



**Global Navigational Satellite System (GNSS) R1 Unit
User Instructions
B-055-OWQ-WAP-XXX-23-T-R0
Technical Standard Operating Procedure (TSOP)
Office: Office of Water Quality
Branch: Watershed Assessment and Planning Branch
Section: Technical and Logistical Services Section**

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Purpose


This technical standard operating procedure (TSOP) provides instruction in the operation of handheld Global Navigation Satellite System (GNSS) Trimble R1 units used in the field by Watershed Assessment and Planning Branch (WAPB) staff for generating accurate X, Y coordinates for each Assessment Information Management System (AIMS) sampling location.

Scope

This TSOP is used by WAPB field staff responsible for collecting Global Navigation Satellite System (GNSS) data for sampling locations in the field.

Authorizing Signatures

I approve and authorize this technical standard operating procedure (TSOP).



Caleb Rennaker, Section Chief
Technical and Logistical Services, WAPB

1/11/2023

Date




Kristen Arnold, Branch Chief,
Watershed Planning and Assessment Branch

1/11/2023

Date

This TSOP is consistent with agency requirements.



Quality Assurance Staff
Office of Program Support

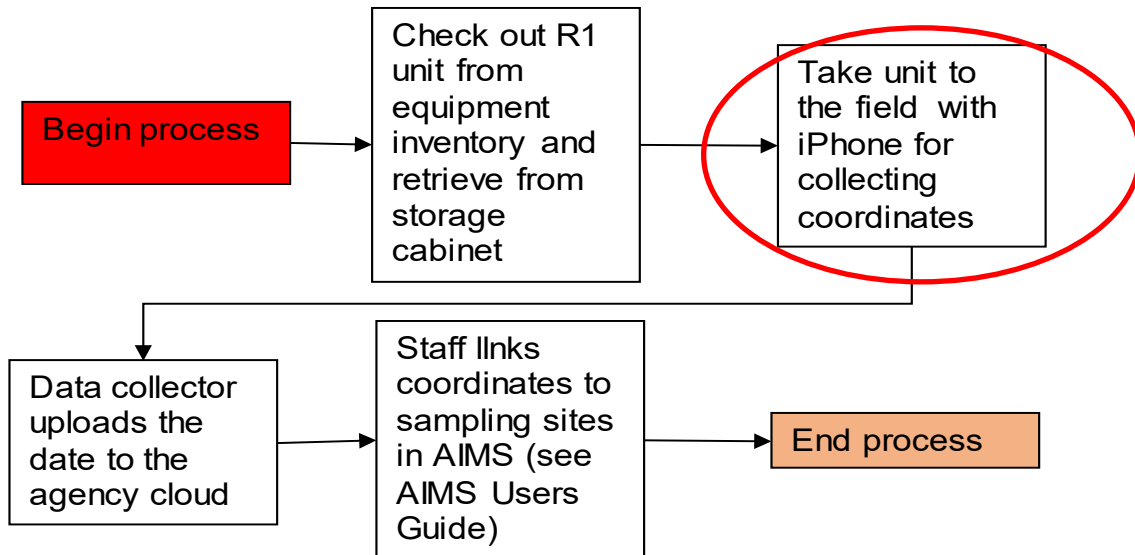
1/12/2023

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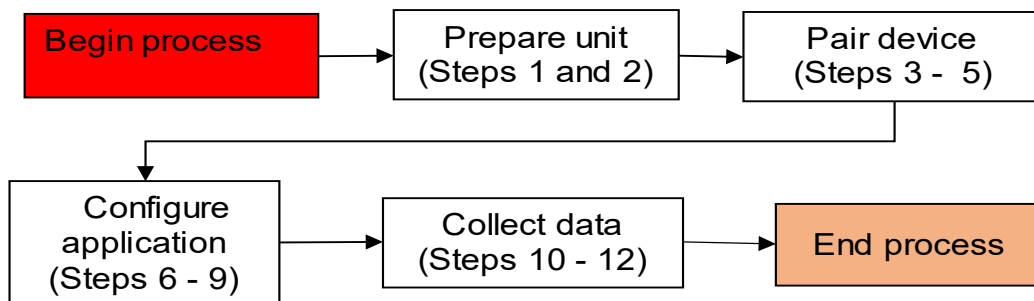
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1.0. Overview Flowchart



2.0. Procedure


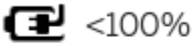


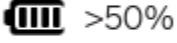

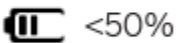




2.1. Procedural Flowchart



2.2. Procedural Steps






- Step 1. Assure the unit is fully charged by checking the battery. Battery level can be found by looking at the Power LED light on the R1 unit (see table below). Charge any units that are low on battery using the charging cable. Charging takes about 5 hours to complete.

Power LED 

 Solid	
 Solid	
Off	
	
	
	

- Step 2. Turn on the unit by holding the power button until the LED light turns green, and then release it.
- Step 3. When the LED starts flashing blue and orange, place the R1 receiver in pairing mode by holding the power button for 5 seconds until the LED is flashing blue. Then pair the receiver with an iOS device (iPad or iPhone), by going to Settings > Bluetooth on the iOS device.

Bluetooth / GNSS LED (10)

LED	Bluetooth status	GNSS status
	Not connected, in pairing mode.	Not connected.
	Not connected, in pairing mode.	Connected.
	Connected.	Not connected.
	Connected.	Connected, sending autonomous positions.
	Connected.	Connected, sending corrected positions.

- Step 4. Download and open the Trimble Mobile Manager app on the iOS device and click on ☰ → Position Source. Select Bluetooth Receiver, then tap on List connected devices, select the correct R1 receiver (either A, B, C, etc.), then tap Connect.

- Step 5. The R1 begins connecting to the iOS device and may take a few minutes. Ensure the Trimble Mobile Manager remains connected to position source, there should be a green bar.
- Step 6. Open the ArcGIS Field Maps app on the iOS device. Click 'Sign in with' ArcGIS Online. Under 'Sign in with' click on 'ArcGIS login.' Sign in as either R1A or R1B, depending on the unit being used. Login credentials for each unit can be found in the front pocket of the unit's case.
- Step 7. Click on the Profile icon in the top left of the screen. Click on Provider, then click Add. Select the correct R1 unit (R1A is called GNSS:93688; R1B is called GNSS:92921). Ensure the R1 unit is the selected Location Provider, not 'Integrated' (which is the iOS device).
- Step 8. Go back to Profile and click 'Collection Settings.' Change the Accuracy to 5 meters (16.404 feet). Turn 'Snapping' off. Click Done. Adjust any other settings as needed, such as metric units or cellular data use.
- Step 9. Under Maps, search for the map in which the data will be collected and stored. Open the map, and the R1 will be connected to Field Maps.
- Step 10. Physically travel to the exact location where corrected coordinates are required. Stand still at location with iOS device and R1 unit until 'GPS Accuracy' on iOS device is within 5 meters (16.404 feet). Click the ⊕ symbol on the bottom right corner of the iOS device.
- Step 11. Select the 'Feature' type to determine where the data for the point is stored and which fields are available to fill in. Fill in the data fields with the site information. If the GPS accuracy becomes more accurate than when ⊕ was first clicked, and the unit is still at the exact desired location, 'Update Point' may be clicked, and the coordinate data will be replaced with higher accuracy.
- Step 12. Click 'Submit' in the top right corner of the iOS device. In the map, select the newly created point. Review to ensure that all fields are entered correctly. Select 'Edit' to make any corrections and resubmit when completed.

2.3. Related Technical Issues

A. Health and Safety Warnings

1. Antennas must be used with extreme caution when operating near power lines and other sources of electric current or during stormy weather, as they are excellent conductors of electricity.

2. Charge the rechargeable lithium-ion battery only in strict accordance with the instructions. To prevent injury or damage:
 - a. Discontinue charging a battery that gives off extreme heat or a burning odor.
 - b. Never attempt to remove, replace, or repair the battery yourself.
 - c. If the battery requires attention, send the receiver to an authorized Trimble Service Center.

B. Cautions

1. This is a high-precision electronic instrument and should be treated with care.
2. Operating or storing the receiver outside the specified temperature range can damage it. The unit can be operated in temperatures ranging from -20°C to $+60^{\circ}\text{C}$ (-4°F to $+140^{\circ}\text{F}$) and stored in temperatures ranging from -30°C to $+70^{\circ}\text{C}$ (-22°F to $+158^{\circ}\text{F}$).
3. The unit should also be operated and stored within a specified altitude range. The maximum operational altitude of the device is 9,000 m (29,520 ft), and the maximum storage altitude 12,192 m (40,000 ft).

C. Interferences

1. Satellite Based Augmentation Systems (SBAS) and L-Band signals are highly compromised when the receiver is used close to the body; geostationary satellites will have a lower signal margin at the receiver than the typical orbiting GNSS satellites. Performance will heavily depend on factors such as user orientation, position of the receiver on body, how exposed the antenna is, and geographic location.

D. Calibration

Not applicable

E. Troubleshooting

1. Receiver won't turn on
 - Cause: The battery is severely discharged. This may be because the device is new and has not yet been charged, or it has been in storage for more than a few months.
 - Solution: Charge the battery for an hour using the supplied charger, then disconnect and reconnect the USB cable. The power LED should turn on. Leave the device on charge until the power LED turns green.
 - See 'Charging the battery,' page 14 of the *Trimble R1 GNSS Receiver User Guide*.

2. Battery indicator for R1 GNSS receiver shows empty on an iOS device
 - Cause: This is an iOS issue which has been logged with Apple.
 - Solution: Use the GNSS Status utility to view the battery status. For full instructions on using the GNSS utility, refer to the *Trimble R1 GNSS Receiver User Guide*.
3. R1 GNSS receiver firmware upgrade
 - Cause: When you upgrade the firmware on a R1 GNSS Receiver, and it was previously paired with an iOS device, you cannot reconnect. The iOS device no longer recognizes the R1 receiver when the firmware is upgraded.
 - Solution: Before you can reconnect your iOS device with a previously connected R1 GNSS Receiver, you must 'forget' the connection on the iOS device. Go to Settings > Bluetooth and tap the Info button next to the R1 [serial number] device you want to forget. Tap 'Forget this device.' You can then reconnect as usual.

3.0. Roles

3.1. Responsibilities

A. GIS specialist

1. Trains personnel in use of Trimble R1 Units for data collection.
2. Responsible for revisions to OWQ Global Navigation Satellite System (GNSS) Data Collection TSOP.

B. Field staff

1. Assures GNSS unit is fully charged prior to taking it into the field.
2. Collects GNSS data in the field and uploads to ArcGIS Field Maps.

3.2. Training requirements

A. Data collection training

1. Field staff

4.0. Required Forms, Equipment, or Software List

4.1. Forms

- ##### A. Not applicable

- 4.2. Equipment
 - A. Trimble R1 Unit
 - B. iOS Device
- 4.3. Software
 - A. ESRI Field Maps App
 - B. Trimble Mobile Manager App

5.0. Records Management

- 5.1. All collected point data are stored in ArcGIS Online and archived at the discretion of the GIS specialist. Data is moved to the Indiana GIO Enterprise Portal at the discretion of the GIS specialist and as warranted by field staff needs.

6.0. Definitions

- 6.1. “Global Navigation Satellite System (GNSS)” – A satellite system that is used to pinpoint the geographic location of a user’s receiver anywhere in the world.
- 6.2. “Global Positioning System (GPS)” – A constellation of satellites developed by the U.S. Department of Defense that transmit radio signals which allow a GPS receiver anywhere on earth to calculate its own location. GPS is used in navigation, mapping, surveying, and other applications where precise positioning is necessary.
- 6.3. “GIS specialist” – The WAPB staff person responsible for training personnel in the use of Trimble GPS units for data collection, uploading data from Trimble GPS units, differentially correcting uploaded GPS data, and reviewing and revising of WAPB GPS related SOPs.
- 6.4. “Standard deviation (SD)” – A statistical measurement of dispersion around an average or mean.
- 6.5. “Trimble” – GNSS/GPS unit manufacturer whose software and hardware is the standard for agency locational data collection.

7.0. Quality Assurance and Quality Control

- 7.1. All GNSS collected data is checked for data quality. All horizontal precisions are verified to be 5 meters or less. If a point is found to not meet the standards by the GIS specialist or field staff, then the individual who collected the GPS data will need to collect it again.

8.0. References

- 8.1. Trimble Navigation Limited. June 2016. Trimble R1 GNSS Receiver User Guide (Version 1.00, Revision C). Web address: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.frontierprecision.com/wp-content/uploads/UserGuide_ENG.pdf
- 8.2. Frontier Precision. 2017. Connecting an R1 to FieldMaps. Web address: <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://support.frontierprecision.com/portal/api/kbArticles/90557000037479071/attachments/13kvw207b7506a4bf4411a55afd202180c58c/content?portalId=edbsnc75f45776fb0eb808c4a49f5e94a081a83e776f12568960f975c77a0836c224c&inline=true>
- 8.3. Indiana Department of Environmental Management. IDEM Spatial Data Collection Standards 1.0. Web address: https://www.in.gov/idem/files/spatial_data_collection_standards.pdf

9.0. Appendices

Not applicable