>Control Station Check</u>	Verify the GCS for uninterrupted line of sight over entire mission Secure on tripod mount Check for wind conditions to locate legs into wind for stability Check battery on Laptop Check charge on GCS
<u>Battery Check</u>	Inspect Battery mounts Inspect all batteries for swell or cracks Verify each battery should be no less than 95% charge (24.8) Cells should be within 0.2 of a volt of each other Batteries in warm place if cold conditions Refer for the Battery Charger
<b>FINAL CHECK</b>	
<u>Blades</u>	Spread out all rotor blades, ensure that they are as straight as possible, ensure all screws are secure and spin in the right direction, check for correct alignment and no play, check for any nicks or imperfections and note
<u>Parachute</u>	Check servo wiring integrity and secure fit of the parachute to the frame, check that the main connection wire is in good condition and not going to tangle with any moving parts of the aircraft. Test Fire the parachute to ensure servo and connection to AP
<u>Integrity of all airframe</u>	Check for any wear, loose wiring that could touch any of the moving parts of the aircraft. Look for any changes or potentially loose items. Note any items that you believe have changed since you last checked the aircraft



# Drone Operations Project Types

- **Hydrone**
  - Stormwater pond certifications
  - Lake / pond / river bottom topography
- **UAS**
  - Topo / volumetric surveys
  - Orthomosaics
  - Inspection imagery
  - Thermal imagery





# Surveying With SONAR

- KD Park Boat Launch
  - Bathymetric survey of pond





# Surveying With SONAR

- **KD Park Boat Launch**
  - **Combined with conventional topo of surrounding land area**

