CGSIC

Survey-Grade Accuracy in a GIS World

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Outline

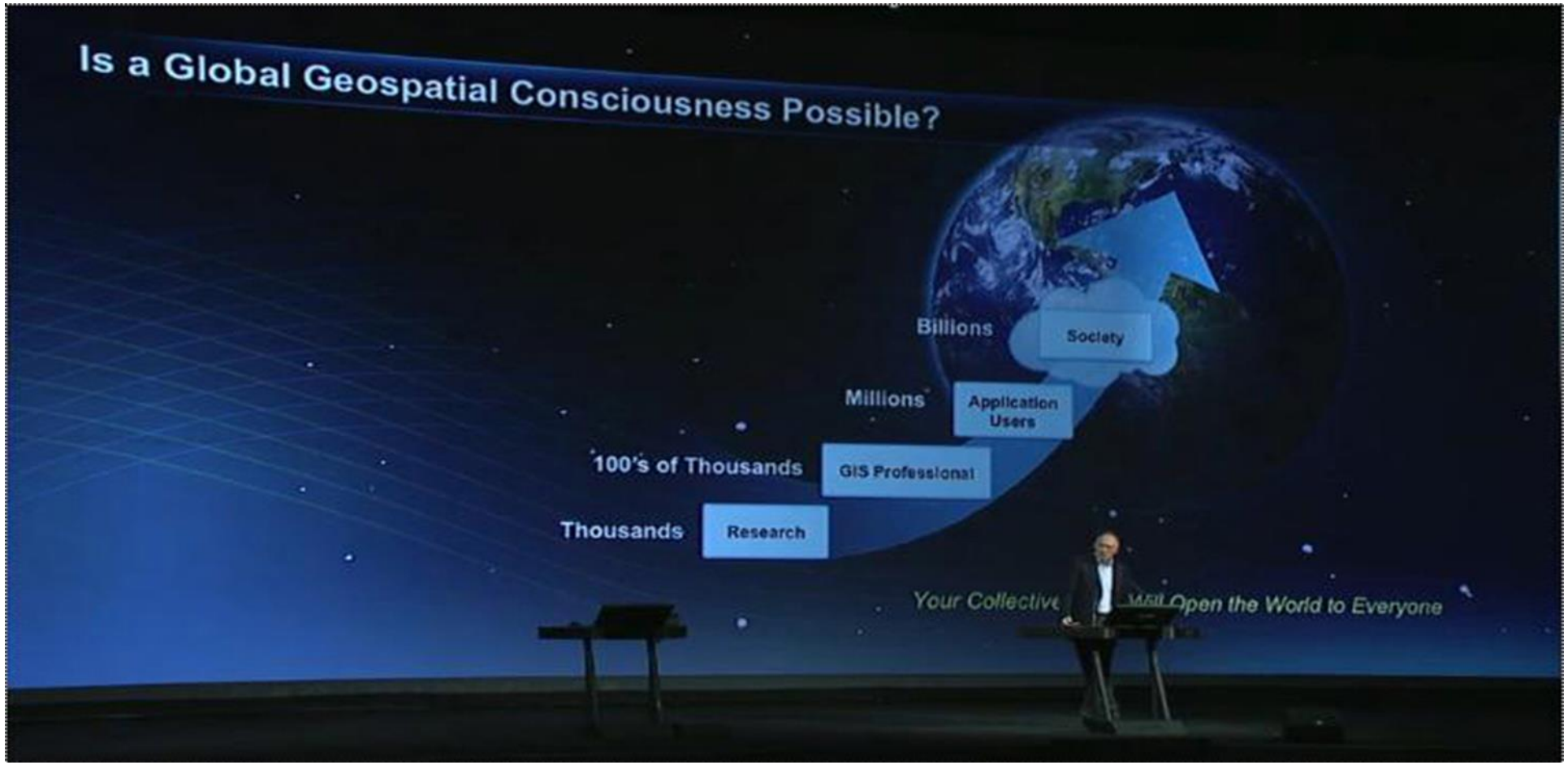
- GIS awareness/growth
- GNSS growth/effect
- Example projects

Geography and GIS

-Merriam-Webster – **geography** is a science that deals with the description, distribution, and interaction of the diverse physical, biological, and cultural features of the earth's surface.

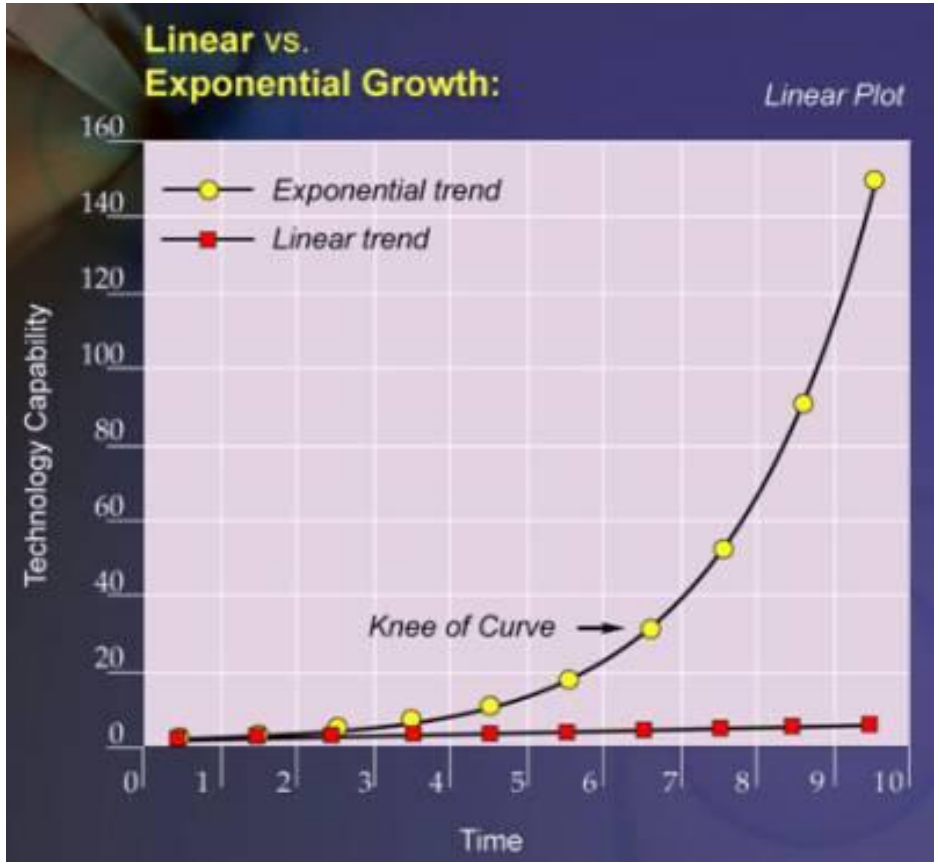
-Geographic Information System (**GIS**) – computer software that analyzes, stores, manipulates and visualizes geographic information. (Wikipedia)

Geospatial Consciousness



Linear vs. Exponential Growth

Is geospatial technology growing linearly……
or exponentially??



Linear vs. Exponential GIS Growth

"Access to geospatial technology will grow exponentially."

Jack Dangermond, Esri President, July 2012

**Esri is a ~$1.2B GIS software company (privately held).*

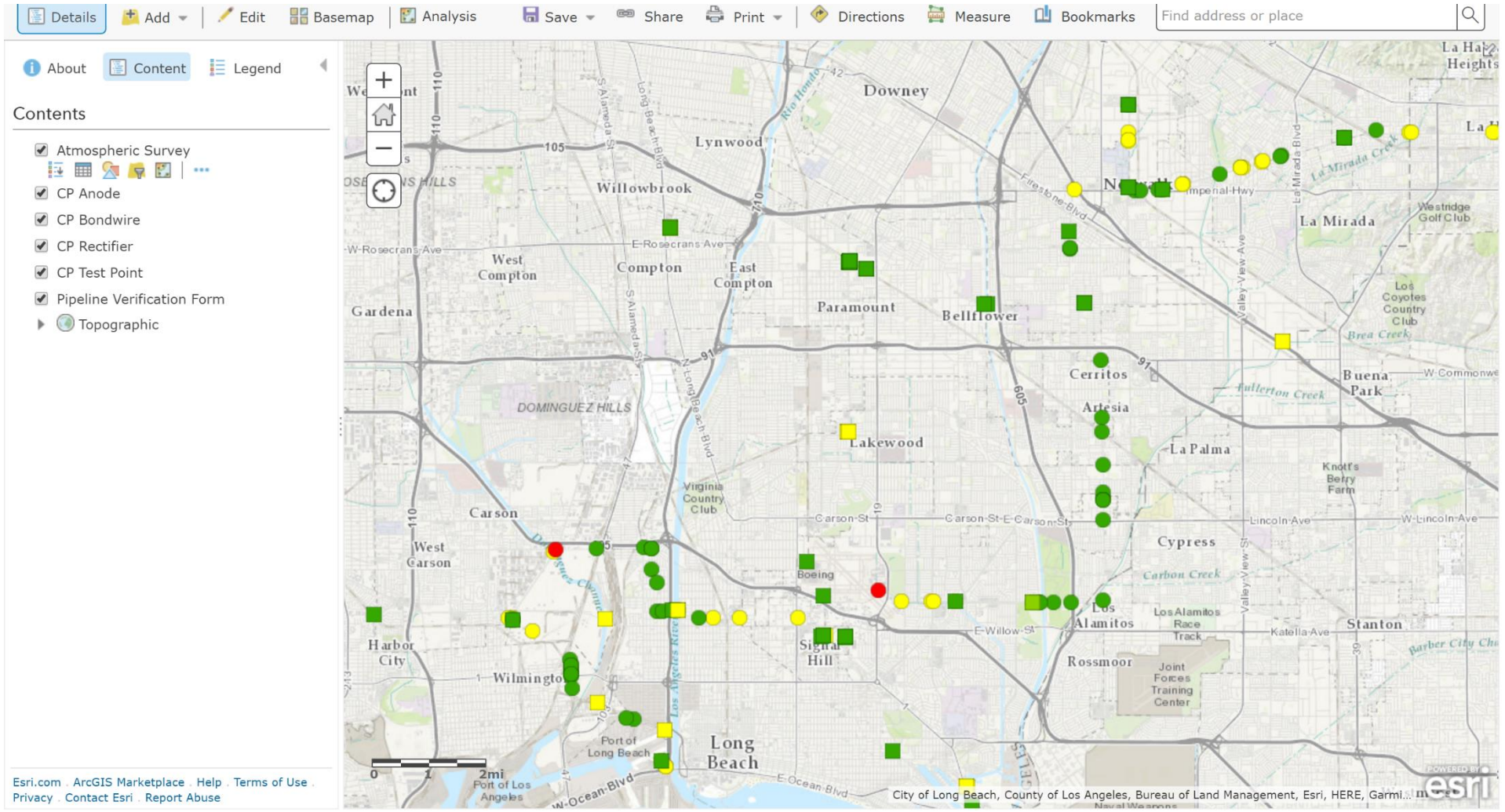
Web GIS Exponential Growth

-Historically, GIS has been a desktop client software.

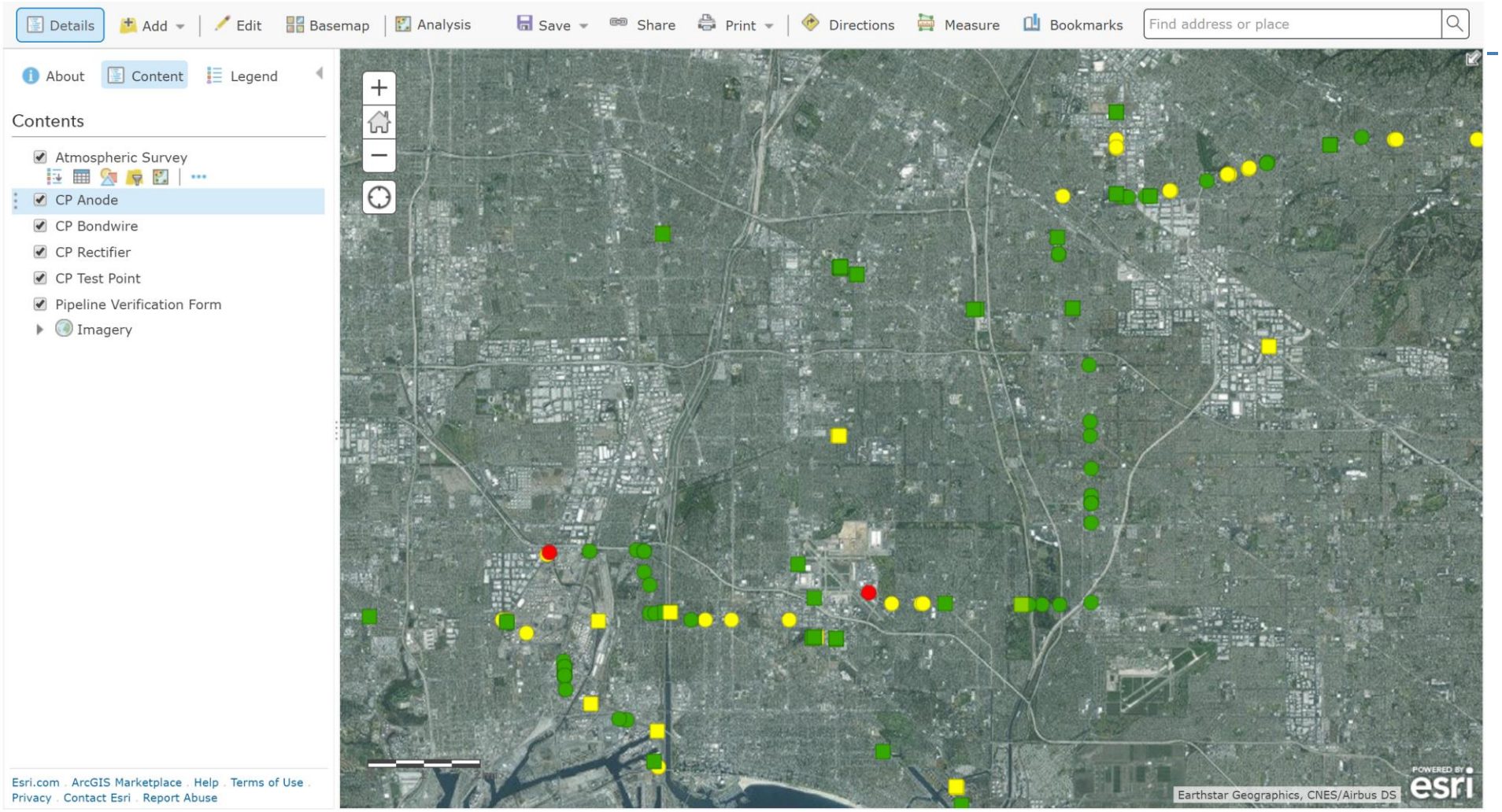
-6 years ago, Esri introduced a web browser-based GIS platform called ArcGIS Online (AGOL)

-Today, AGOL has more than 4 million users and 1 BILLION web maps published per day

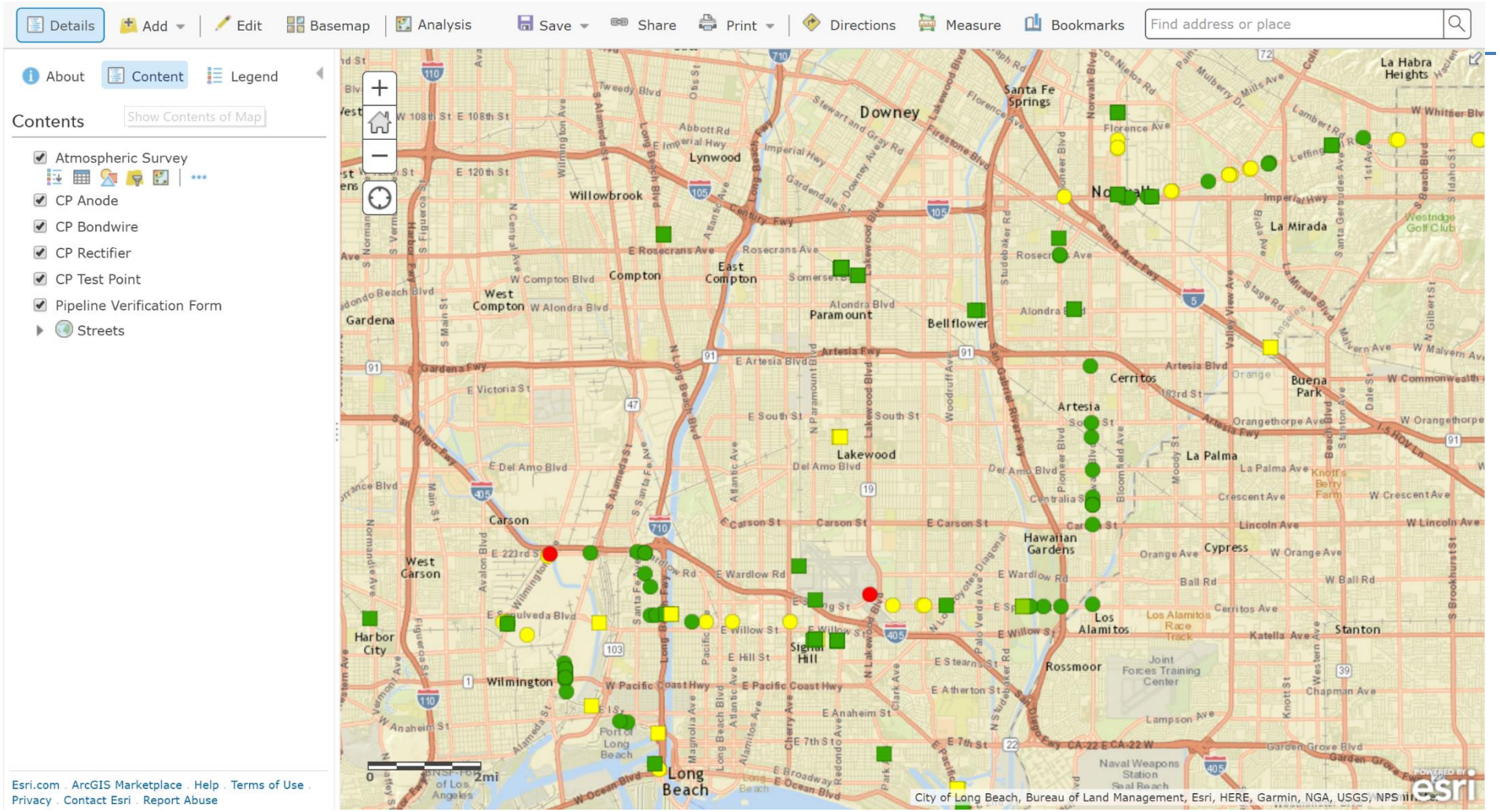
ArcGIS Online – Topo basemap



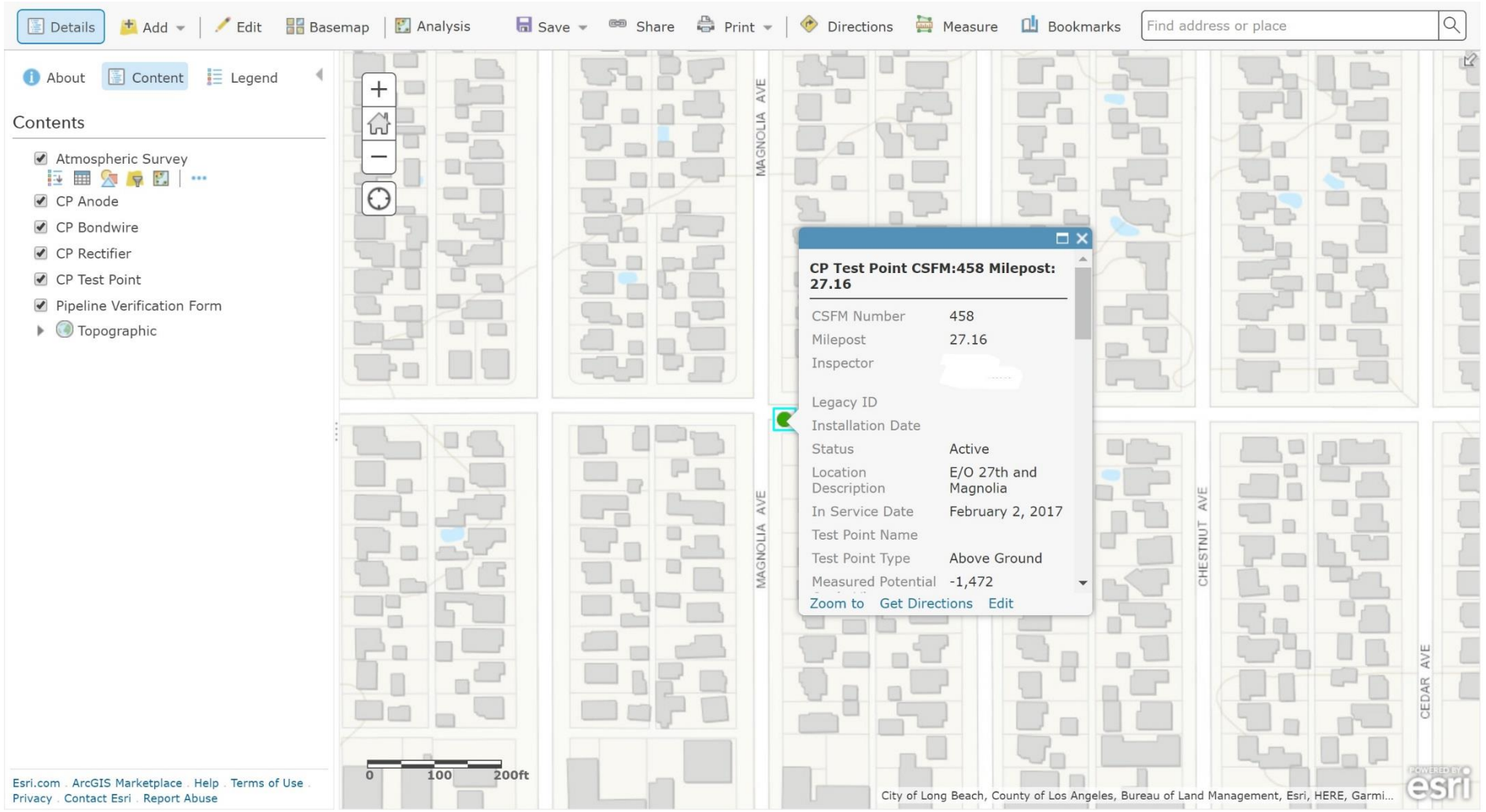
ArcGIS Online – Ortho basemap



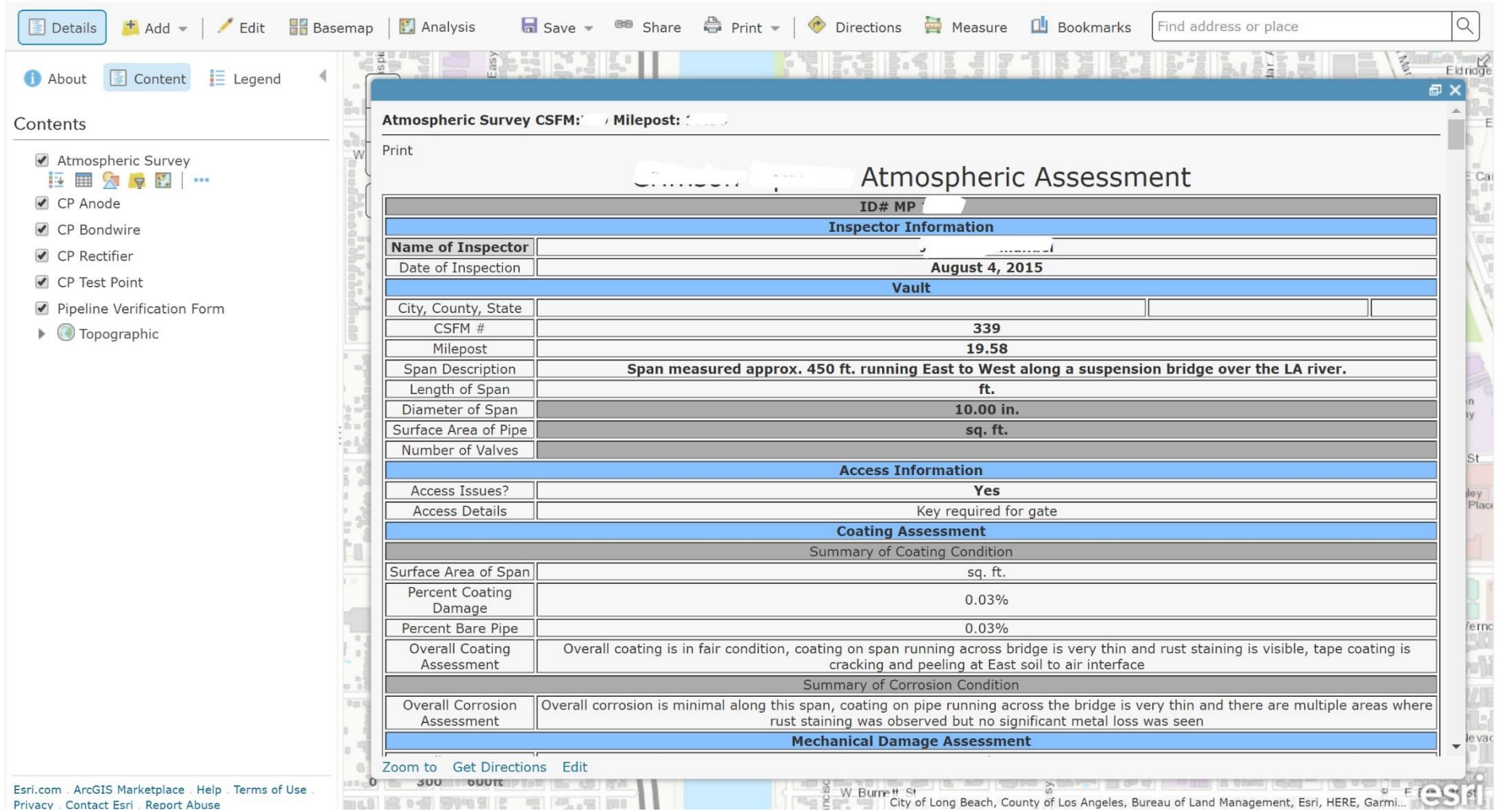
ArcGIS Online – Street basemap



ArcGIS Online – Zoom feature



ArcGIS Online – Reporting



Data Fuels the GIS Software Engine

-Data is the fuel of GIS. Real-time, accurate data enables quicker and more accurate decisions.

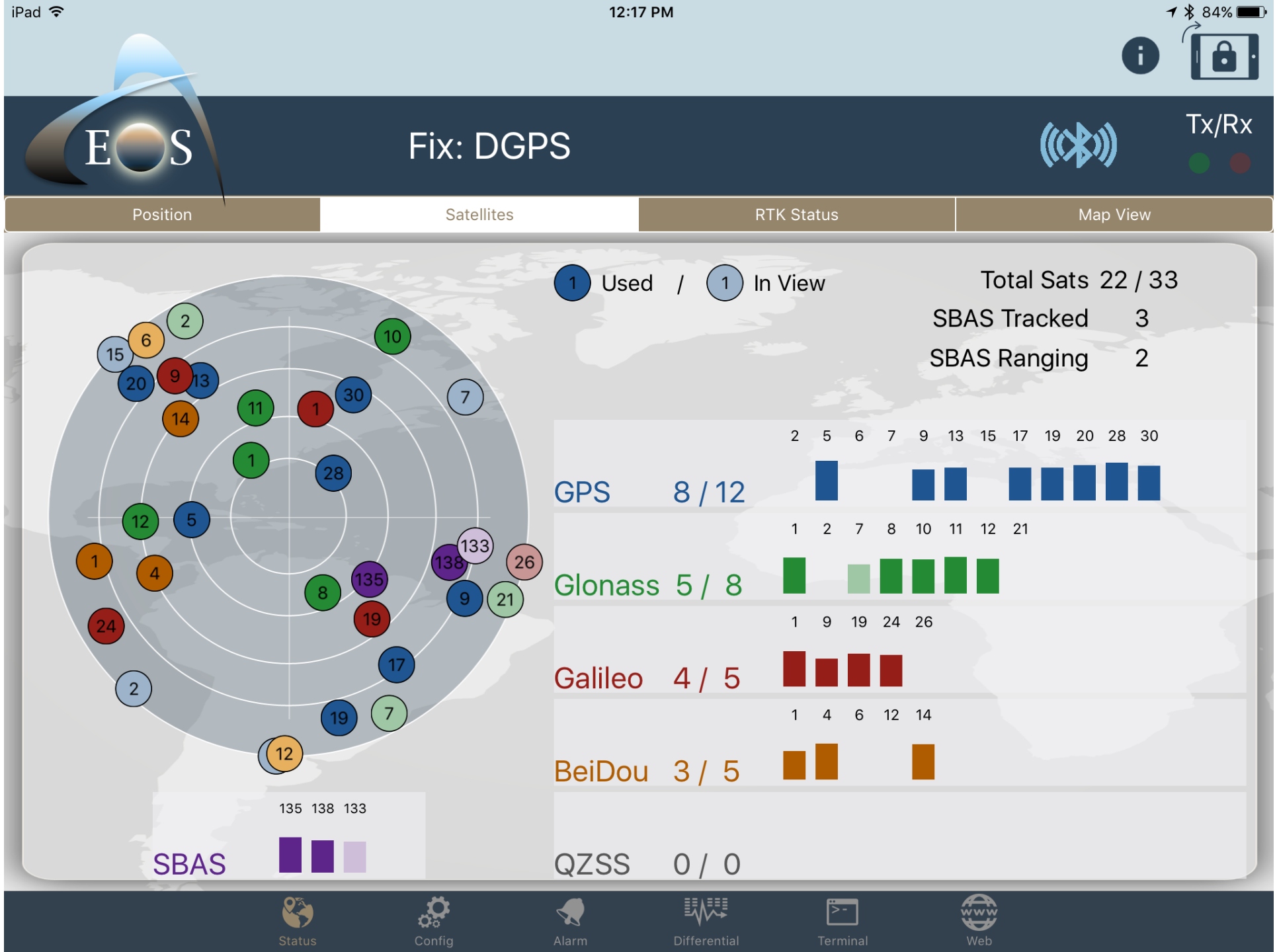
-Real-time GNSS data is trending up. “Post-processed” data is fading, not just in a GNSS sense, but in general.

GPS Technology is Changing

A Few Thoughts about GNSS

GPS Technology is Changing - GNSS

- It’s not just about GPS any longer.
- GLONASS (Russia) 24 healthy sats in orbit.
- Galileo (Europe) 17 healthy and growing.
- BDS (China) 9 healthy (in global orbits) and growing.
- More navigation satellites = faster, more accurate mapping in **impaired** conditions.


iPad
12:17 PM
84%
EOS
Fix: DGPS
Tx/Rx
Position
Satellites
RTK Status
Map View
1 Used / 1 In View
Total Sats 22 / 33
SBAS Tracked 3
SBAS Ranging 2
GPS 8 / 12
2 5 6 7 9 13 15 17 19 20 28 30
Glonass 5 / 8
1 2 7 8 10 11 12 21
Galileo 4 / 5
1 9 19 24 26
BeiDou 3 / 5
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SBAS
135 138 133
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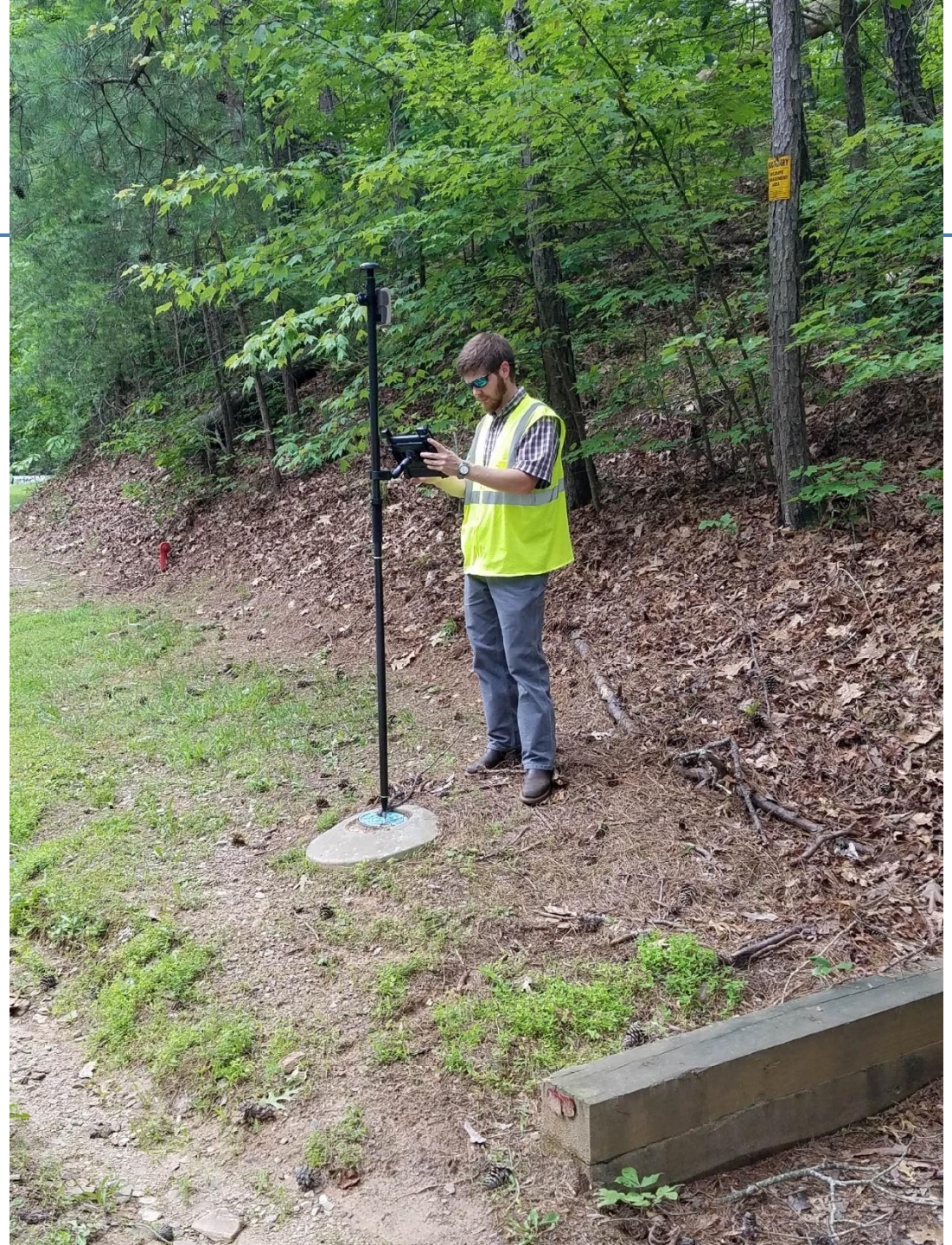
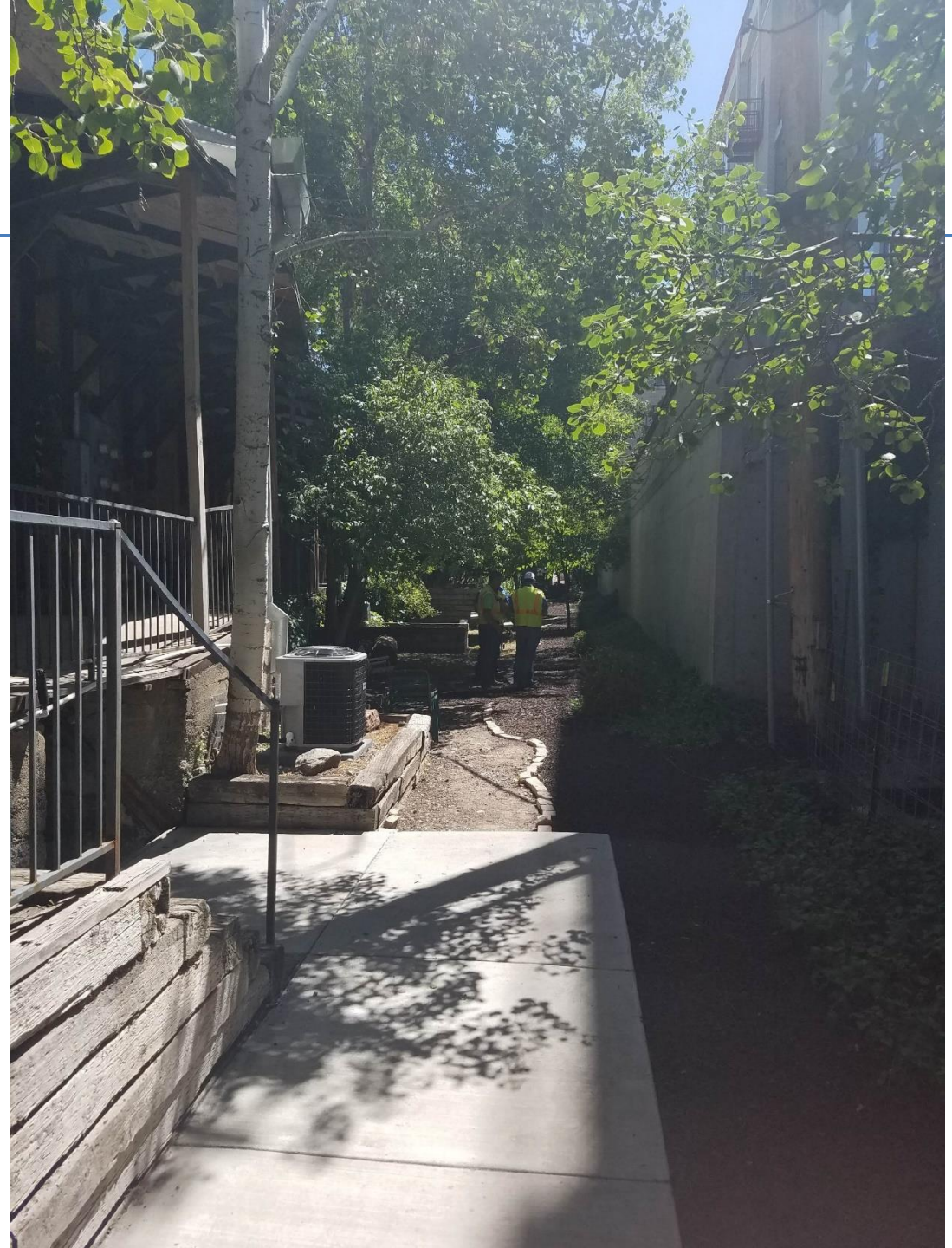
Status
Config
Alarm
Differential
Terminal
Web





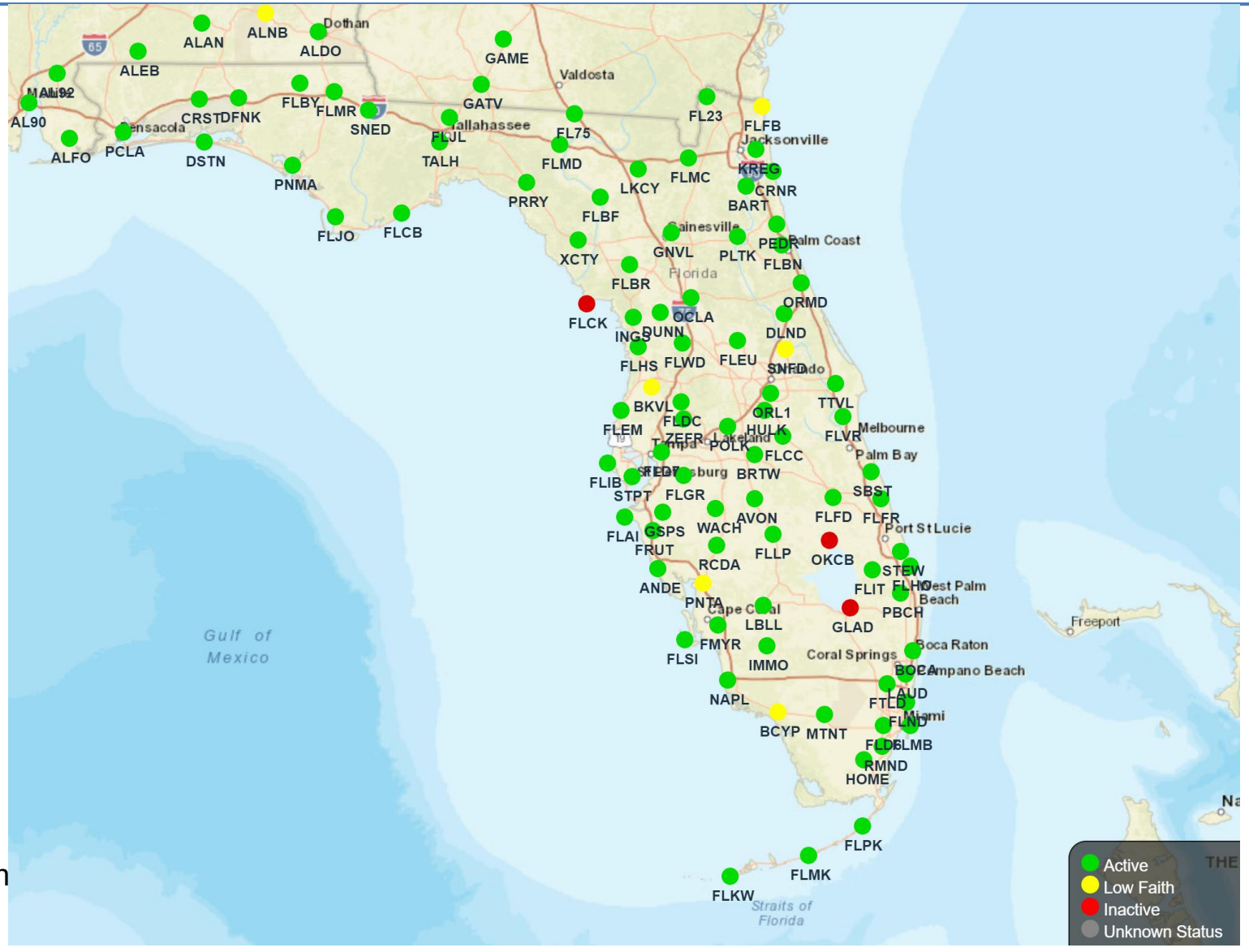
High-Accuracy GNSS Test Course

- Surveyed: total station to determine true coordinates.
- Clear, mild, moderate, heavy tree canopy.
- Static and dynamic testing

Public Infrastructure – RTK base access

Arizona
Alabama
California
Colorado
Connecticut
Iowa
Indiana
Florida
Kentucky
Maine
Michigan
Minnesota
Missouri
Mississippi
New York
North Carolina
Oregon
Ohio
South Carolina
Tennessee
Vermont
Washington
West Virginia
Wisconsin

Florida RTK Network



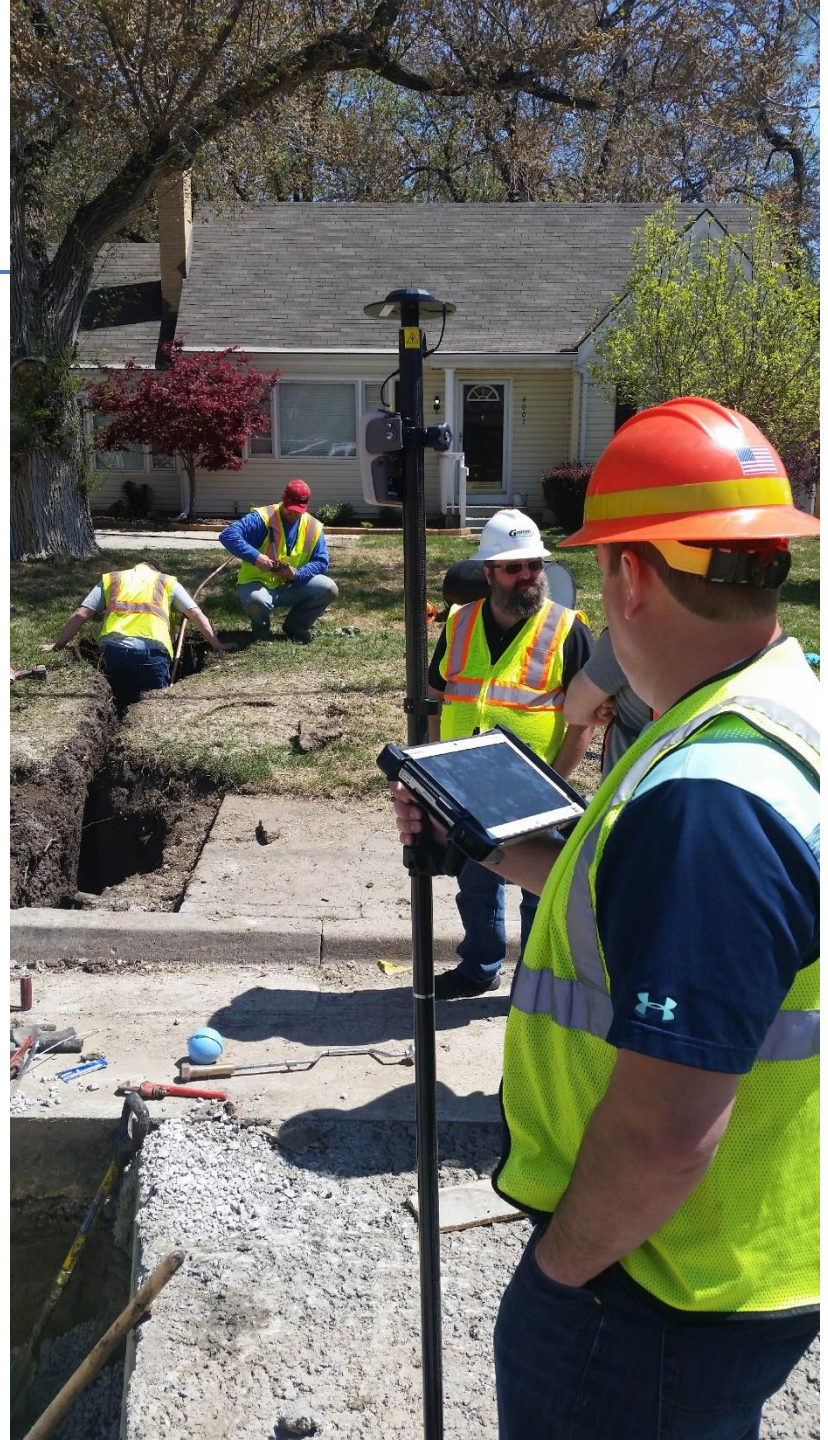
Examples of GIS users of Centimeter GNSS Technology

A Water Utility

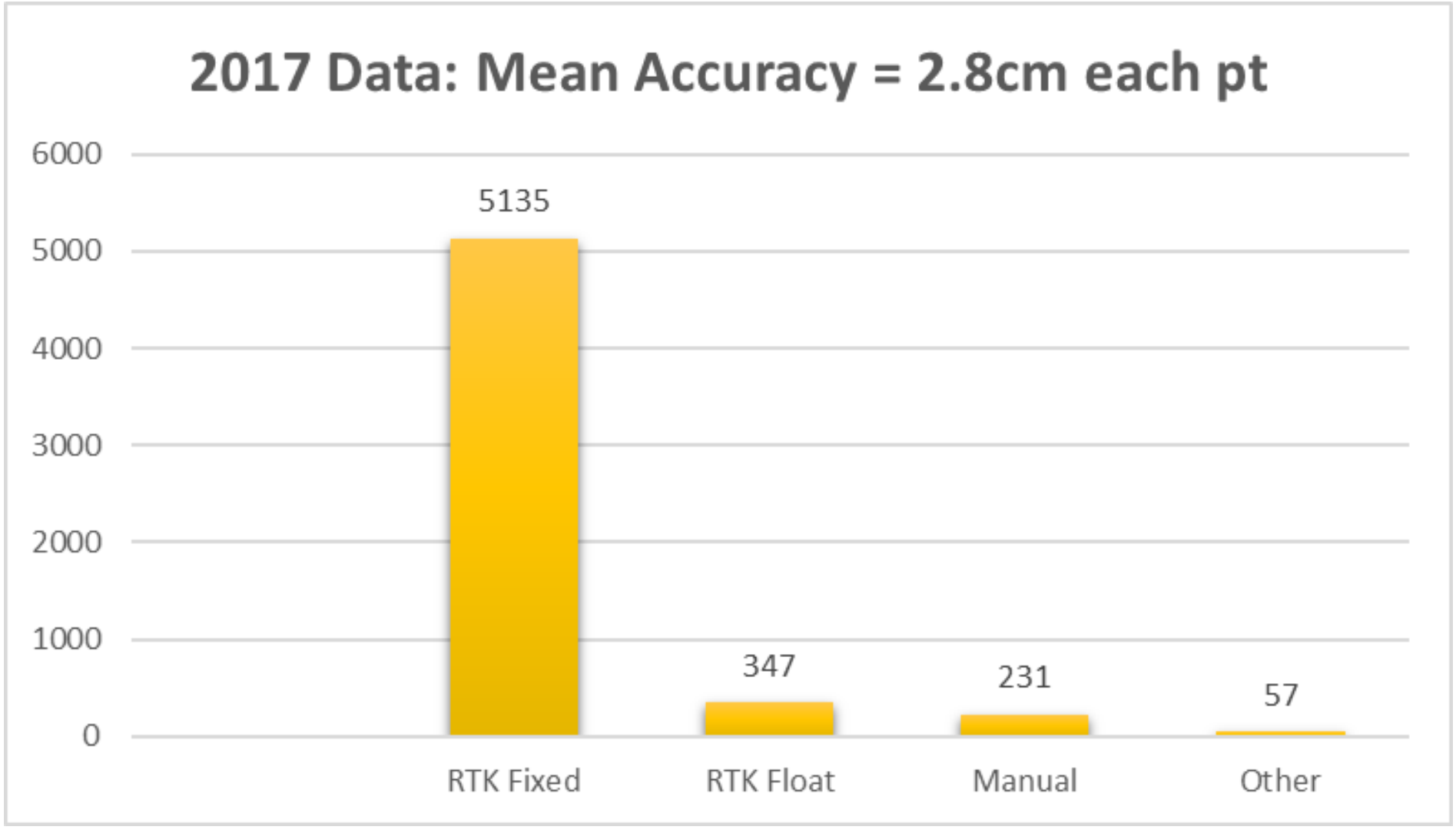
- 2,685 miles of water main serving a population of 420,000.
- 272 square miles.
- 145,000 metered accounts.
- Hundreds of thousands of fixed assets.

A Water Utility

- Free statewide RTK.
- 10x mapping productivity.
- Real-time connectivity.
- Windows tablets (BYOD).



Four months of data = 2.8cm ave Accuracy



2017 US Open Golf Course

2017 U.S. Open Overview

2017 US Open Golf Course

- The USGA requested design changes to 9 green complexes after the Open tournament.
- First task was to create a high-resolution as-built map of each green complex:

-3-inch elevation contours of the green surface.

-1 foot elevation contours of the green complex.

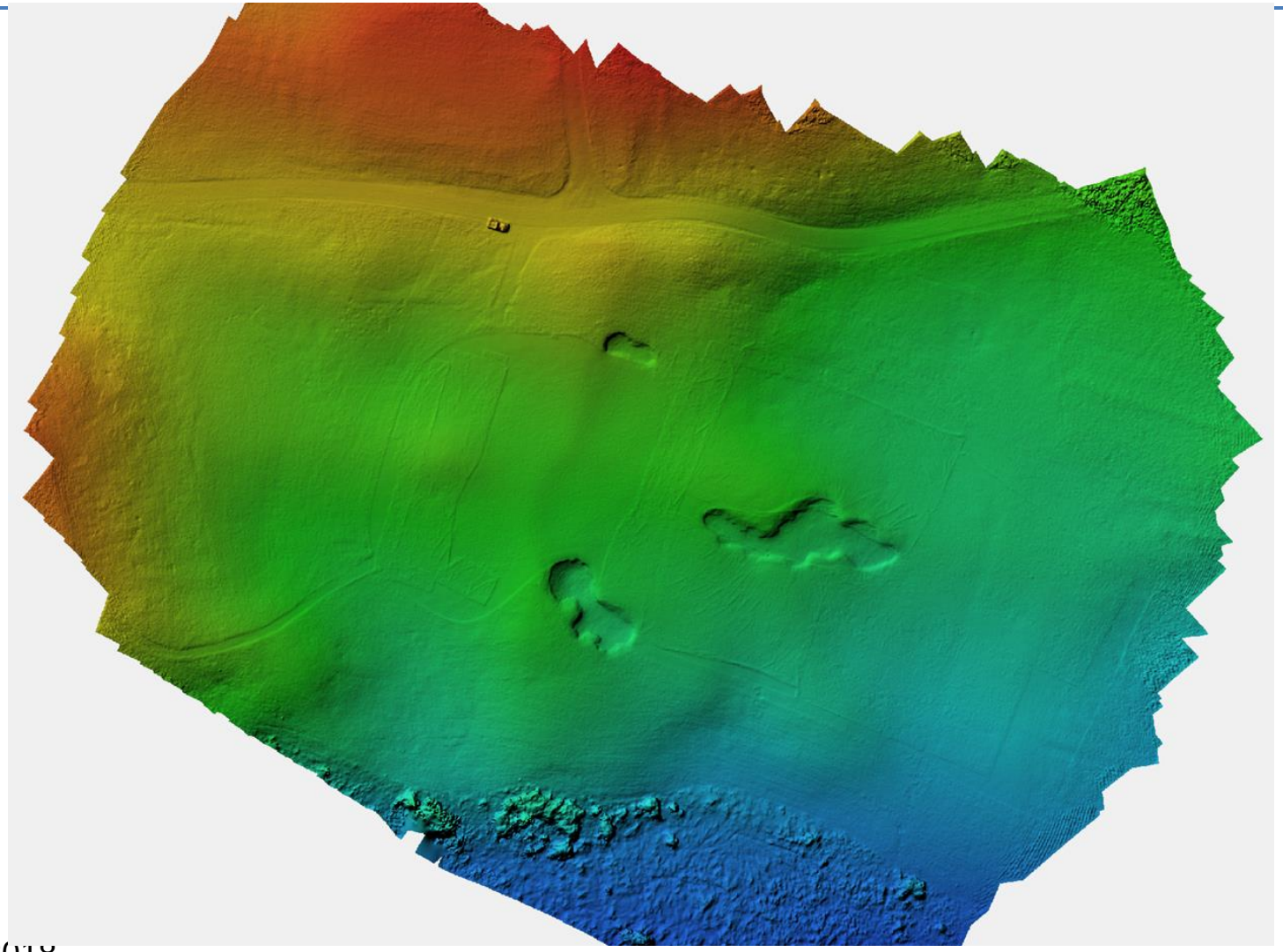
2017 US Open Golf Course

- Free statewide RTK infrastructure.
- Golf architect operating the RTK system and UAV.
- Green elevations mapped with RTK GNSS on a “wheel”.
- RTK GNSS used to survey Ground Control Points (GCPs) for the UAV flight.

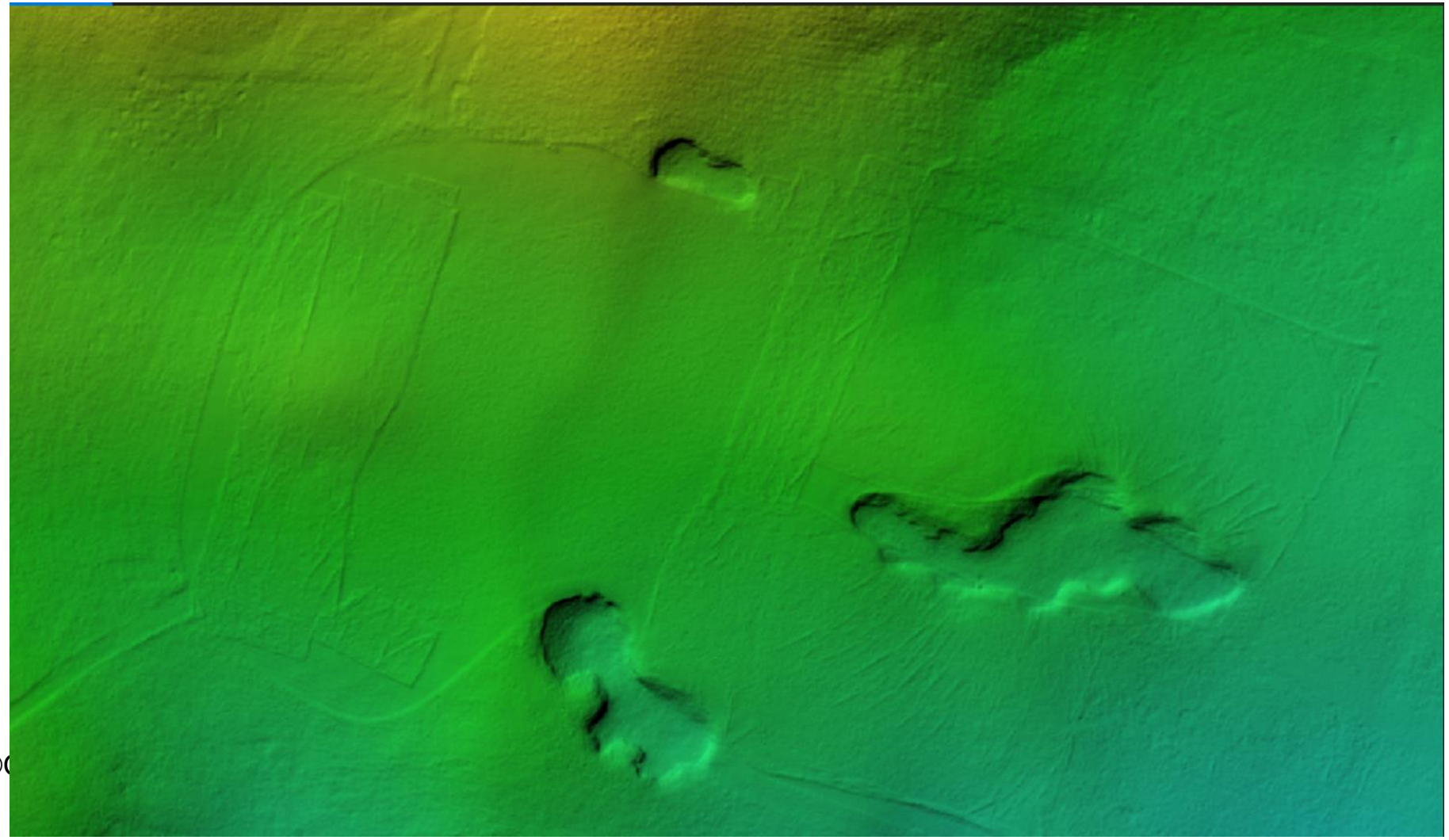
RTK GNSS “wheel” on Green Surface

Low-Level UAV Flight Pattern

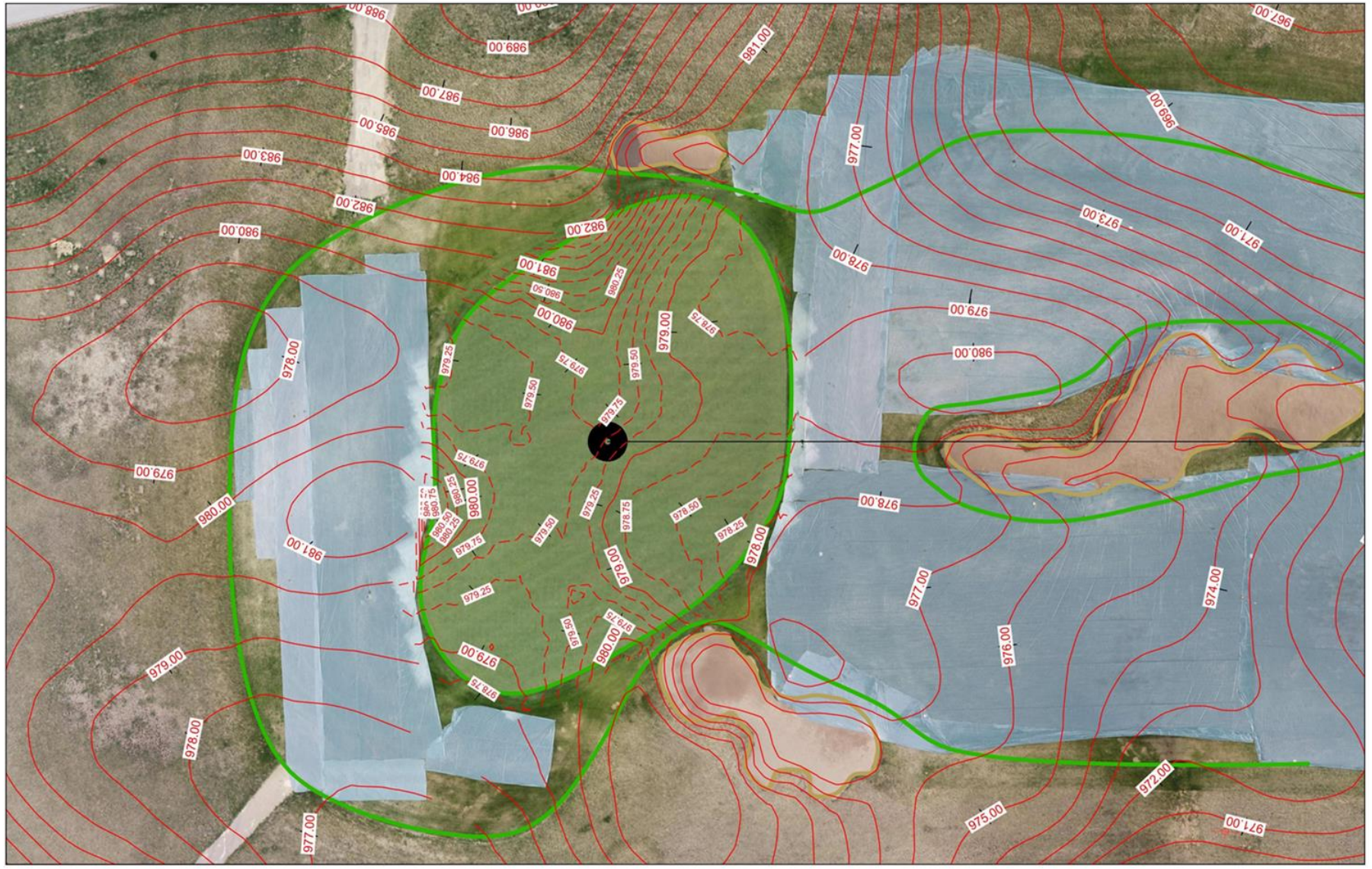
Digital Elevation Model – 4cm



Digital Elevation Model – 4cm



3” and 1’ Elevation Contour Lines



Takeaway Messages

- Increasingly free access to RTK base infrastructure promotes RTK GNSS adoption.
- Smaller and less costly RTK receivers make high-precision available to a broad audience.
- iOS/Android/Windows compatibility makes RTK GNSS accessible to a broad audience.
- The cost of collecting high-accuracy horizontal and vertical GNSS data is less costly and easier than ever before in history.

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