

NJDOT Research ShowCase



Glenn G. Stott, UAS Coordinator
NJDOT Division of MultiModal, Bureau of Aeronautics





"Delivered by a stork? Don't be silly, sweetie.
A drone brought you."

The Problem.....

- ▶ How do you start a brand new and innovative NJDOT Drone program that has never been done before?



The Key Components are Personnel and Funding

Personnel – A “UAS Coordinator” position was created within the Division of MultiModal, Bureau of Aeronautics to lead NJDOT’s UAS initiatives:

- ▶ Provide leadership, guidance, and coordination for flight operations to Divisions
- ▶ Ensure compliance with State and Federal Aviation Regulations
- ▶ Ensure flight operations are based on the most current best practices
- ▶ Coordinate FAA Airspace Waivers and ATC Authorizations
- ▶ Develop Implementation and Staff Training Plans
- ▶ Assist with the drafting of RFP’s (Request for Proposal) for consultants
- ▶ Keep NJDOT informed of public perception and liability



Funding – We researched and applied for grant funding assistance through:

- ▶ FHWA Tech Transfer Deployment Funds for a UAS Peer Exchange on Best Practices.
- ▶ FHWA State Transportation Innovation Council (STIC) Incentive program for equipment & training.
- ▶ FHWA State Planning & Research Program for Best Practices, Policies and Procedures.



Potential Uses for Transportation

- ▶ Traffic Incident Management
- ▶ Aerial 3D Corridor Mapping
- ▶ Structural Inspection
- ▶ Traffic Congestion Assessment
- ▶ Emergency Response Assessment
- ▶ Real-time Construction Project Monitoring
- ▶ Landfill Volume Calculations
- ▶ Inspection of Confined or Hazardous Spaces



Advantages of UAS over Traditional Methods

- ▶ Inexpensive
- ▶ Rapid deployment
- ▶ Easy to use
- ▶ Easily transportable
- ▶ Very low carbon footprint
- ▶ Can operate in areas that are risky or dangerous to humans



NJDOT UAS Peer Exchange



October 3-5, 2017



The goals of our Peer Exchange were to discuss and share:

- ▶ Best practices
- ▶ Policies
- ▶ Procedures
- ▶ Current projects
- ▶ Research studies
- ▶ Funding sources
- ▶ State UAS legislation
- ▶ Our common challenges



Peer Exchange Presenters	
FAA (Northeast Region)	Skip Weigand
Delaware DOT	Joshua Thomas
Kansas DOT	Merrill Atwater
Massachusetts DOT	Andrew Mihaley
New Jersey DOT	Glenn Stott (Host)
North Carolina DOT	Basil Yap
Pennsylvania DOT	John Melville
New Jersey State Police	Sgt Ron Leach
New Jersey Forest Fire Service	Robert Gill



Key Takeaways

- ▶ Additional safety training is required to supplement FAA certification
- ▶ Insurance companies are leading risk management efforts
- ▶ Data management and privacy are important issues
- ▶ The responsibility for regulating airspace below 400 feet may soon be delegated to the state and local level
- ▶ DOT's must share best practices and research to maximize resources
- ▶ Standardized state training will help to coordinate a national response to disasters
- ▶ Educational Outreach efforts are needed to teach the general public how to safely and responsibly operate UAS
- ▶ States should encourage drone friendly areas to promote an acceptable culture for drone use



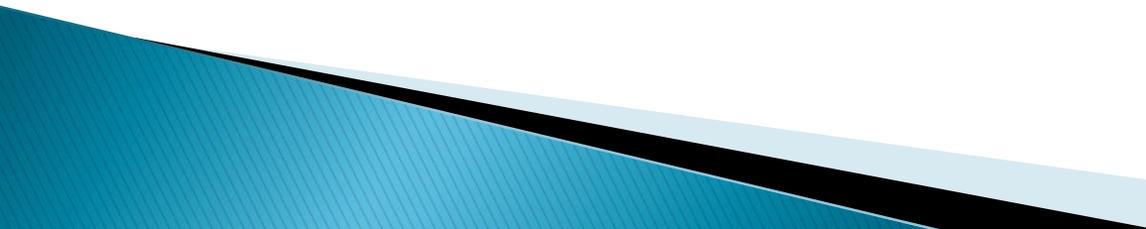
FHWA STIC Grant

Purchase, use, and evaluate Unmanned Aircraft Systems for Structural Inspections and Traffic Incident Monitoring

- ▶ Purchase UAS equipment
- ▶ Train initial cadre of FAA certified UAS pilots
- ▶ Assist with developing guidance for best practices on UAS projects
- ▶ Purchase mapping software to convert UAS data into 3D Volumetric maps and GIS data



FHWA State Planning & Research Program Grant for Best Practices, Policies, and Procedures

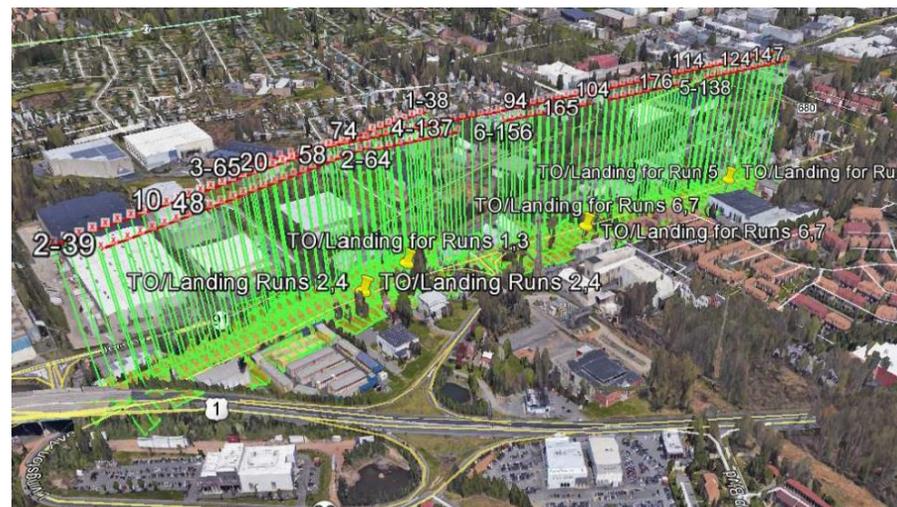
- ▶ Awarded to UTRC (University Transportation Research Center), CUNY (City Univ. of NY), NUAIR, and Texas A&M
 - ▶ To incorporate NJDOT Risk Management concerns and best practices
 - ▶ To recommend comprehensive New Jersey UAS Regulations
 - ▶ To create New Jersey UAS Policy
 - ▶ To create an NJDOT UAS Operations Manual
- 

How does NJDOT select UAS Projects?

The Bureau of Aeronautics leads the department's UAS initiatives.

Projects must have the potential to meet one or more of the following criteria to be considered for Aeronautics support;

- ▶ Increased Safety
- ▶ Increased Efficiency
- ▶ Save Time
- ▶ Save Money



Current UAS Initiatives at NJDOT

- ▶ Traffic Incident Management
- ▶ Structural Inspections
- ▶ Aerial 3D Corridor Mapping
- ▶ Emergency Response Assessment
- ▶ Real-time Construction Project Monitoring
- ▶ 3D Reality Modeling
- ▶ Landfill Volume Calculations



High Mast Light Pole Inspection Project

- ▶ NJDOT owns and operates 250 HMLP near NJ roadways
- ▶ Traditionally inspected with binoculars or bucket trucks
- ▶ UAS are less disruptive to traffic, more efficient, and costs less
- ▶ UAS allow an inspector to view the entire pole in high definition
- ▶ Provides a photo record of potential problem areas for review
- ▶ NJDOT was the first UAS operator granted an FAA Authorization Letter to fly in Newark's Class Bravo airspace



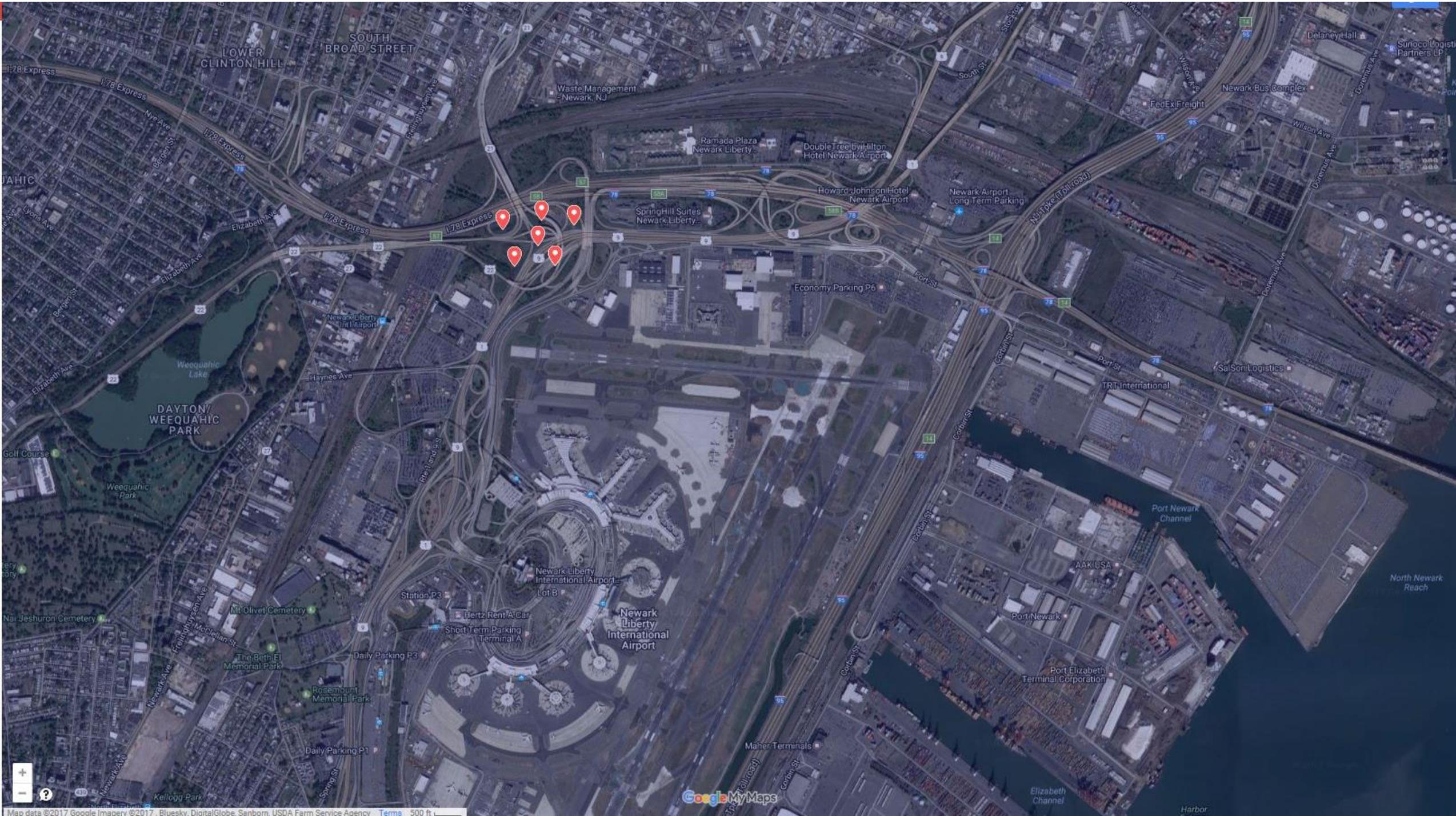


241 out of 250 HMLP inspections were completed with UAS

The nine HMLP sites that could not be completed had the following issues:

- Five due to airspace issues
- Two due to dense vegetation
- One was too close to the roadway
- One had poor communication with the UAS (strong RFI)





LOWER CLINTON HILL

SOUTH BROAD STREET

DAYTON/ WEEQUAHIC PARK

Newark Liberty International Airport

Newark Liberty International Airport

Google My Maps

HMLP STRUCTURAL INSPECTIONS

PRODUCED BY GLENN STOTT

View from 95 feet



View from 150 feet



View from 300 feet



View from 400 feet



Traffic Management Center (TMC)



Video Capture

2.4 GHz
Radio



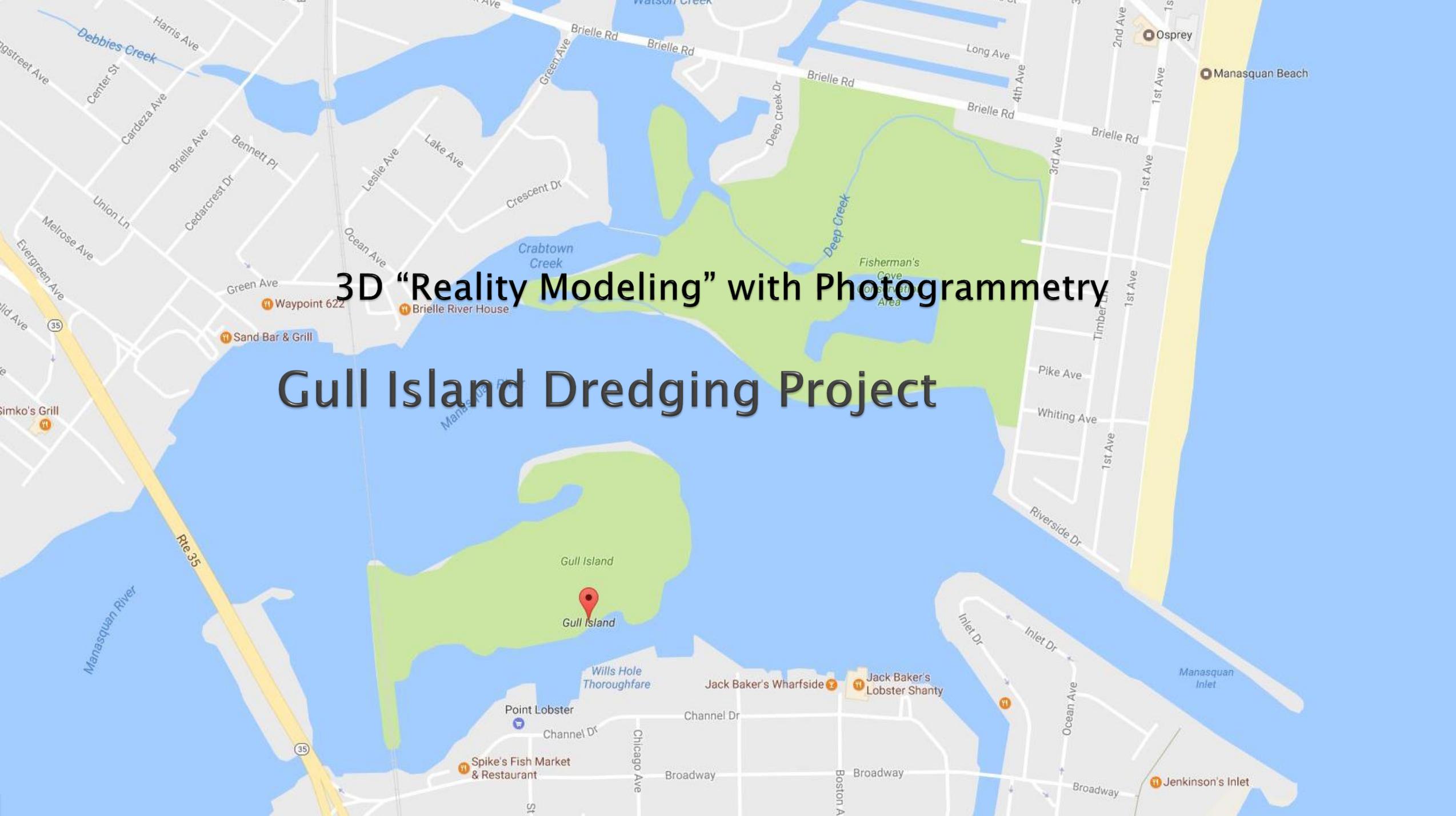
4G/L
TE

Portable
Communication



Remote
UAS
Operation



A map of the Gull Island Dredging Project area. The map shows a large body of water, the Manasquan River, with several creeks and inlets. A large green area, likely a dredged area or a specific project site, is highlighted in the center. The map includes various streets, landmarks, and points of interest. The text "3D 'Reality Modeling' with Photogrammetry" and "Gull Island Dredging Project" is overlaid on the map.

3D "Reality Modeling" with Photogrammetry

Gull Island Dredging Project

Gull Island
Gull Island

Wills Hole Thoroughfare

Jack Baker's Wharfside
Jack Baker's Lobster Shanty

Point Lobster
Spike's Fish Market & Restaurant

Jenkinson's Inlet

Manasquan Beach

Osprey

Fisherman's Cove

Crabtown Creek

Deep Creek

Debbies Creek

Harris Ave

Brielle Rd

Brielle Rd

Brielle Rd

Long Ave

4th Ave

Brielle Rd

Brielle Rd

3rd Ave

1st Ave

Riverside Dr

Pike Ave

Whiting Ave

Inlet Dr

Inlet Dr

Ocean Ave

Broadway

Waypoint 622

Brielle River House

Sand Bar & Grill

Rte 35

Union Ln

Bennett Pl

Center St

Harris Ave

Bennett Pl

Cedarcrest Dr

Melrose Ave

Green Ave

Ocean Ave

Leslie Ave

Lake Ave

Crescent Dr

Green Ave

Crescent Dr

Lake Ave

Brielle Rd

Green Ave

Chicago Ave

Channel Dr

Broadway

OFFICE OF MARITIME RESOURCES

MANASQUAN DREDGING & BEACH REPLENISHMENT

3D “Reality Modeling” with Photogrammetry

- ▶ Provides precise real-world models for conceptual design, construction, and operational decisions.
- ▶ 3D models created from simple photographs, not expensive LIDAR.
- ▶ Provides fine details, sharp edges, and geometric accuracy.
- ▶ Can access and share in CAD or GIS on desktop and mobile devices.
- ▶ 3D CAD drawings can be inserted inside the 3D model





Keansburg CDF
(Combined Disposal Field)





Measurements ✕

Coordinate Distance Surface Volume

Click on the model to select a new position.

Position: **40.4506935N**
74.1443547W
-52.74m

Spatial reference system:

Measurements x

Coordinate Distance Surface Volume

Click on the model to select a new position.

Position: **40.4506935N**
74.1443547W
-52.74m

Spatial reference system: WGS 84, orthometric height (EGM96) ▼

Clear





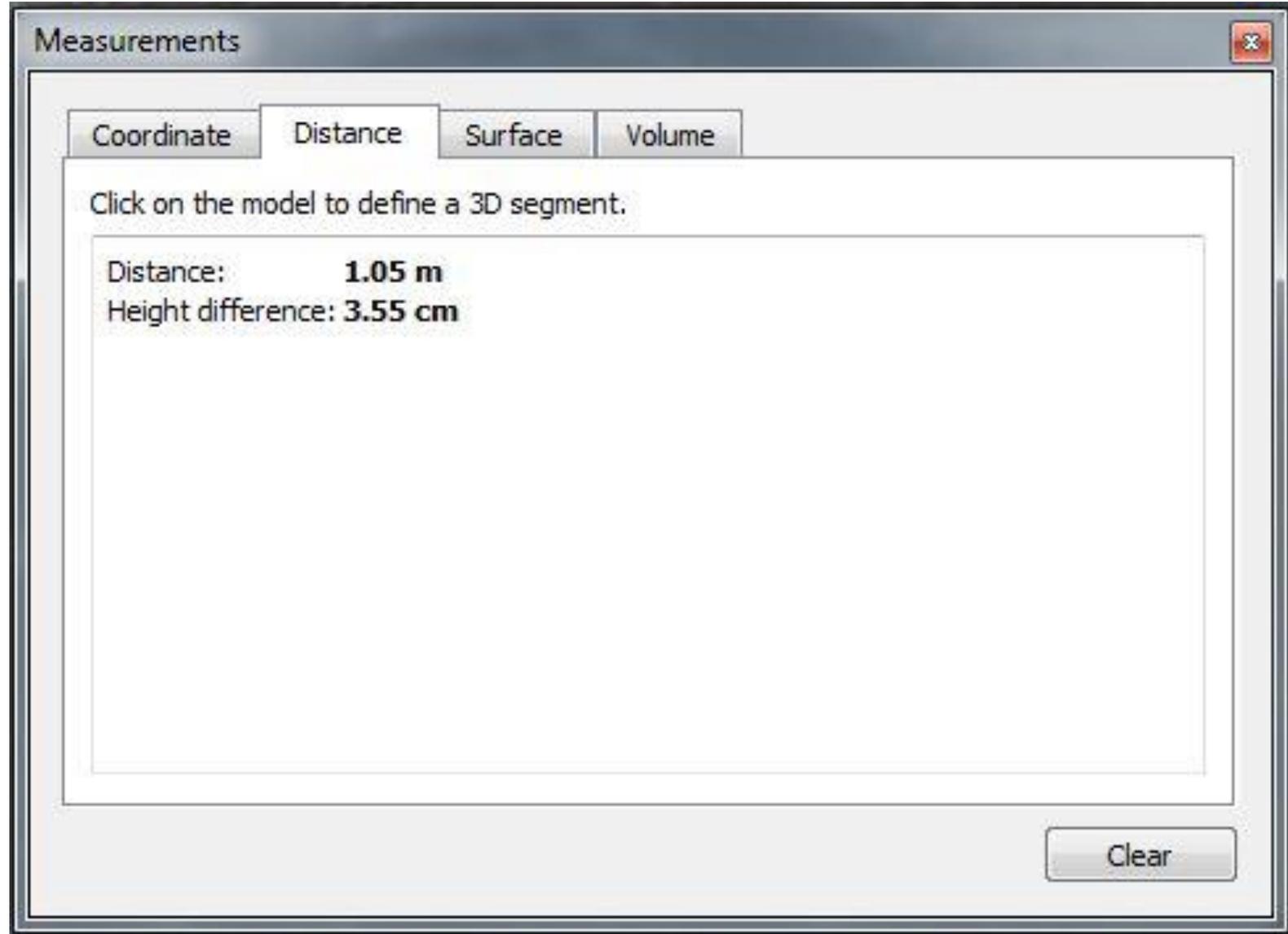
Measurements ✕

Coordinate Distance Surface Volume

Click on the model to define a 3D segment.

Distance: **1.05 m**
Height difference: **3.55 cm**

Clear





Measurements

Coordinate Distance Surface **Volume**

Click on the model to define the base surface.
Double click to close the polygon. Backspace to delete the last point.

Method: **Mean plane**

Sampling distance: 6.57773 meters

Perimeter: **558.10 m**
Area: **16184.51 m2**

Cut volume: **1539.33 m3**
Fill volume: **24006.17 m3**

Clear

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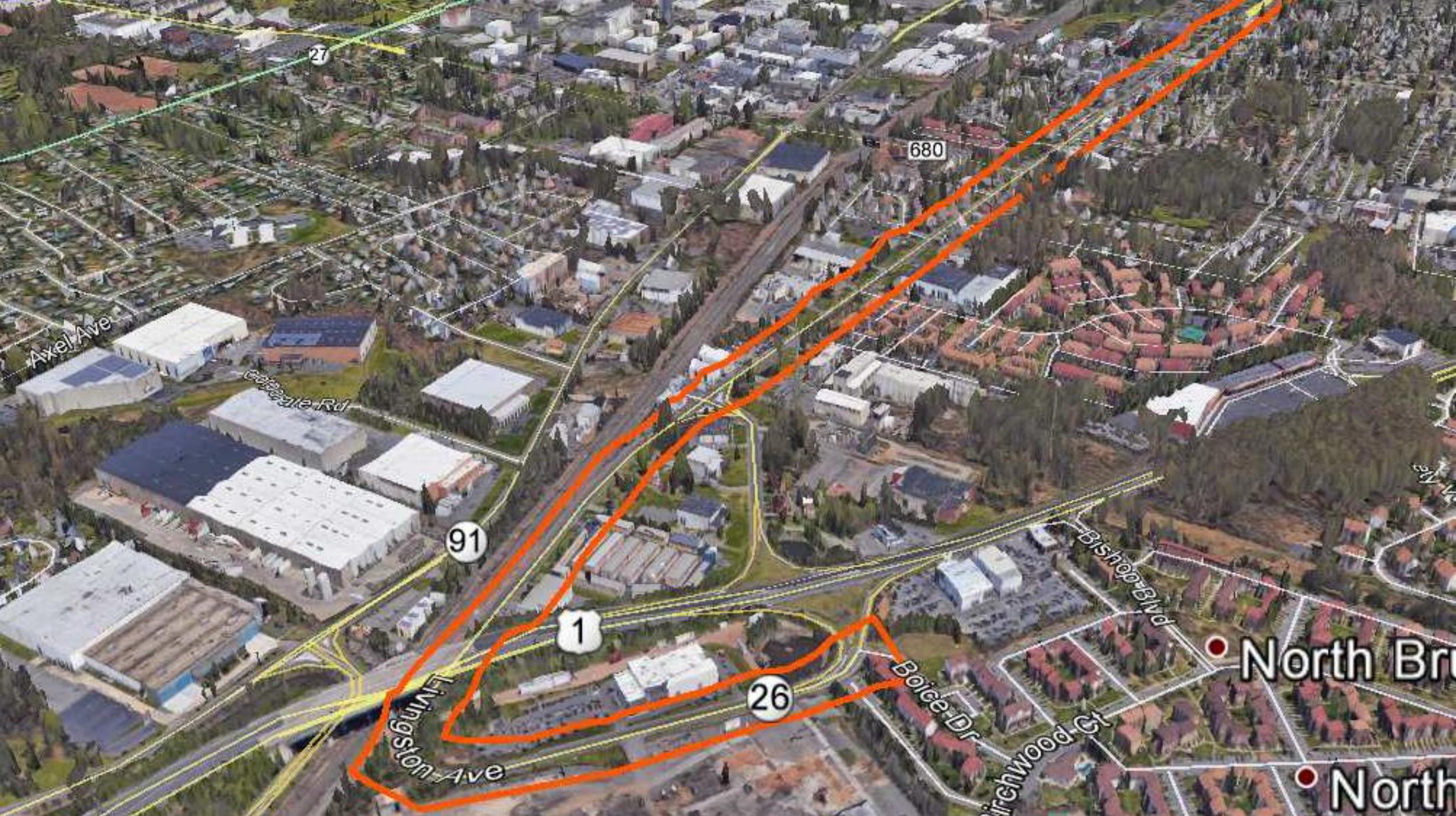


BEACH REPLENISHMENT

BRIGANTINE, OCT 10, 2017







27

680

Axel Ave

Cabrera Rd

91

1

26

Livingston Ave

Boice Dr

Birchwood Ct

Bishop Blvd

North Br

North



Runway Rehab & New Apron
SOUTH JERSEY REGIONAL AIRPORT

PHASE II & III TAXIWAY CONSTRUCTION

EAGLES NEST AIRPORT



©NJDOT Aeronautics UAS Photo
Eagles Nest Taxiway Phase II



©NJDOT Aeronautics UAS Photo
Eagles Nest Taxiway Phase III

Challenges for Public Sector Use

- ▶ Slowly evolving FAA Regulations and Standards.
- ▶ The “Cool vs Creepy” factor of public perception.
- ▶ Local “Drone Bans” creating a confusing patchwork of regulations.
- ▶ Privacy and data security concerns.
- ▶ Compliance with Federal Airspace Regulations in congested airspace.
- ▶ Risk Management concerns operating near roadways and critical infrastructure.



Questions?