Subsurface Infrastructure Location Technology Innovations

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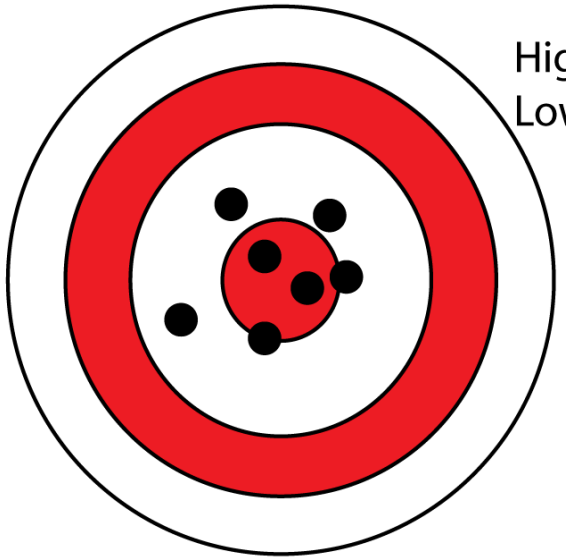
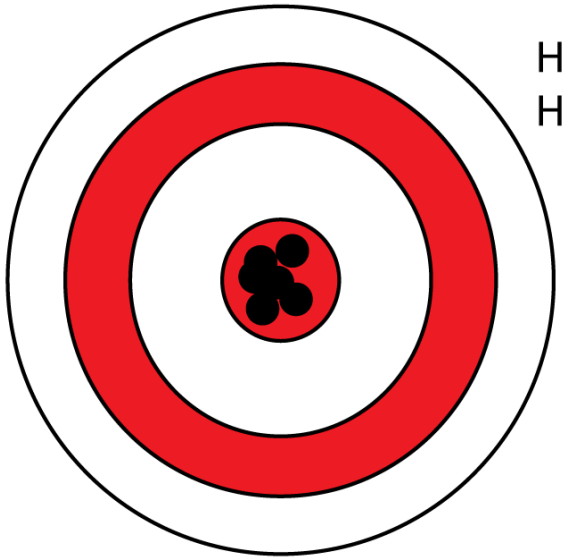
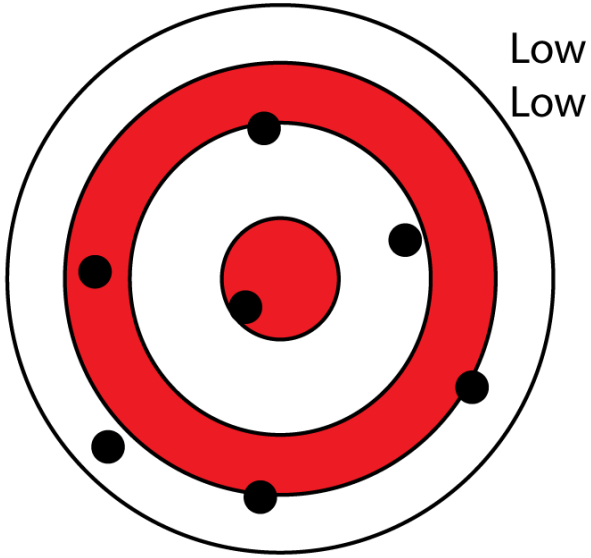
Accuracy vs. Precision



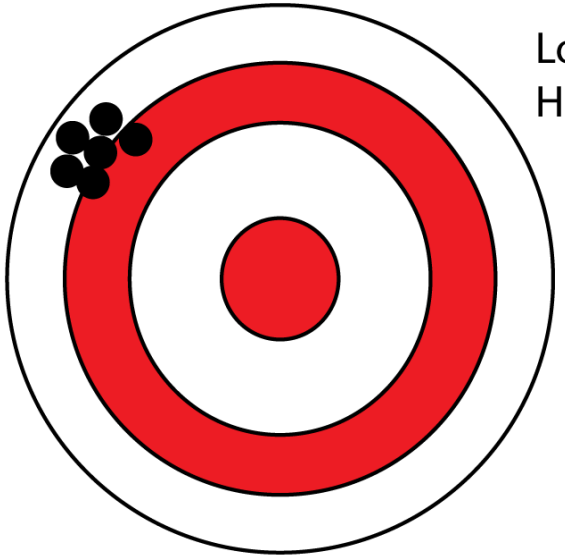
High accuracy
Low precision



High accuracy
High precision



Low accuracy
Low precision



Low accuracy
High precision

ASCE 75-22 Positional Accuracy (Planning)

Positional Accuracy Level	Positional Accuracy[a] (customary units)	Positional Accuracy[a,b] (SI units)
1	0.1 ft	25 mm
2	0.2 ft	50 mm
3	0.3 ft	100 mm
4	1 ft	300 mm
5	3 ft	1,000 mm
0	Indeterminate	Indeterminate

ASCE 75-22 Reporting Requirements

- Horizontal and vertical positions referenced to US National Spatial Reference System (NSRS) horizontal and vertical datums.
- Data elements (data record level or metadata level):
  - Horizontal spatial reference (coordinate system, datum, epoch date)
  - Vertical spatial reference (datum and geoid model)
  - Horizontal accuracy (at the 95% confidence level)
  - Vertical accuracy (at the 95% confidence level)

2024 ASPRS Accuracy Standard

- 2024 positional accuracy standards published by the American Society for Photogrammetry and Remote Sensing (ASPRS)
- Positional accuracy: Based on root mean square error (RMSE) thresholds for horizontal and vertical accuracy of spatial data
- Replaced 95% confidence measure of accuracy that existed in the 2014 version of the standard

Data Collection/Processing Technologies

Devices
Samsung Galaxy S22
Samsung Tab Active3
Apple iPhone 14 Pro Max
Apple iPad Pro 11
Bad Elf Flex
Leica Zeno FLX100 Plus
Trimble DA2
Emlid RS2+

Devices
viDoc RTK Rover
DJI Phantom 4 RTK rotary
Wingtra Gen II VTOL
FreeFly Alta X with Lidar
REDUCT ABM-30 and ABM-40

Skydio X2E (Color):
- Quadcopter
- NDAA compliant

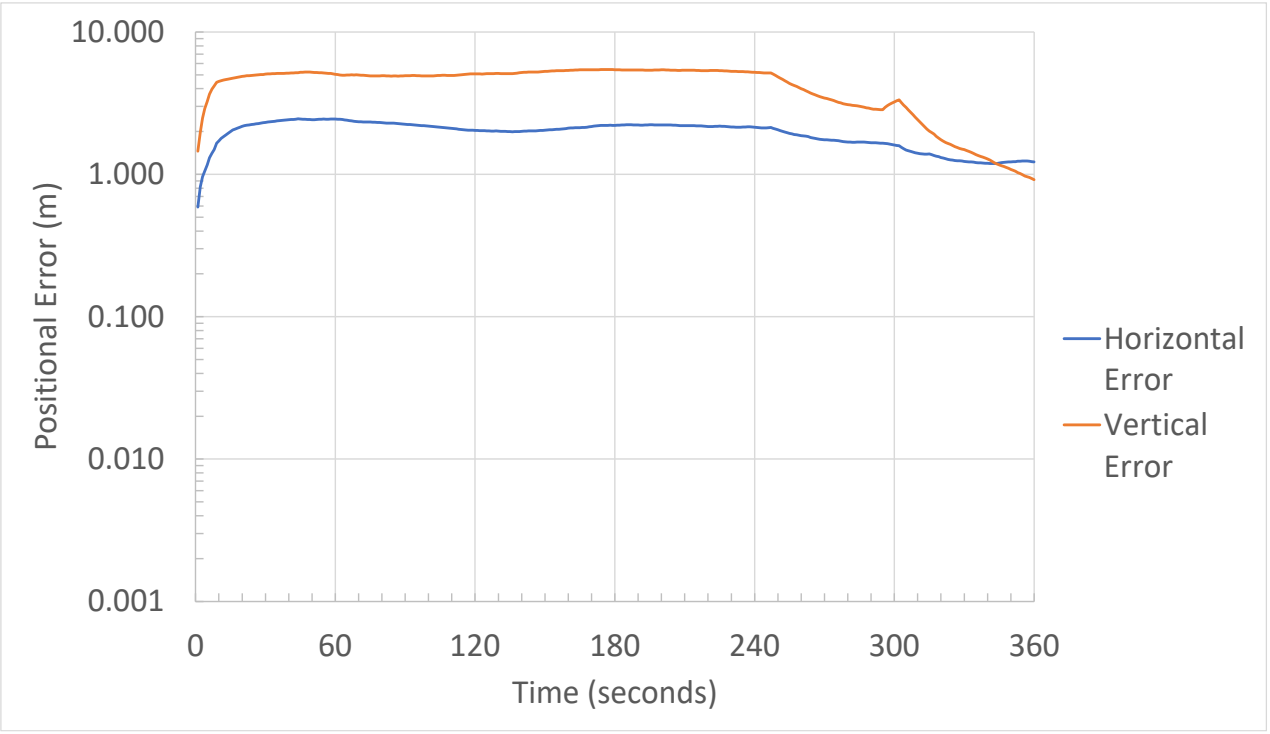
Data Collection/Processing Technologies

Software
Skydio 3D Scan
Trimble Penmap
Leica Zeno Mobile
ArcGIS Field Maps
ProStar PointMan
PIX4D PIX4Dcatch

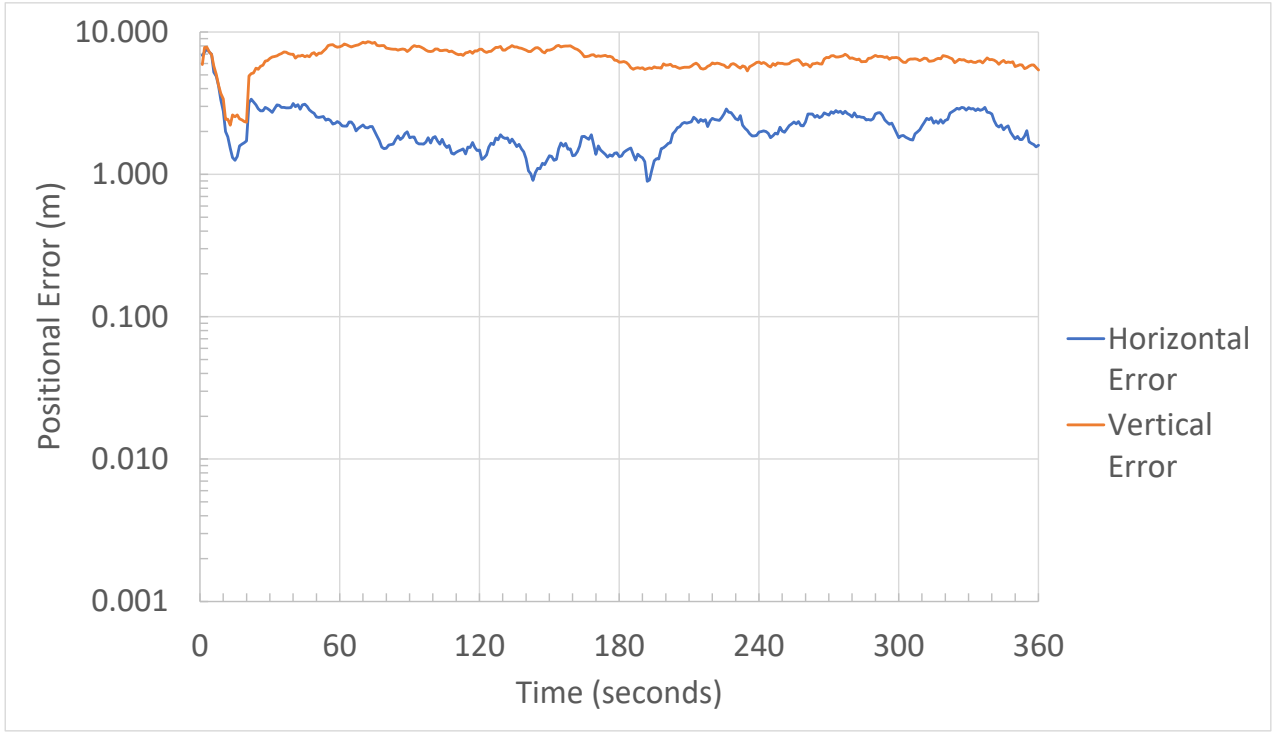
Software
Bentley iTwin Capture Mobile
PIX4D PIX4Dmapper
PIX4D PIX4Dmatic
PIX4D PIX4Dsurvey
PIX4D PIX4Dcloud
Bentley iTwin Capture Modeler
Bentley iTwin Capture Cloud

Benchmark Tests—Autonomous

Leica FLX100 Plus GNSS—Autonomous

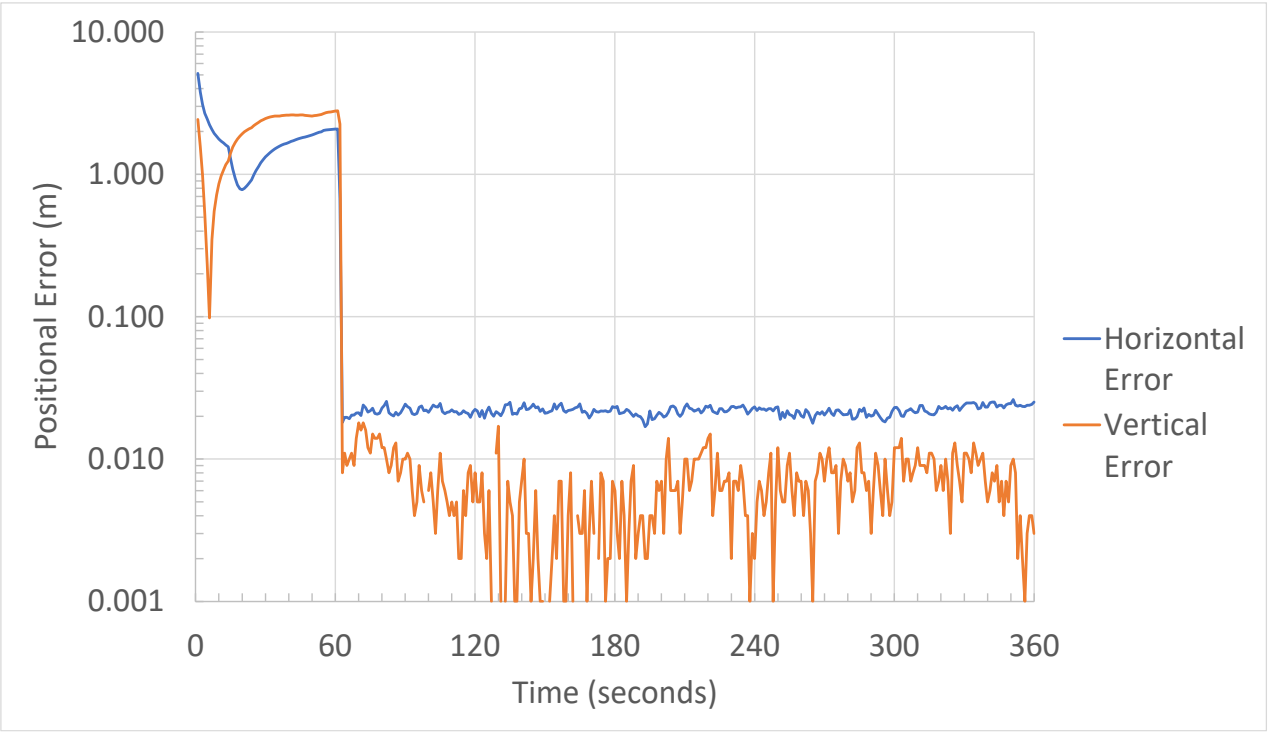


Trimble DA2 GNSS—Autonomous

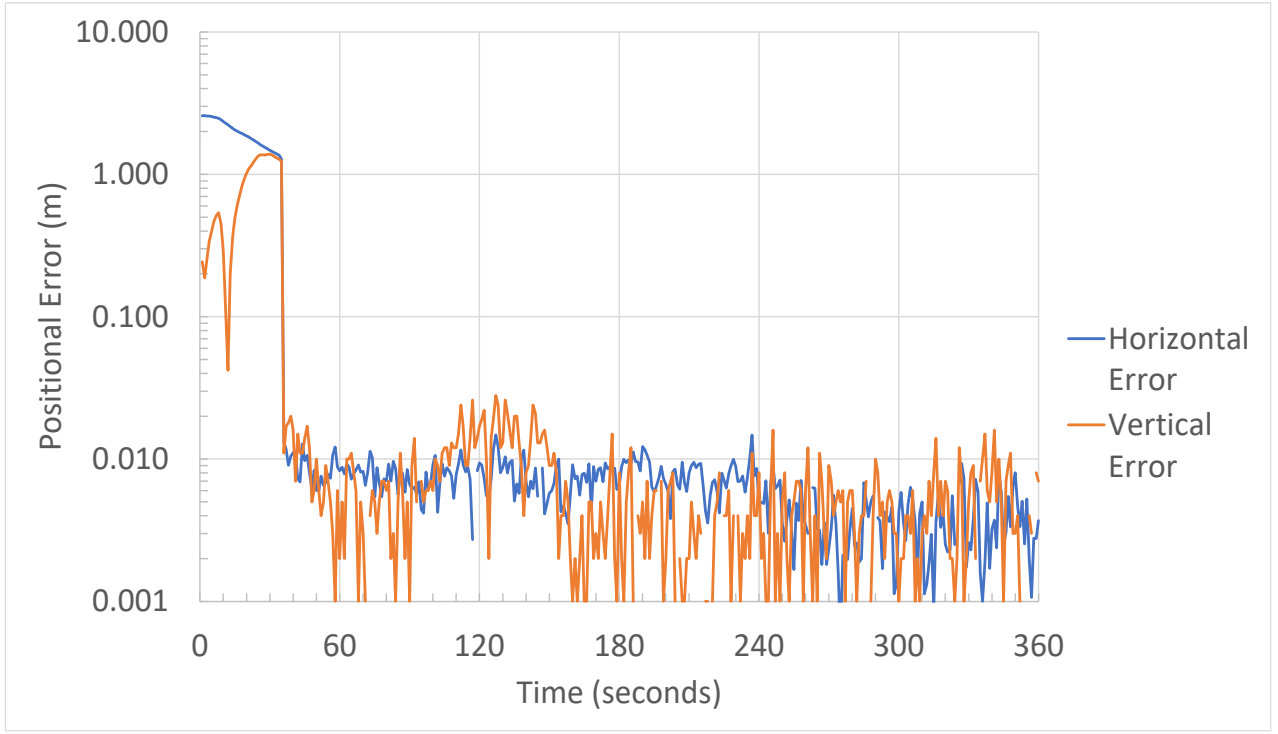


Benchmark Tests—RTK

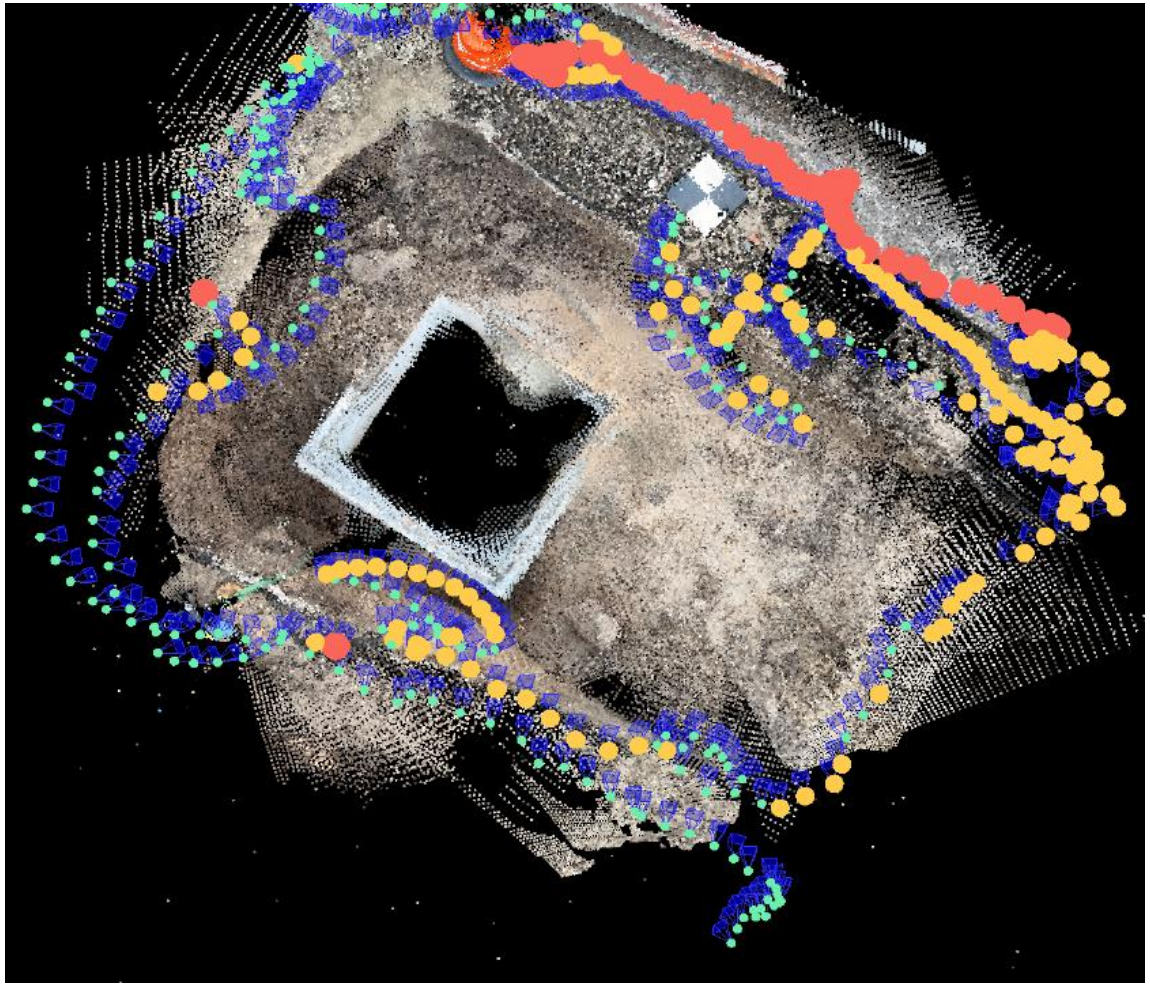
Leica FLX100 Plus GNSS—SmartNet RTK



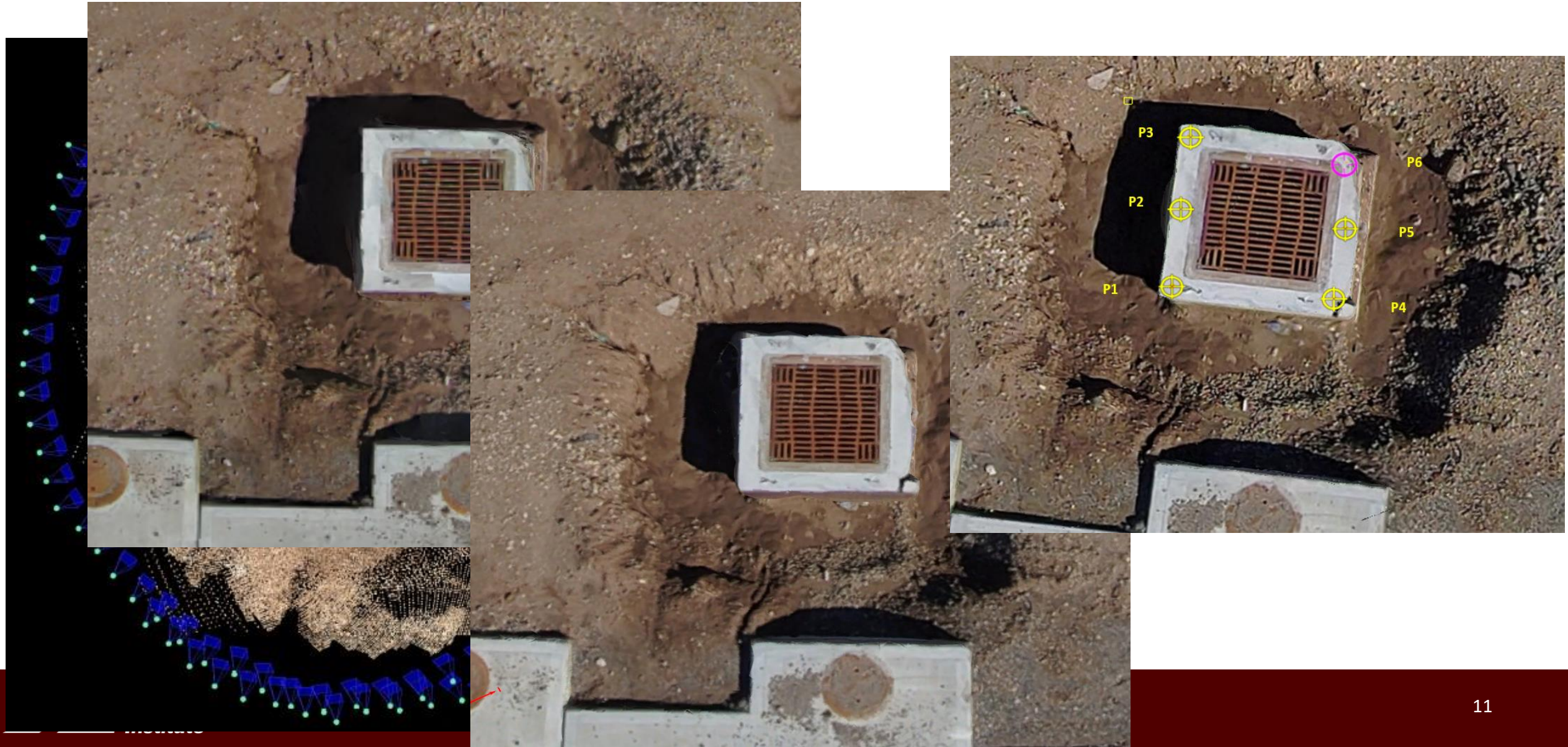
Leica FLX100 Plus GNSS—TxDOT RTN



Data Collection Site 1

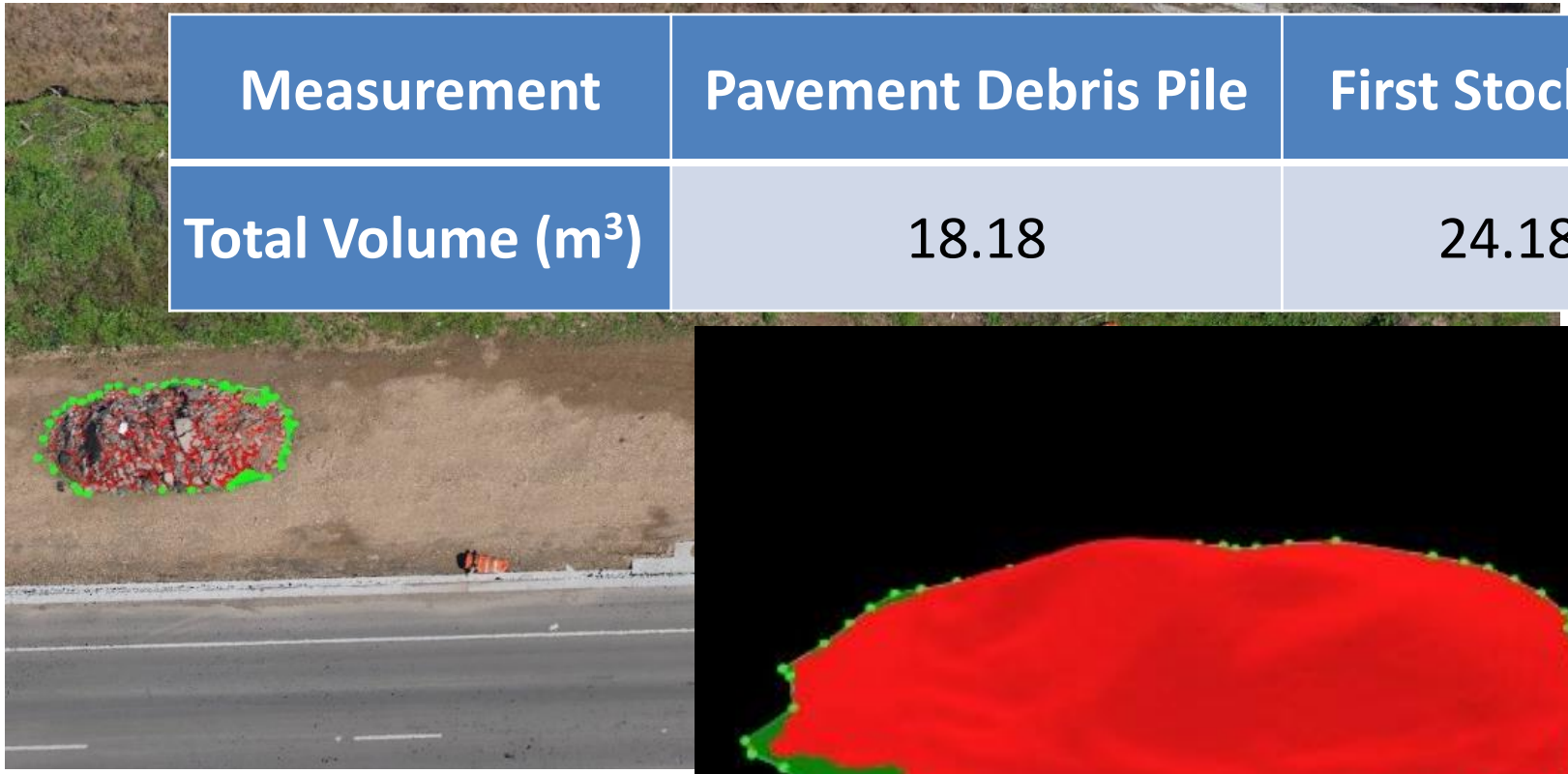


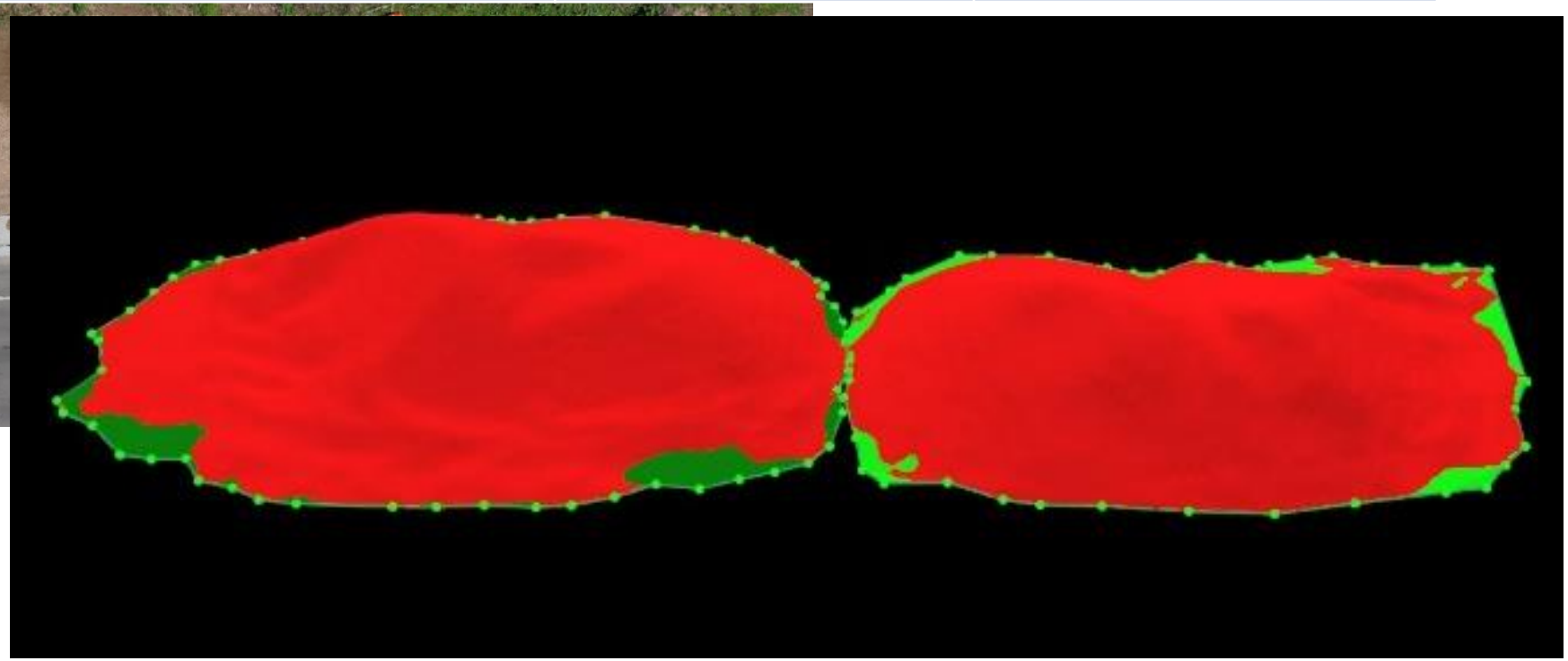
Data Collection Site 2



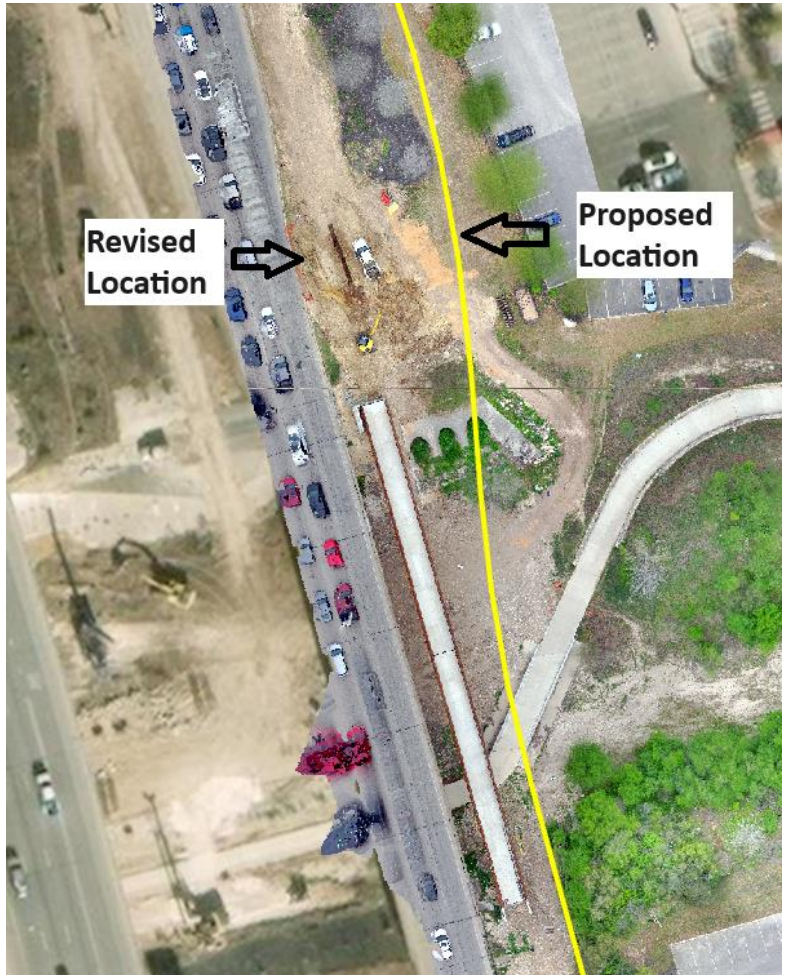
Data Collection Site 3

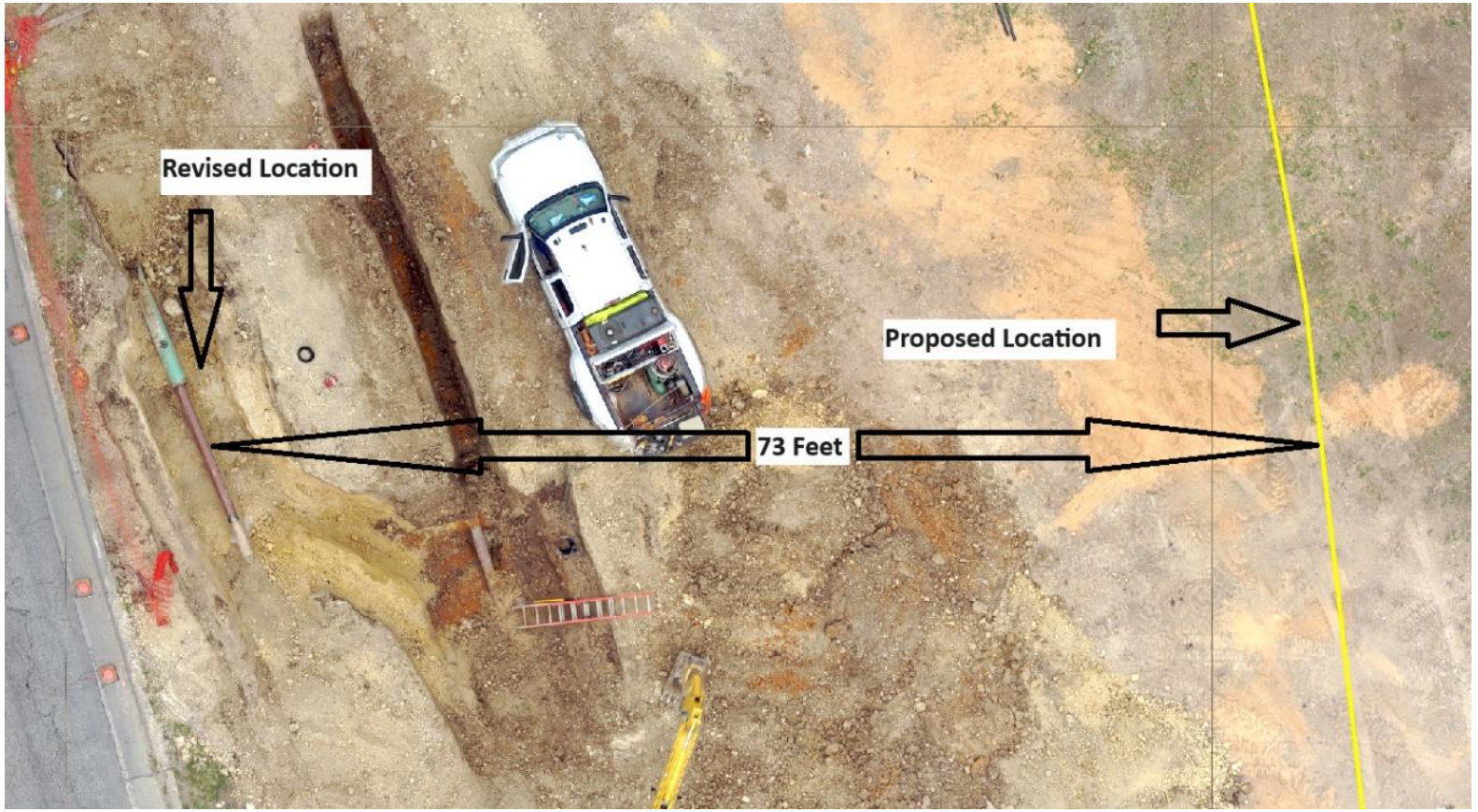
Measurement	Pavement Debris Pile	First Stockpile	Second Stockpile
Total Volume (m^3)	18.18	24.18	21.36





Data Collection Site 4





Data Collection Site 4

Gyroscopic Probes

Range	Picture
29–35 mm (1.1–1.4 inches)	
40–75 mm (1.5–3.0 inches)	

Research Team Contact Information

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