



GPS / GNSS Overview

for Status & Trend Network Projects

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DEAR / WQAP
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Presentation Outline

Background Information

Reminders:

- Office - Preparation
- Field - Using the Equipment
- Office - Downloading Data

GNSS Training Videos are posted at:

[publicfiles.dep.state.fl.us/dear/watershed
monitoring/info_center_appdata/GNSS_train
ing_videos/](http://publicfiles.dep.state.fl.us/dear/watershed_monitoring/info_center_appdata/GNSS_training_videos/)

GNSS/GPS

Table of Contents

1. Brief Background of GNSS

2. Office Preparation

3. Using the Equipment

1. Brief Background of GNSS

What's the difference between GNSS and GPS?

GNSS = Global Navigation Satellite System

**This term includes GPS, GLONASS, Galileo,
and Beidou.**

GPS is a U.S. system

GLONASS is a Russian system

**For the Water Quality Assessment
Program (WQAP), for simplicity's sake
I'll refer to GNSS as GPS.**

GPS System

Global Coverage

All-weather availability

GPS Grades

- Recreational grade

- Resource grade

- Survey grade

Locations by Cell Phones

- Cell phones are not GPS receivers.
- Collect location data by triangulating cell phone signals.
 - These locations are based on a single point
 - These locations have very low statistical confidence
- Do not Satisfy the Division Location Standard

Typical Resource Grade GPS Equipment Accuracy

Autonomous = 5 - 50 meters

WAAS = 3 - 7 meters

Differential Corrected = 0.3 - 2.0 meters

Autonomous GPS Equipment

***Collect GPS Data without any
Corrections.***

Recreational grade units

(e.g. Garmin, Magellan, etc.)

Data is coded as AGPS data.

WAAS Corrected Data

WAAS (Wide Area Augmentation System)

*Satellite Based Augmentation
System (SBAS)*

*Produces a Real-Time differential
correction of data.*

Data is coded as **WGPS** data.

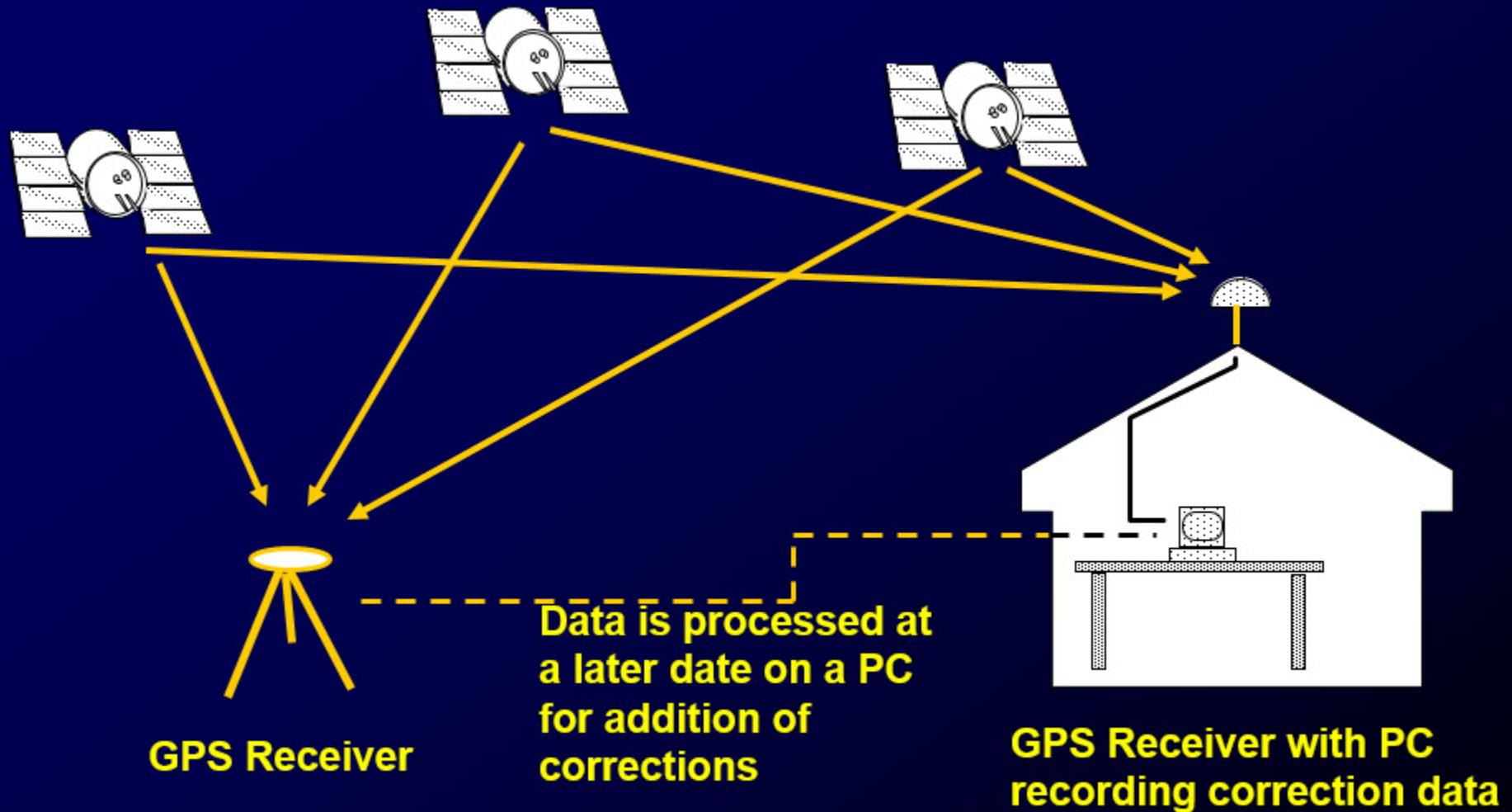
Differential Correctable GPS Equipment

GPS Receivers with after-the-fact corrections for atmospheric delay, and other errors.

- The data is collected and then processed later. This process is known as post processing

Data is coded as **DGPS** data.

Differential Corrected Data



Tallahassee FDEP Trimble Reference Station



Web browser window showing the Trimble FDEP interface. The URL is <http://199.73.196.254/>. The page title is "FDEP - 2016-09-...". The interface includes a sidebar with navigation links: Receiver Status, Satellites, Data Logging, Receiver Configuration, IO Configuration, Bluetooth, OmniSTAR, Network Configuration, Security, Firmware, and Help. The main content area displays a "Data Files" section with a table of files.

Filename	Created	Size
FDEP201609281500T.T02	2016-09-28T15:00:00 GPS	352.0 kB
FDEP201609281400T.T02	2016-09-28T14:00:00 GPS	993.4 kB
FDEP201609281300T.T02	2016-09-28T13:00:00 GPS	996.4 kB
FDEP201609281200T.T02	2016-09-28T12:00:00 GPS	982.1 kB
FDEP201609281100T.T02	2016-09-28T11:00:00 GPS	895.8 kB
FDEP201609281000T.T02	2016-09-28T10:00:00 GPS	969.6 kB
FDEP201609280900T.T02	2016-09-28T09:00:00 GPS	0.991 MB
FDEP201609280800T.T02	2016-09-28T08:00:00 GPS	1.009 MB
FDEP201609280700T.T02	2016-09-28T07:00:00 GPS	1.142 MB
FDEP201609280600T.T02	2016-09-28T06:00:00 GPS	1.077 MB
FDEP201609280500T.T02	2016-09-28T05:00:00 GPS	0.979 MB
FDEP201609280400T.T02	2016-09-28T04:00:00 GPS	1.174 MB
FDEP201609280300T.T02	2016-09-28T03:00:00 GPS	1.150 MB
FDEP201609280200T.T02	2016-09-28T02:00:00 GPS	1.177 MB
FDEP201609280100T.T02	2016-09-28T01:00:00 GPS	1.267 MB
FDEP201609280000T.T02	2016-09-28T00:00:00 GPS	1.304 MB

Web browser window showing the FTP directory listing for the Tallahassee FDEP Trimble Reference Station. The URL is <ftp://ftp.dep.state.fl.us/pub/gps/>. The page title is "FTP directory /pub/gps/ at ftp.dep.state.fl.us". The interface includes a sidebar with navigation links: File, Edit, View, Favorites, Tools, and Help. The main content area displays a directory listing of files.

Directory	Almanac Files
01/23/2014 12:00AM	2,216,100 FDEP201604010000T.zip
01/23/2014 12:00AM	2,364,718 FDEP201604010100T.zip
04/01/2016 12:00AM	2,610,197 FDEP201604010200T.zip
04/01/2016 12:00AM	2,496,119 FDEP201604010300T.zip
04/01/2016 12:00AM	2,654,821 FDEP201604010400T.zip
04/01/2016 12:00AM	2,498,125 FDEP201604010500T.zip
04/01/2016 12:00AM	2,539,072 FDEP201604010600T.zip
04/01/2016 12:00AM	2,218,006 FDEP201604010700T.zip
04/01/2016 12:00AM	2,103,633 FDEP201604010800T.zip
04/01/2016 12:00AM	2,057,190 FDEP201604010900T.zip
04/01/2016 12:00AM	2,491,320 FDEP201604011000T.zip
04/01/2016 12:00AM	2,797,161 FDEP201604011100T.zip
04/01/2016 12:00AM	2,793,744 FDEP201604011200T.zip
04/01/2016 12:00AM	2,727,701 FDEP201604011300T.zip
04/01/2016 12:00AM	2,667,858 FDEP201604011400T.zip
04/01/2016 04:05PM	2,498,498 FDEP201604011500T.zip
04/01/2016 05:05PM	2,533,873 FDEP201604011600T.zip
04/01/2016 06:05PM	2,206,624 FDEP201604011700T.zip
04/01/2016 07:05PM	2,497,197 FDEP201604011800T.zip
04/01/2016 08:05PM	2,531,478 FDEP201604011900T.zip
04/01/2016 09:05PM	2,496,189 FDEP201604012000T.zip
04/01/2016 10:05PM	2,423,922 FDEP201604012100T.zip
04/01/2016 11:05PM	2,421,950 FDEP201604012200T.zip
04/02/2016 12:05AM	2,185,791 FDEP201604012300T.zip
04/02/2016 01:05AM	2,411,637 FDEP201604020000T.zip
04/02/2016 02:05AM	2,544,557 FDEP201604020100T.zip
04/02/2016 03:05AM	2,633,926 FDEP201604020200T.zip
04/02/2016 04:05AM	2,451,969 FDEP201604020300T.zip
04/02/2016 05:05AM	2,651,332 FDEP201604020400T.zip
04/02/2016 06:05AM	2,520,638 FDEP201604020500T.zip
04/02/2016 07:05AM	2,536,048 FDEP201604020600T.zip
04/02/2016 08:05AM	2,202,000 FDEP201604020700T.zip
04/02/2016 09:05AM	2,078,221 FDEP201604020800T.zip
04/02/2016 10:05AM	2,136,413 FDEP201604020900T.zip
04/02/2016 11:05AM	2,517,992 FDEP201604021000T.zip
04/02/2016 12:05PM	2,745,662 FDEP201604021100T.zip

2. Office Preparation

Terms to know

Terms to know

GPS Data Dictionary is an electronic form of attribute questions for a particular feature.

.ddf = Data Dictionary File

Terms to know

GPS Data Dictionary is an electronic form of attribute questions for a particular feature.

.ddf = Data Dictionary File

GPS Import File is a data file that contains the random selects for a particular resource.

These files are named by project name

.imp = Import File

The Import files are used to navigate to sampling stations.

Office tasks

- Transfer Data Dictionary to receiver.**
- Transfer Import file to receiver.**
- Check receiver settings.**

Trimble GeoExplorer 6000 or GeoExplorer 7x



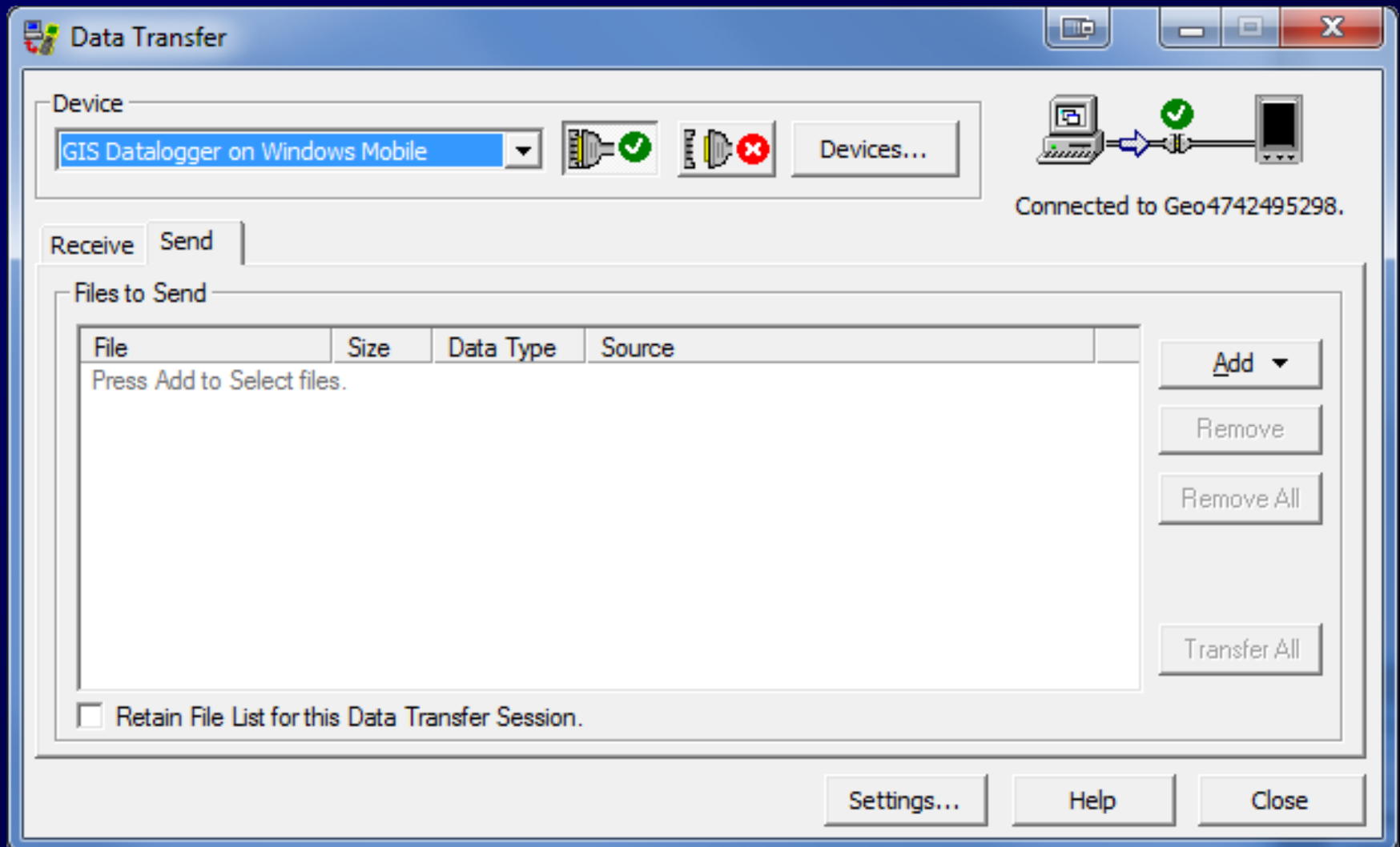
**This equipment uses
both the GPS and
GLONASS systems,**

**Therefore it is true
GNSS equipment**

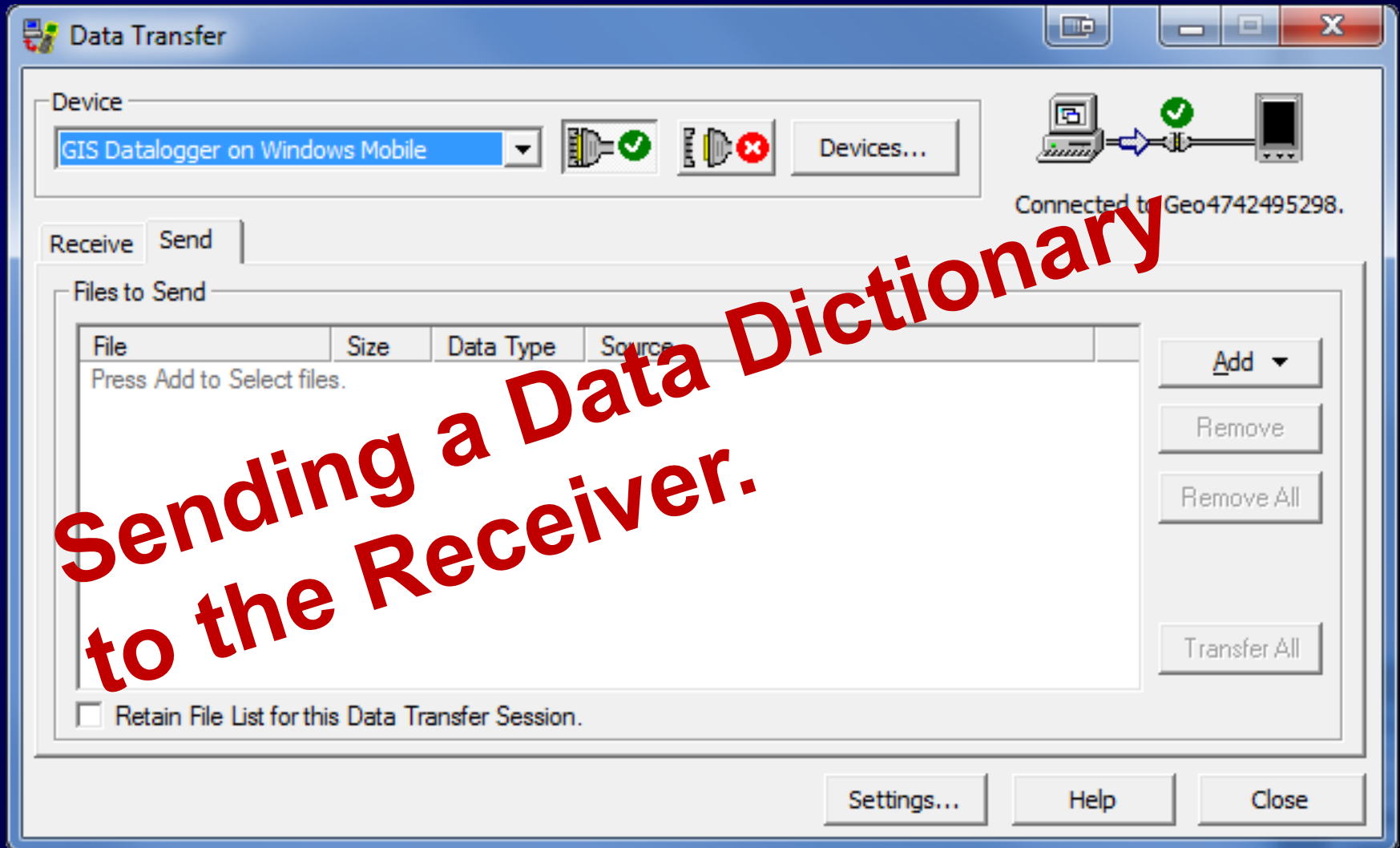
Data Transfers

- Use the Trimble Data Transfer Utility software to move files to and from the receiver by means of a USB cable.

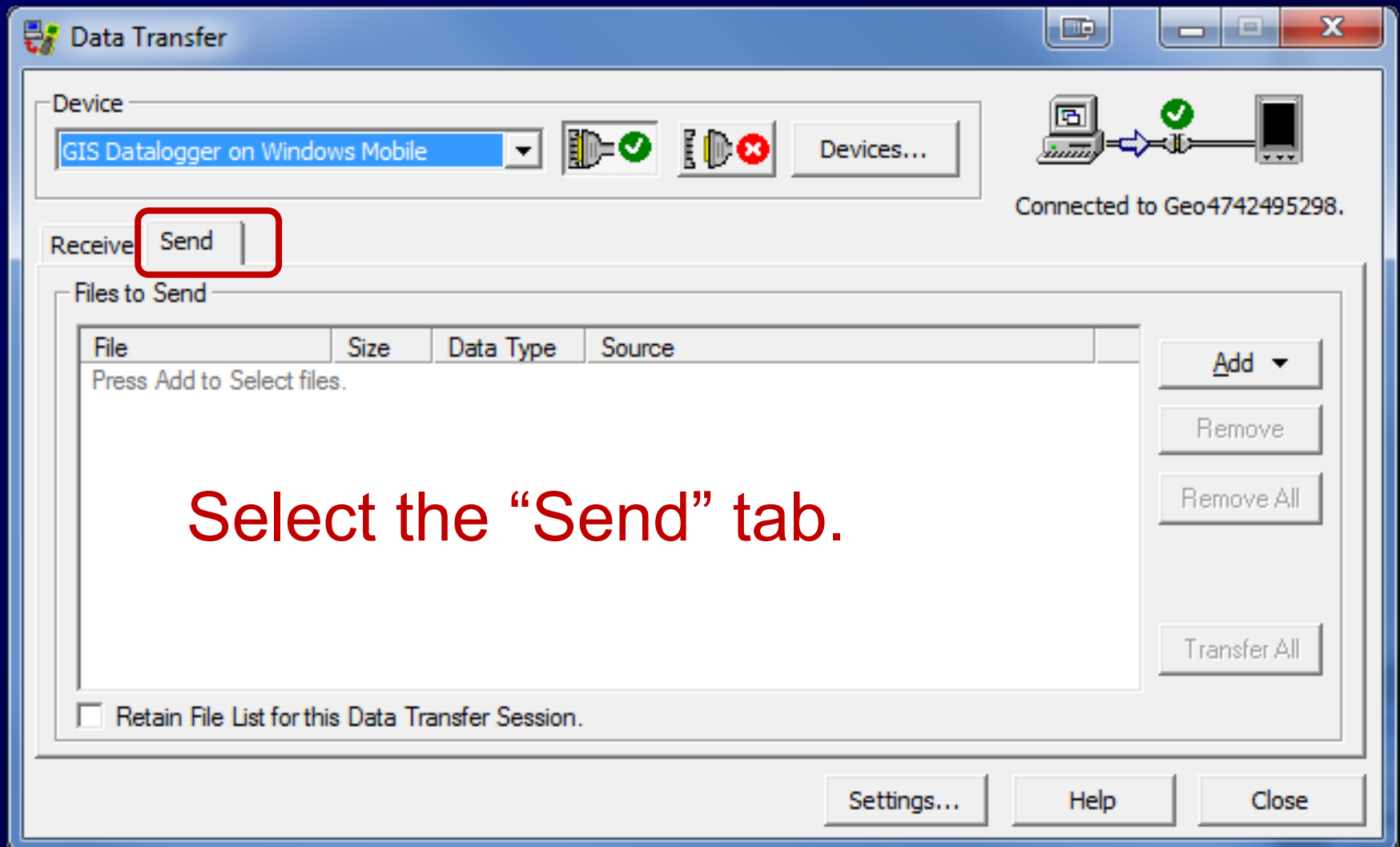
Data Transfer Utility



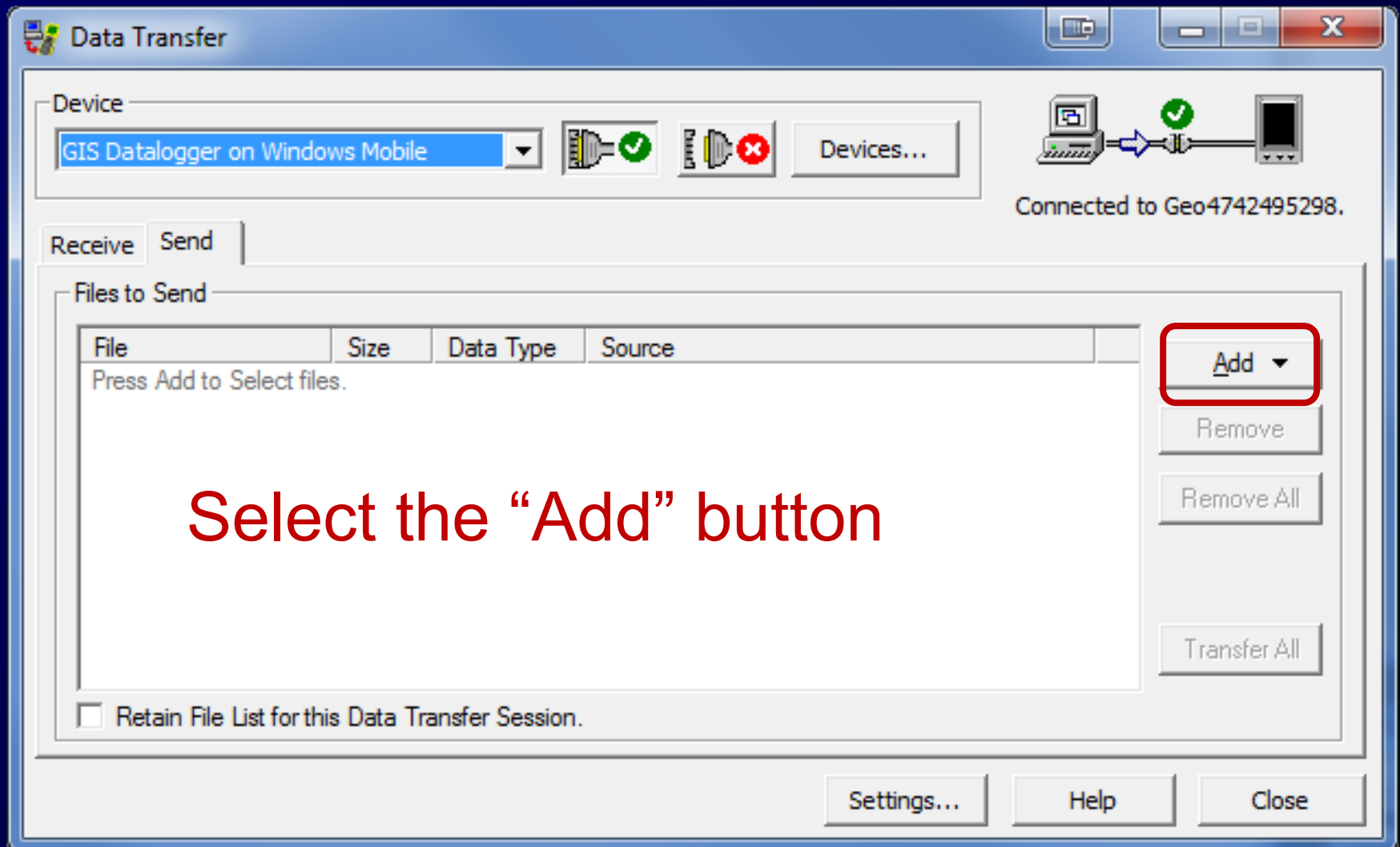
Data Transfer Utility



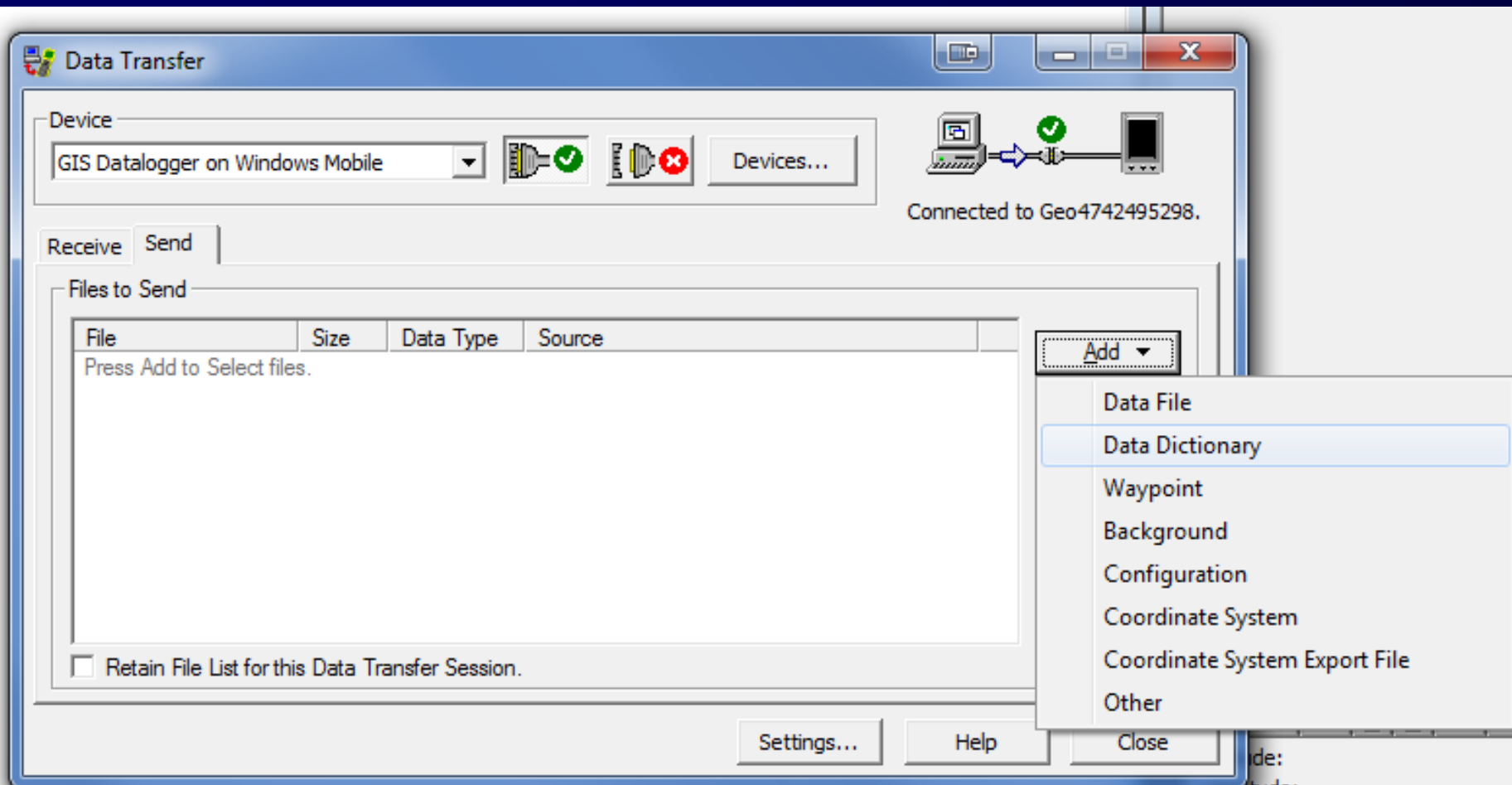
Data Dictionary Transfers



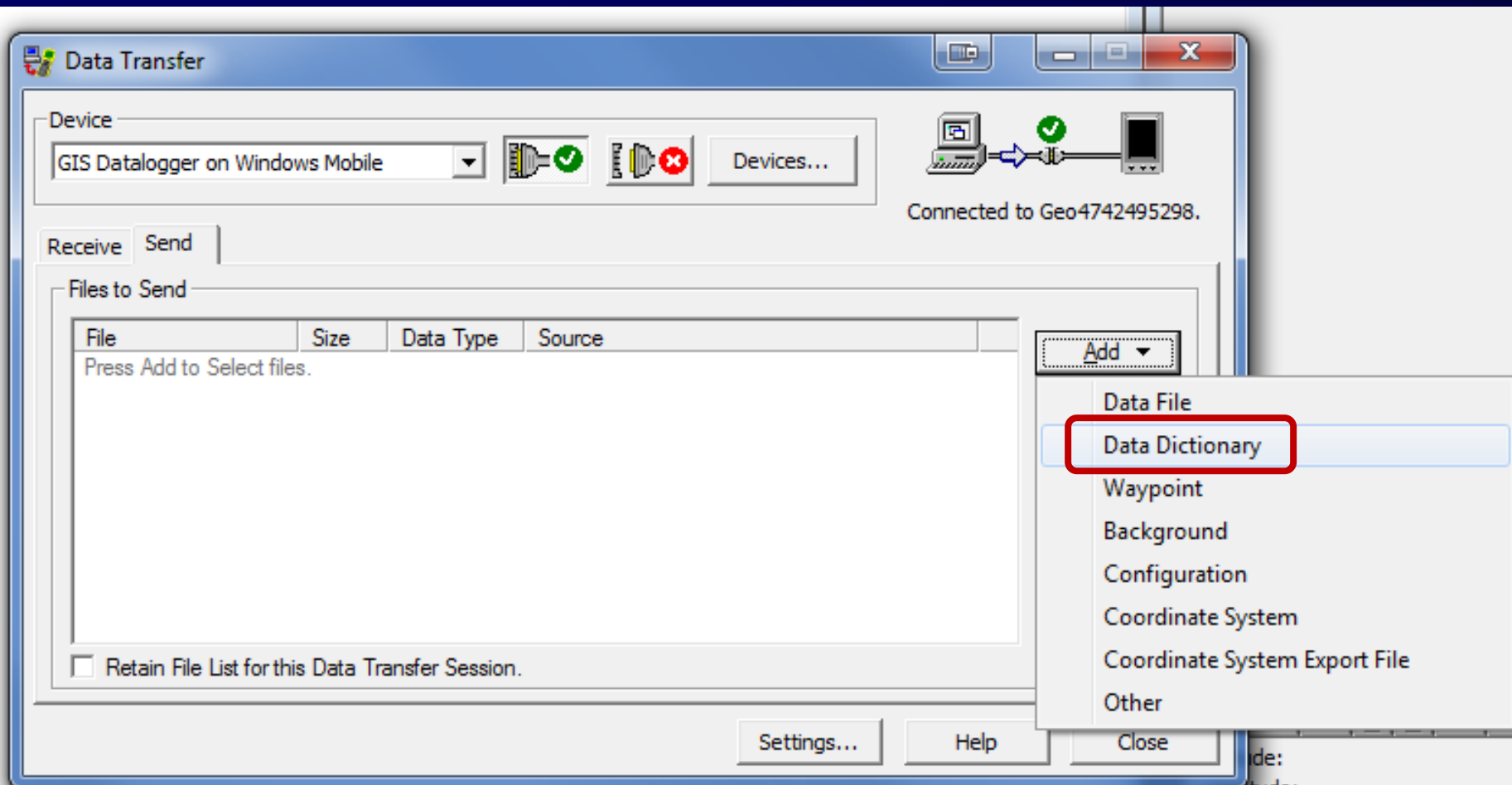
Data Dictionary Transfers



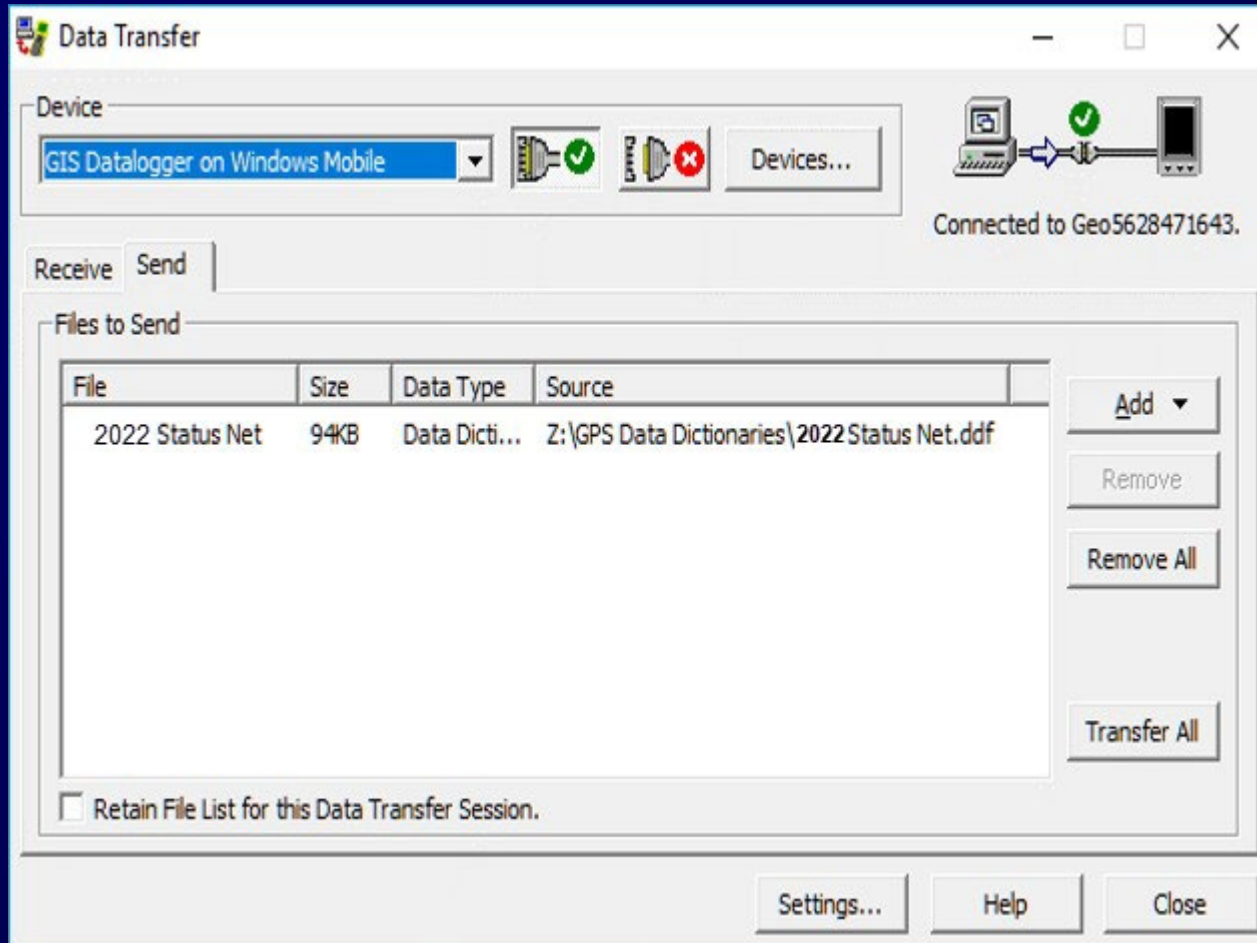
Data Dictionary Transfers



Data Dictionary Transfers

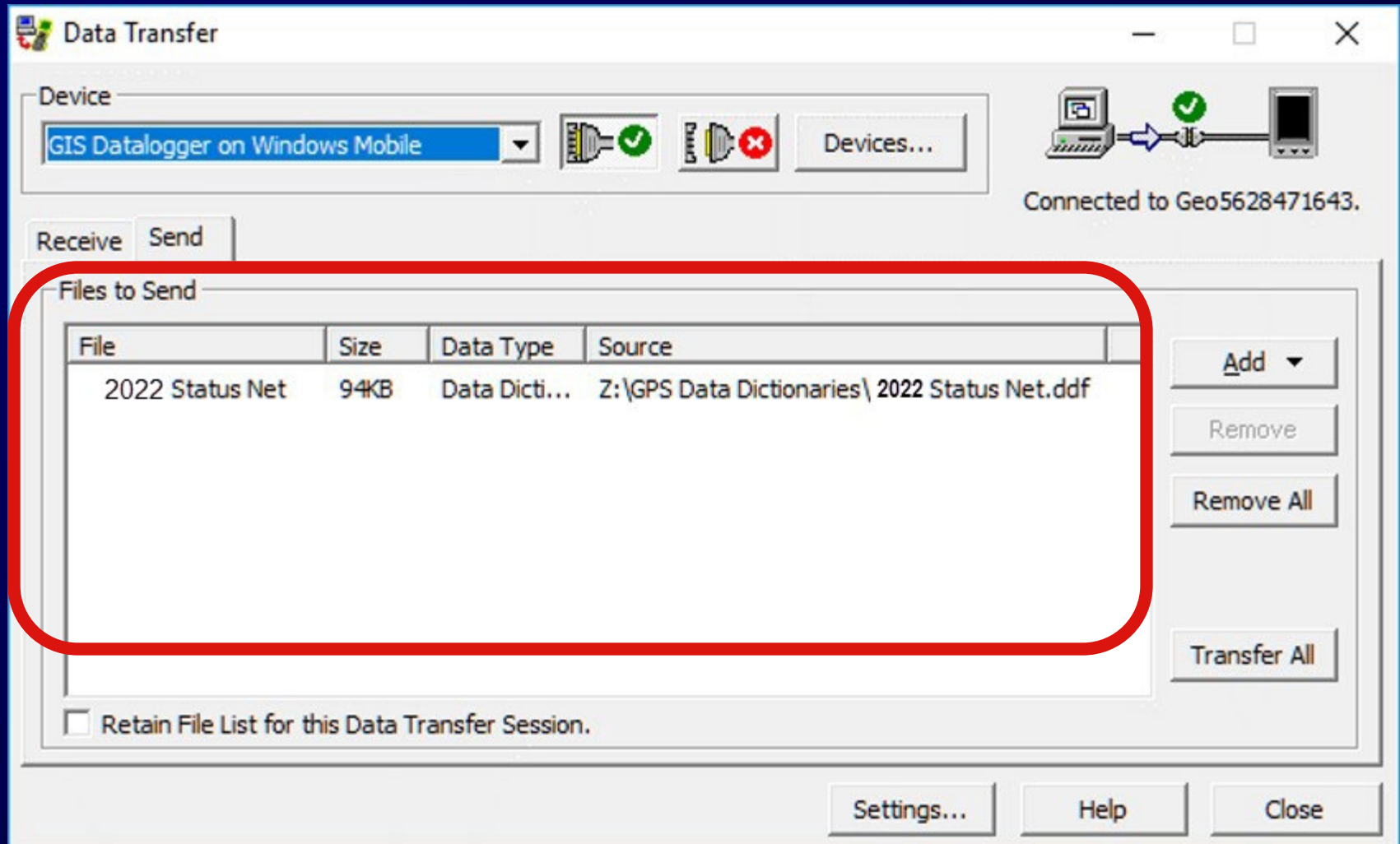


Data Dictionary Transfers



- **Select Proper Data Dictionary.**

Building the File Transfer Queue



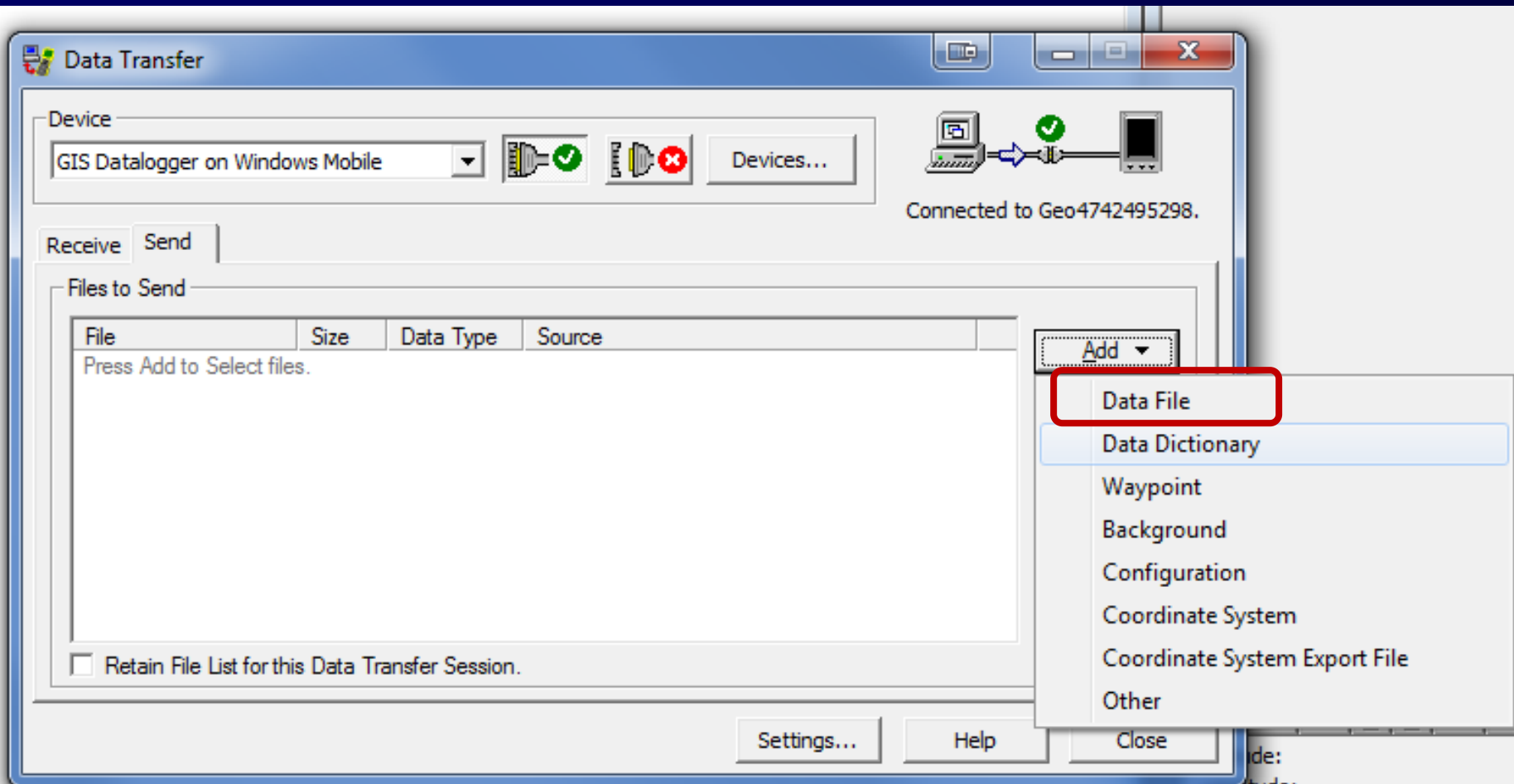
Using Import Data Files for Navigation

- **Navigating to random site locations using Import Data Files.**

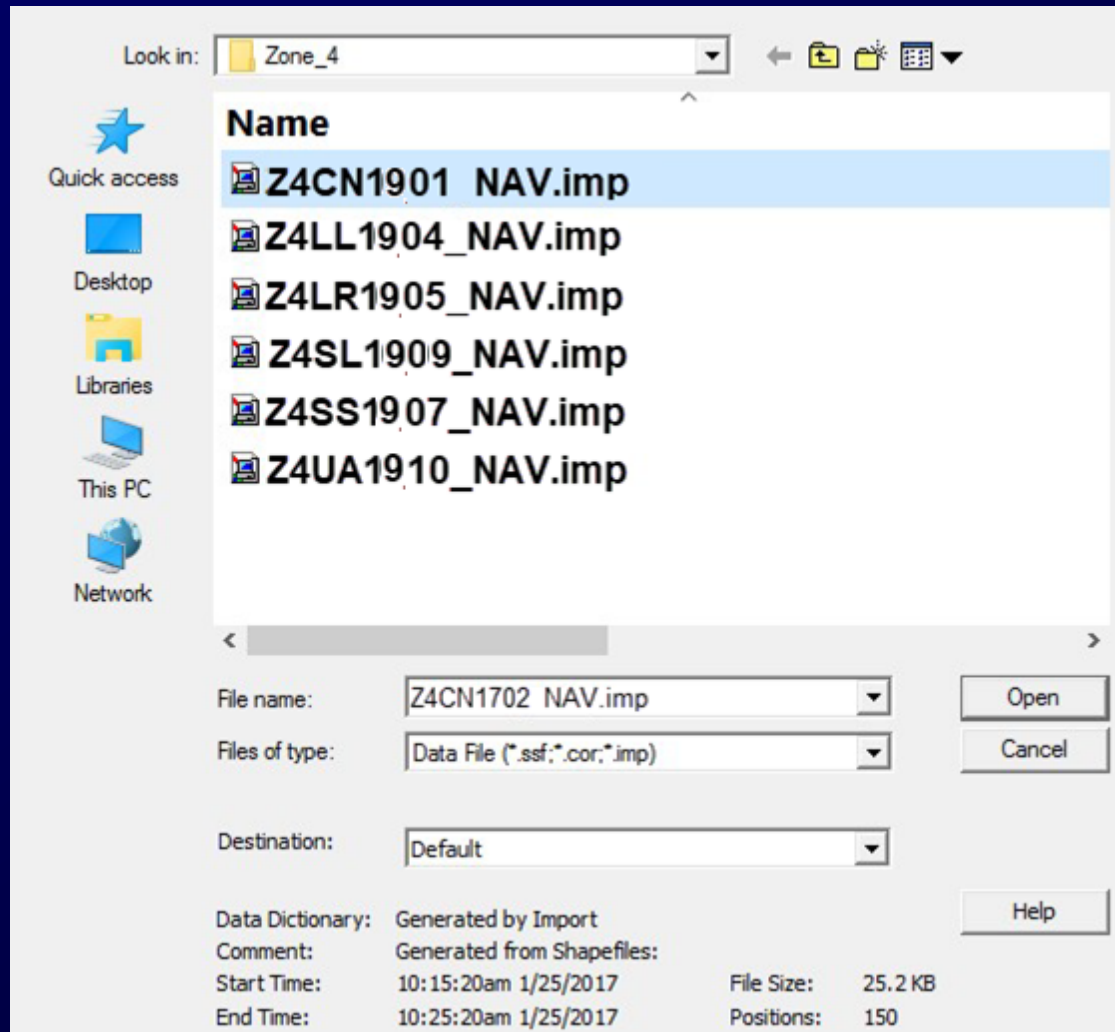
Using Import Data Files for Navigation

- **Navigating to random site locations using Import Data Files.**
- **Import Data Files are loaded into handheld GPS unit using the data transfer utility.**

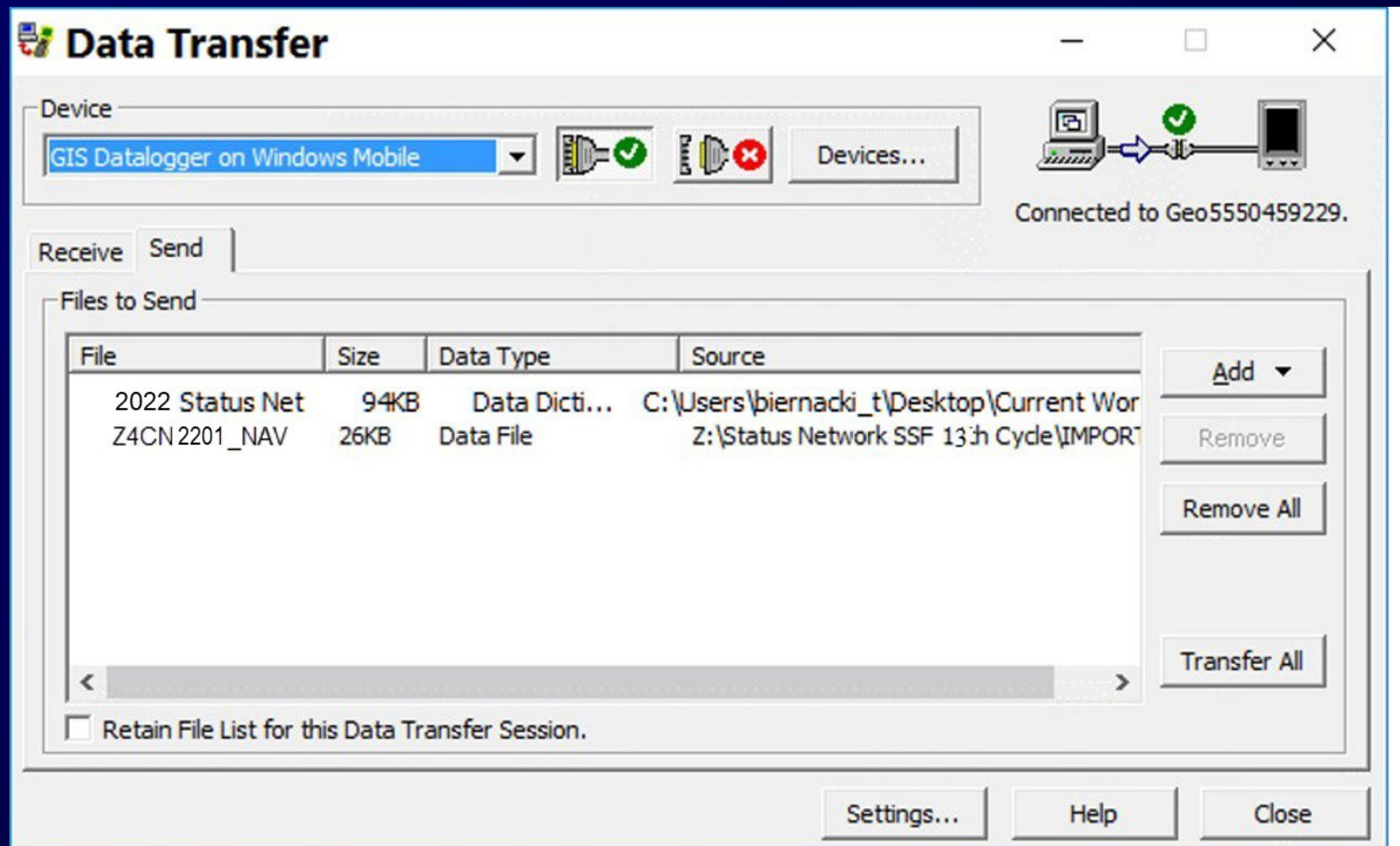
Import File Transfers



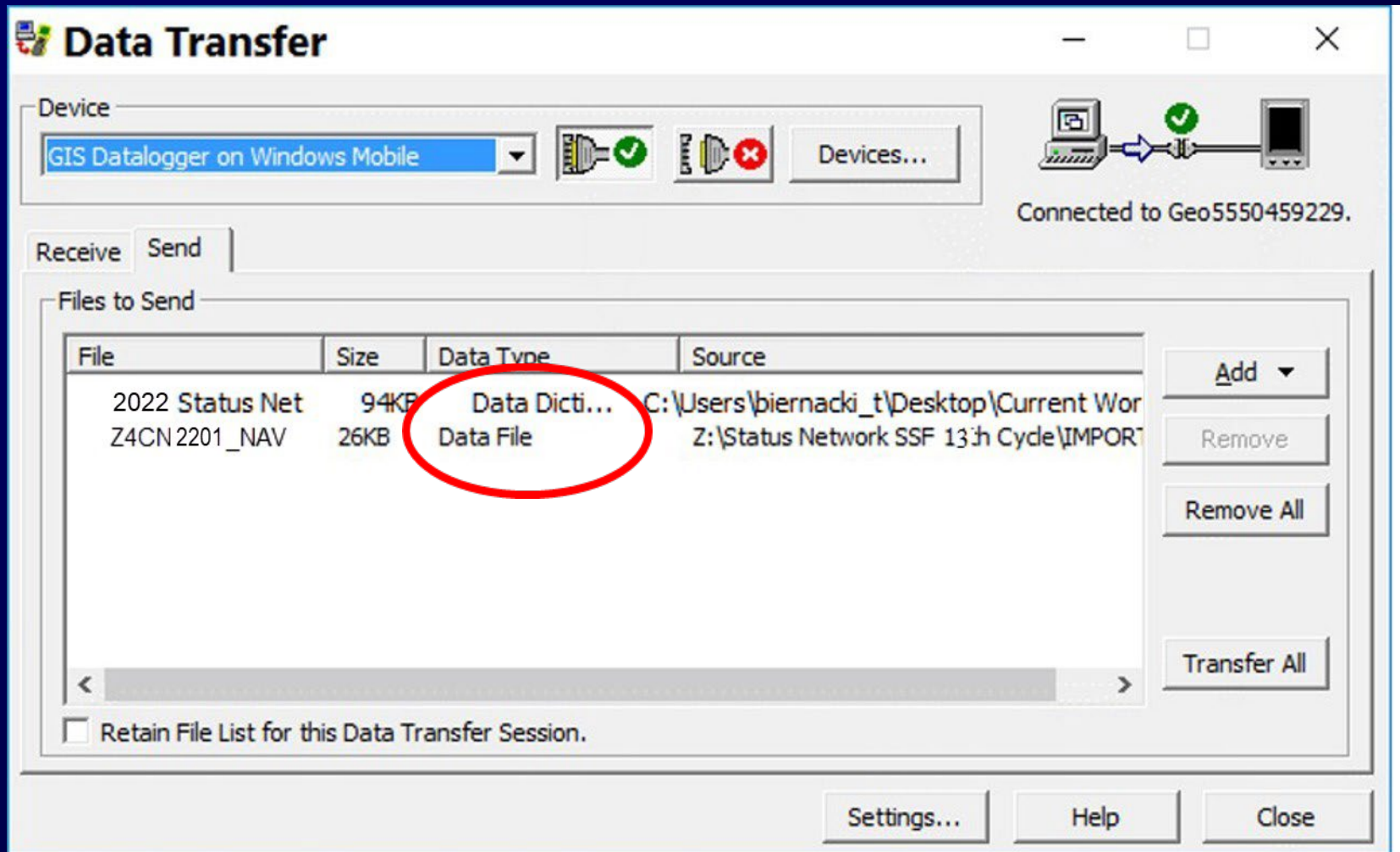
Select Data File



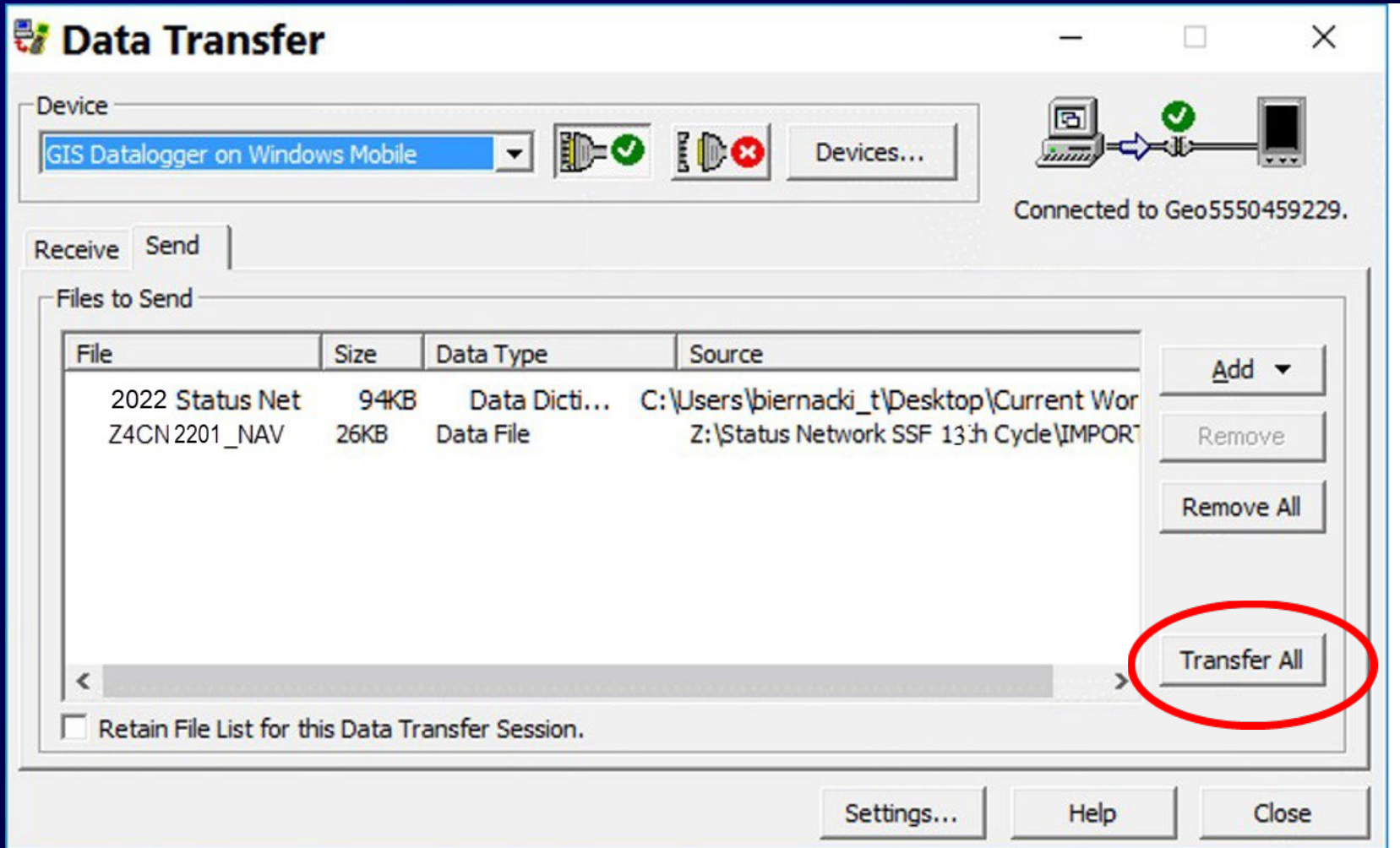
Now the Queue is loaded with a Data Dictionary and an Import File.



Now the Queue is loaded with a Data Dictionary and an Import File.



Now the Queue is loaded with a Data Dictionary and an Import File.



**Now you should check the
logging settings in
TerraSync.**

**Turn on Receiver and Start
Terrasync**

Trimble GeoExplorer Home Screen

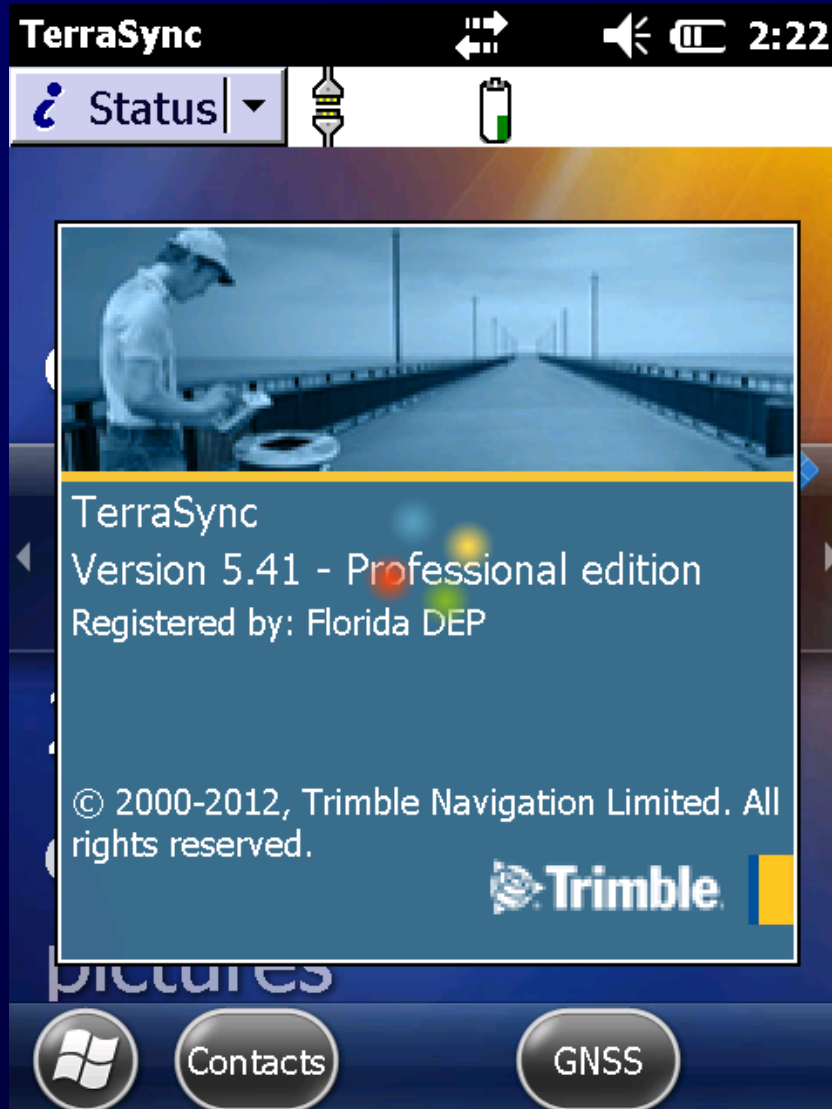


Trimble GeoExplorer Home Screen

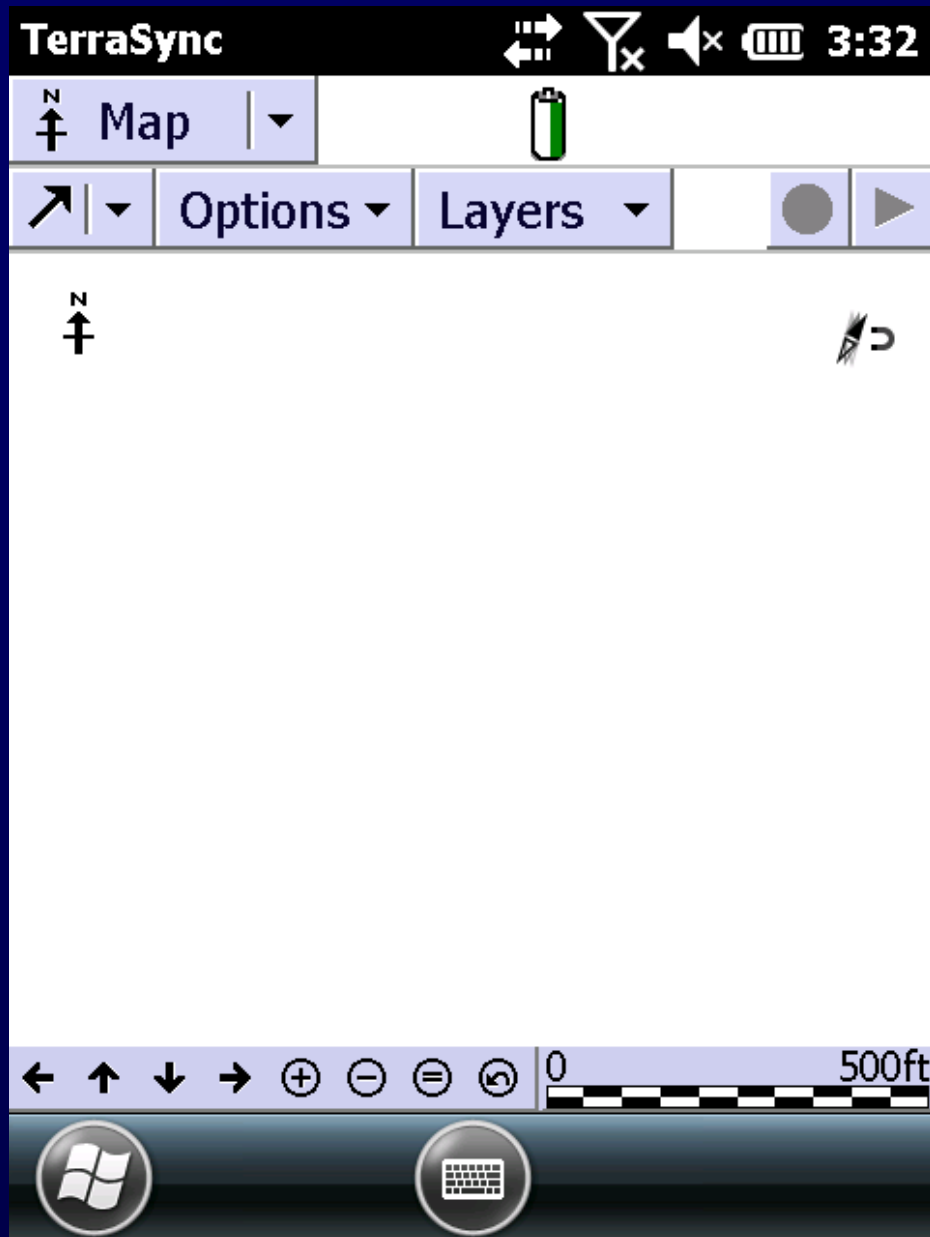


Tap HERE to start
TerraSync software

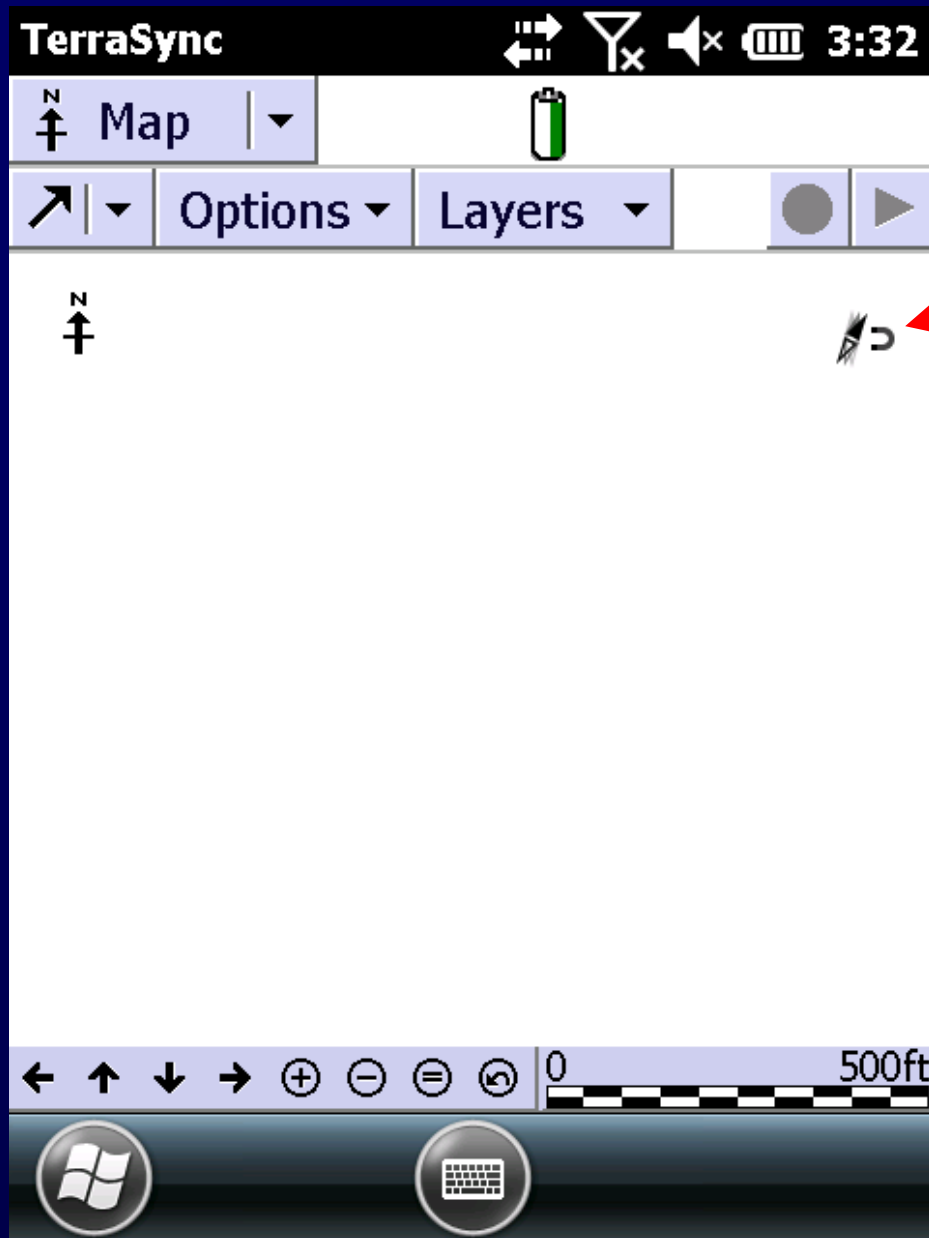
Trimble GeoExplorer TerraSync Startup



Turning on the GNSS Receiver

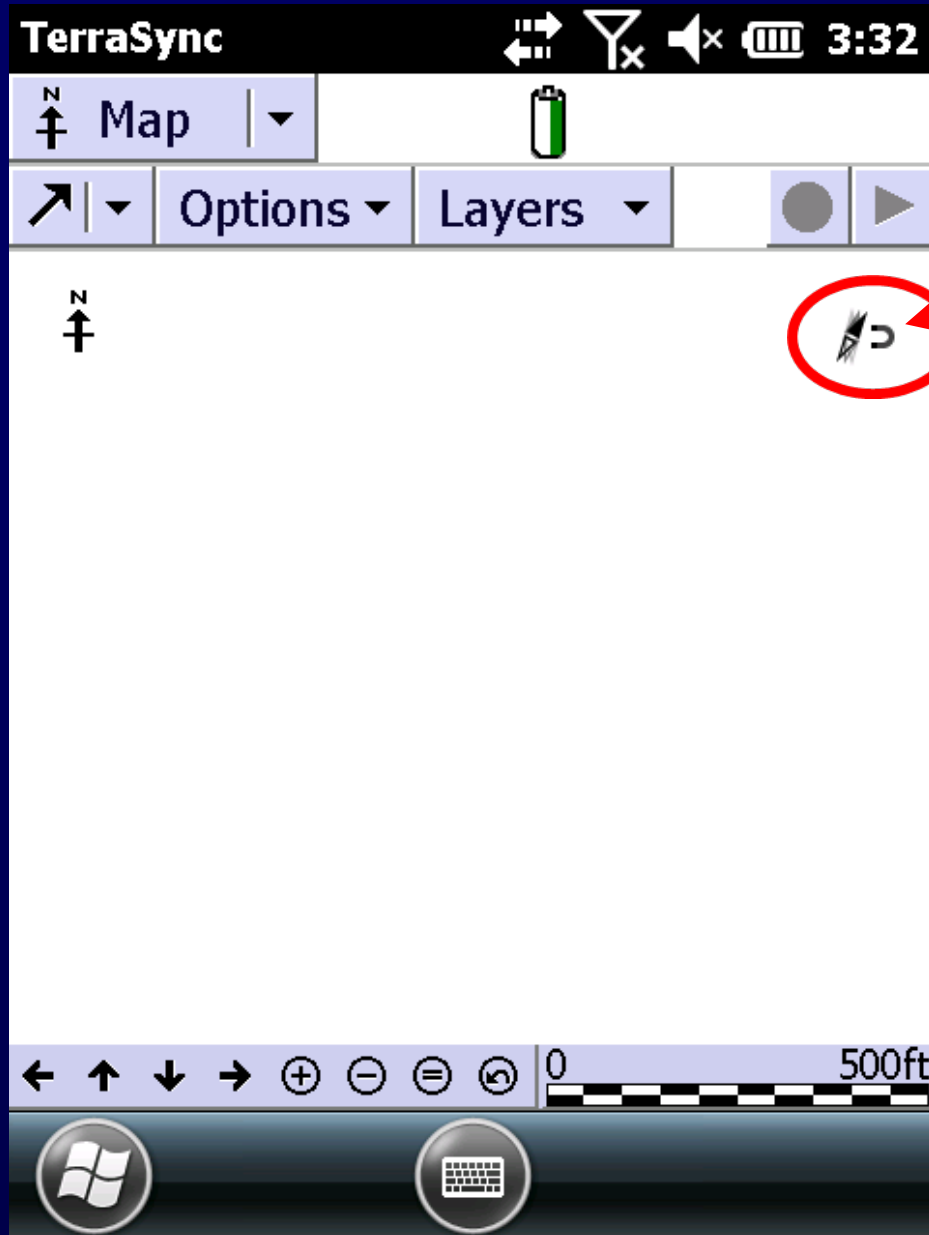


Turning on the GNSS Receiver



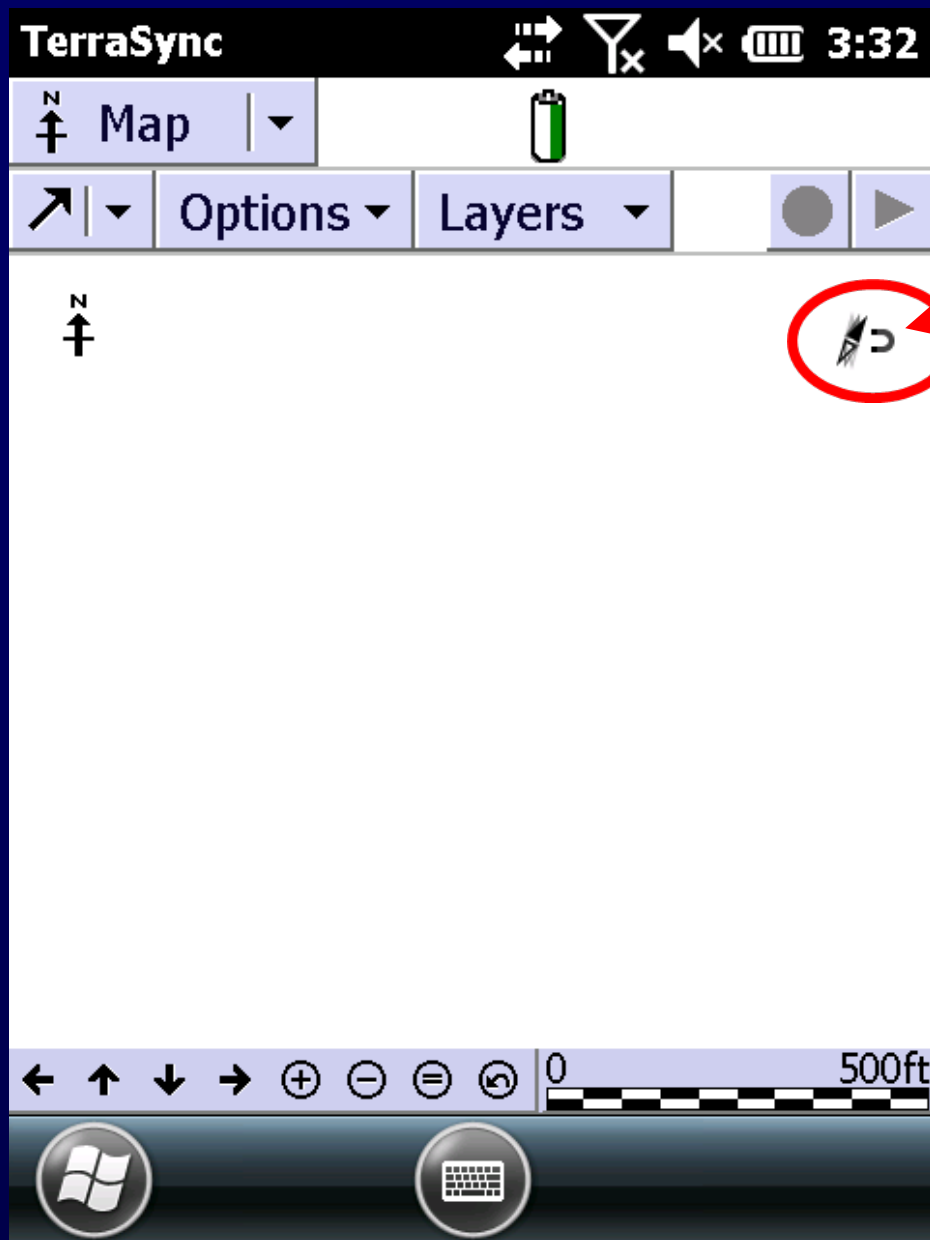
Note This Icon!

Trimble TerraSync



Note This Icon!

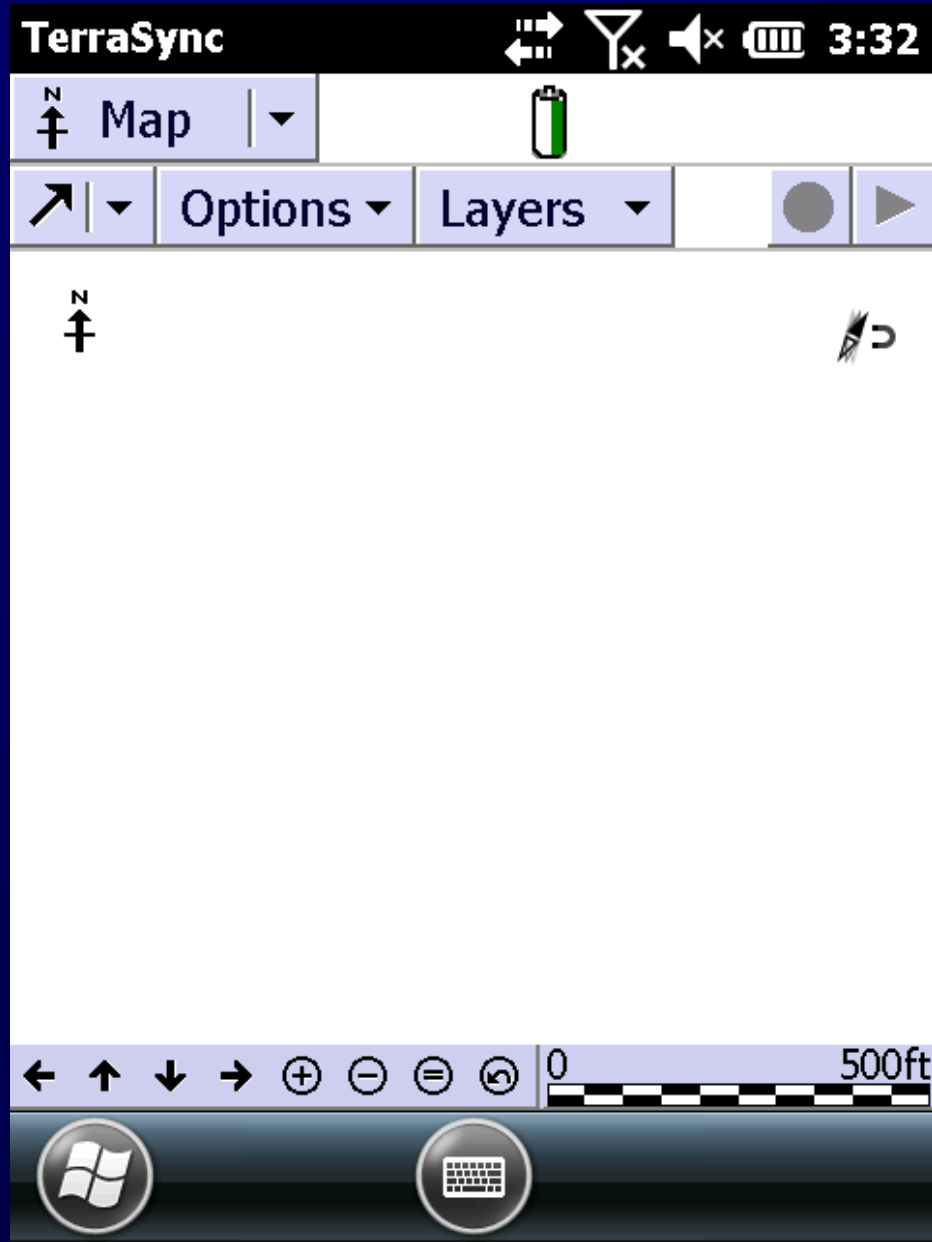
Trimble TerraSync



Note This Icon!

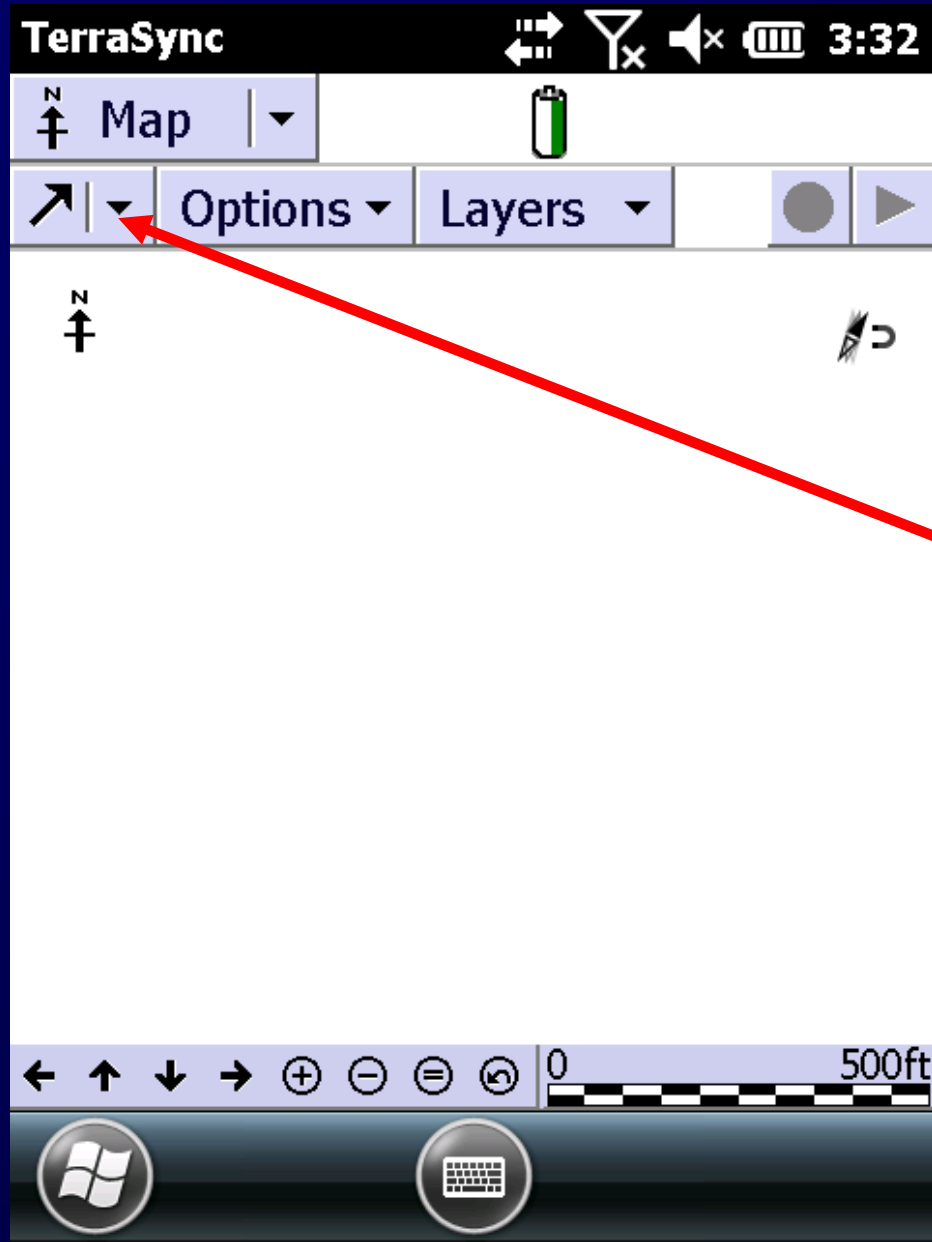
This means the receiver is not turned on.

Trimble TerraSync



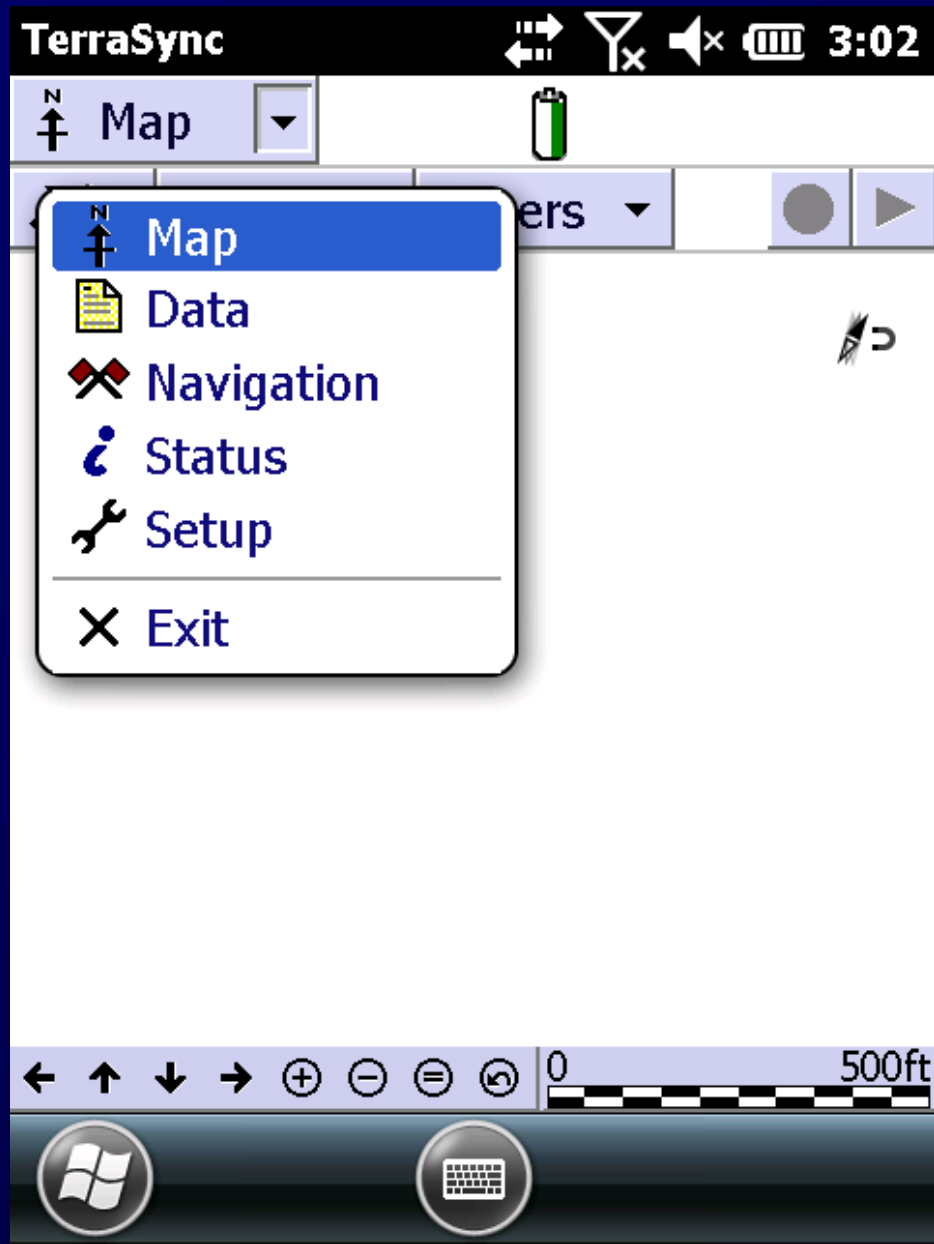
**The next slides
show how to
turn the
receiver on.**

Trimble TerraSync

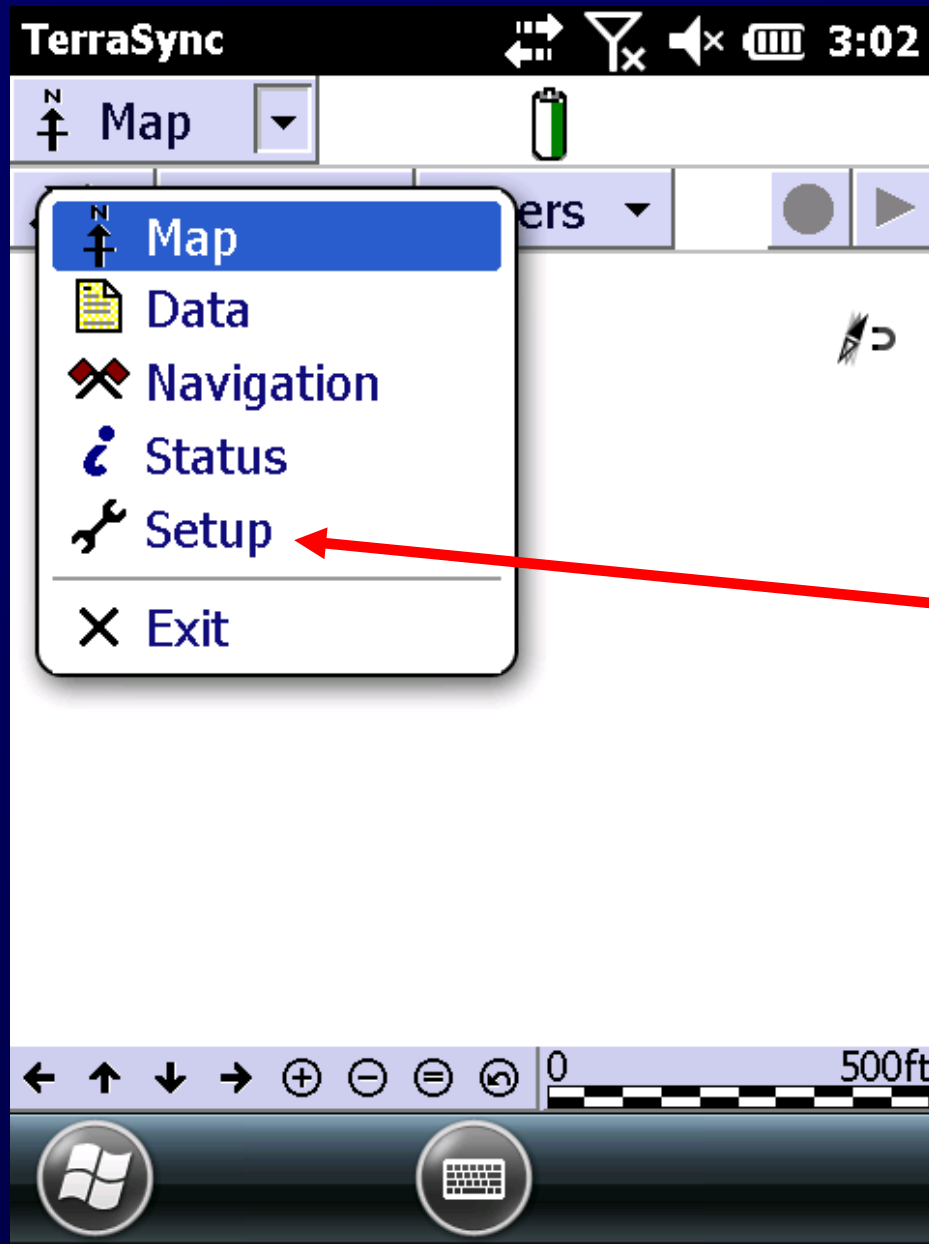


**Tap dropdown
arrow**

Trimble TerraSync



Trimble TerraSync



Tap Setup

Trimble TerraSync

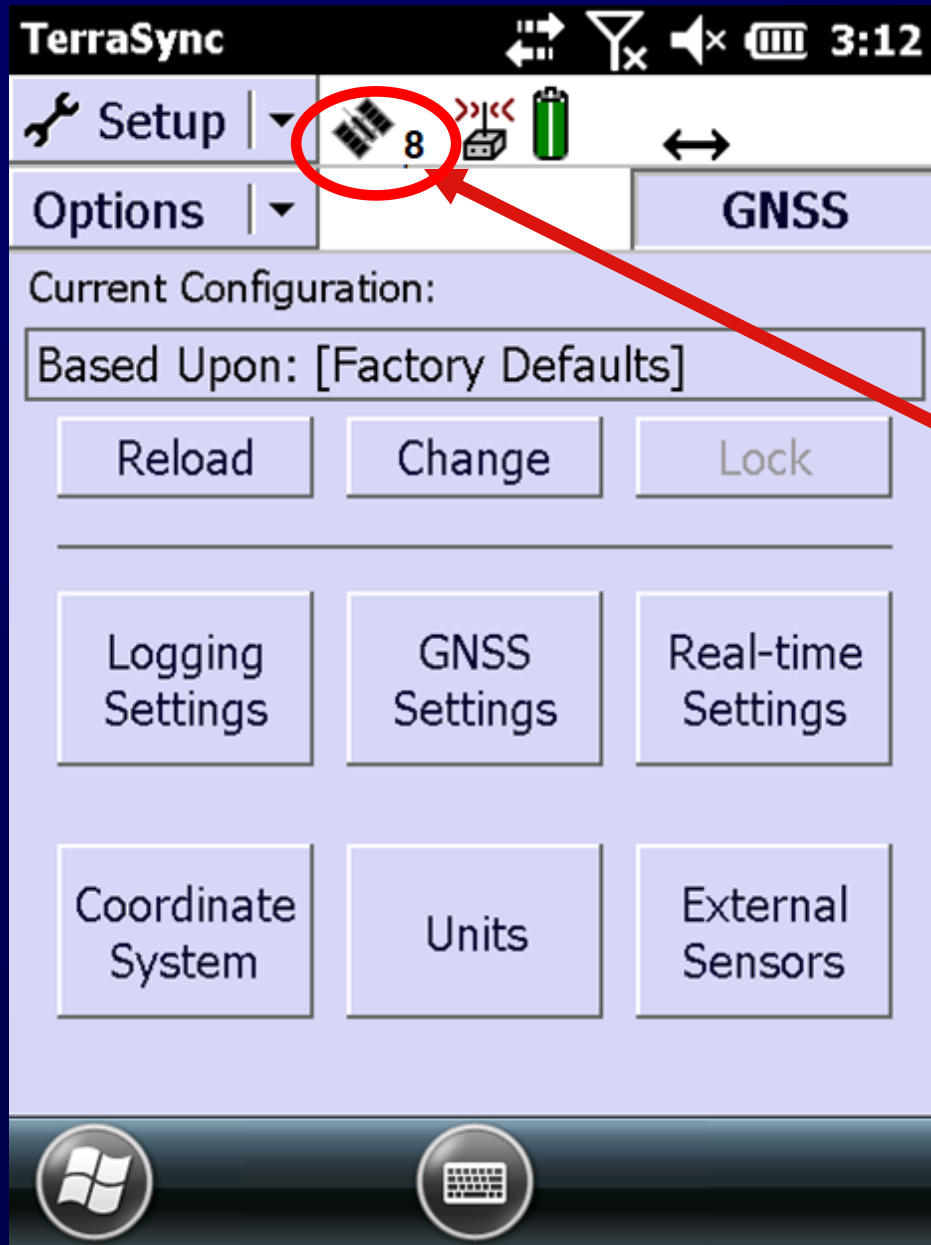


Tap here

Trimble TerraSync



Trimble TerraSync



Now the receiver is getting signals from 8 satellites

TerraSync



3:53



Map



8



Options



Layers



0

500ft



GPS Setup

**These settings should not change,
but it's good to check them in
case someone else changed
them.**

GPS Setup

**These settings should not change,
but it's good to check them in
case someone else changed
them.**

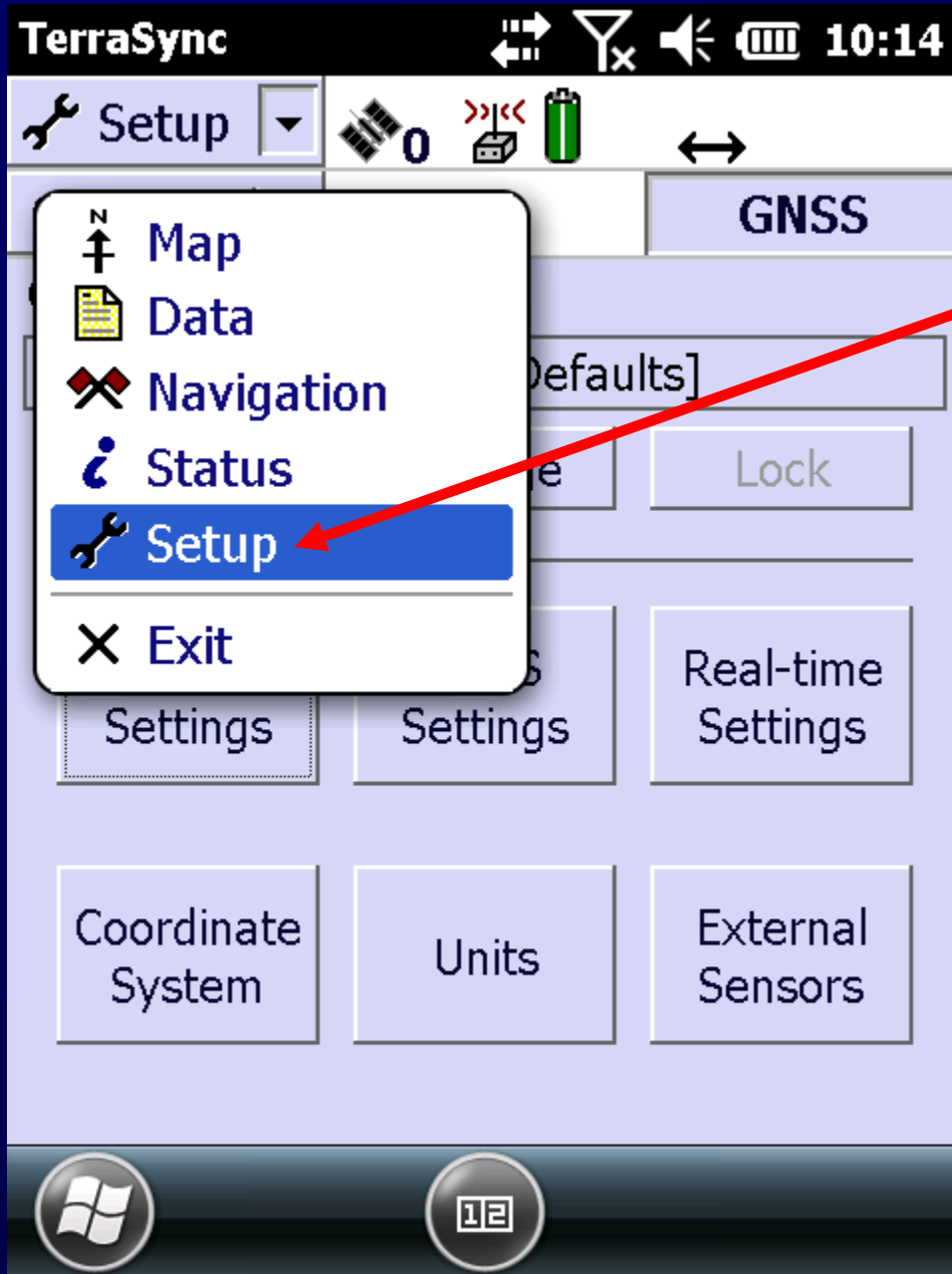
- Now we'll talk about
minimum positions**

Minimum Positions

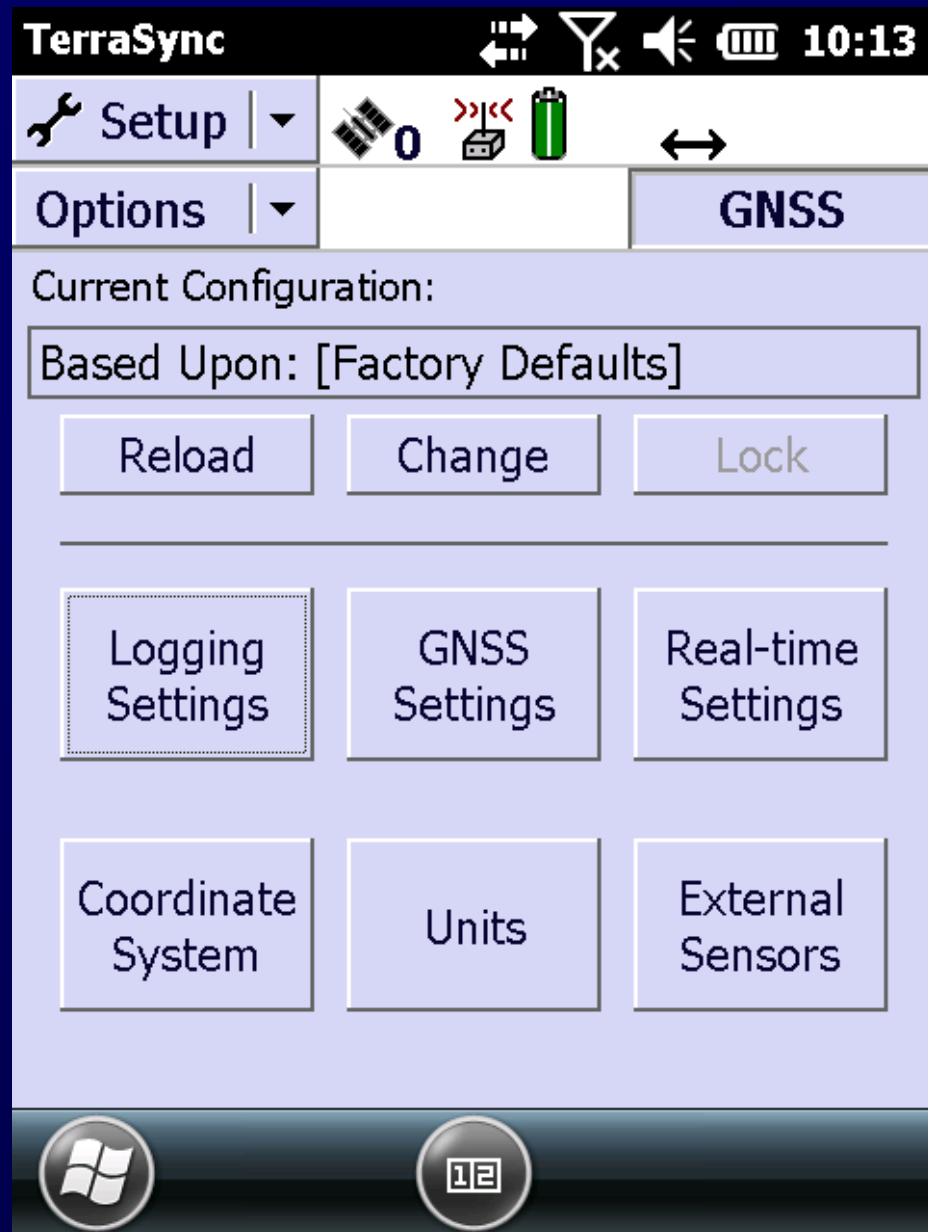
A minimum of 30 positions per point feature produces the best accuracy and is the Division Standard.

Setup

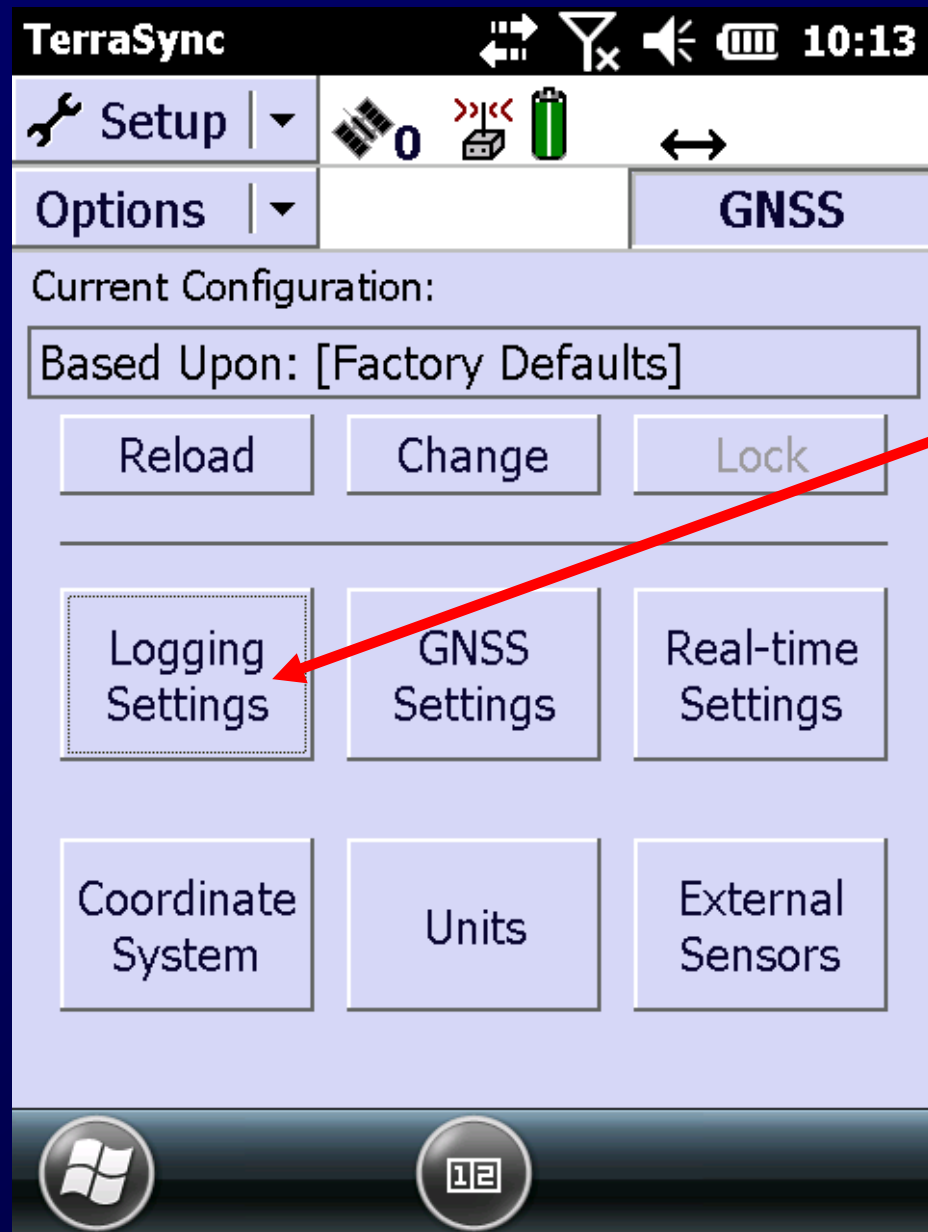
Select "Setup"



Minimum Positions

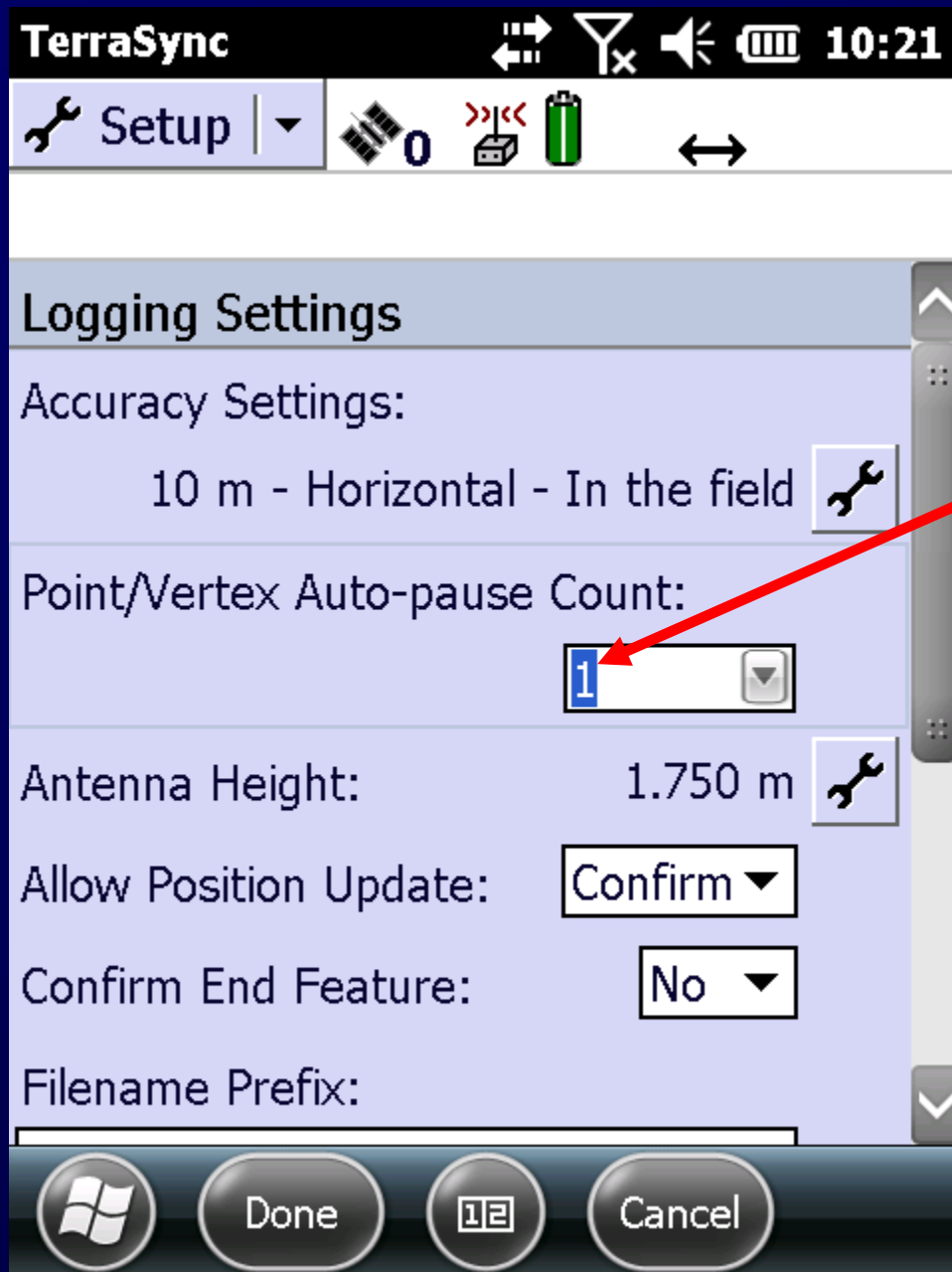


Minimum Positions



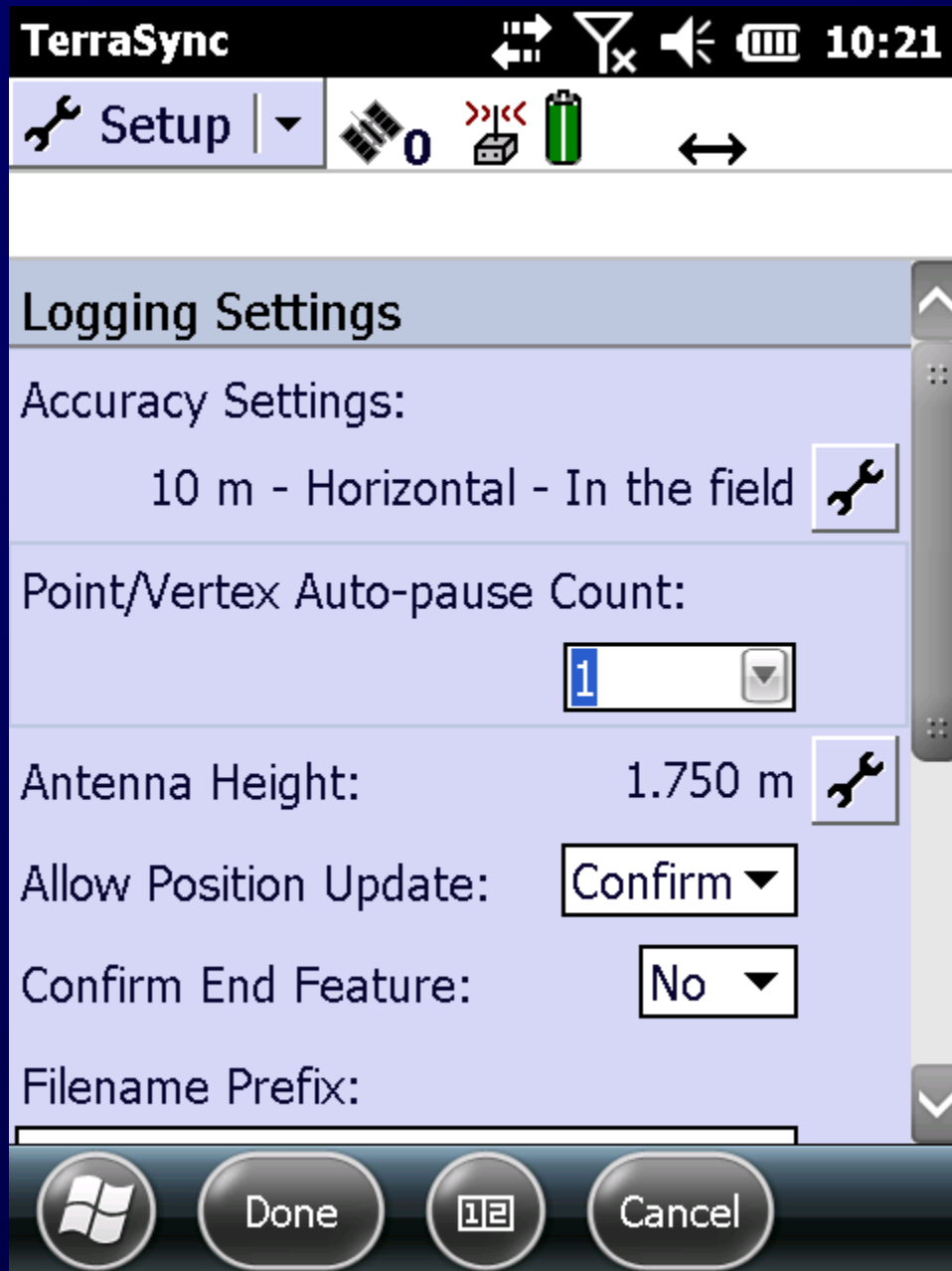
**Select
“Logging Settings”**

Minimum Positions



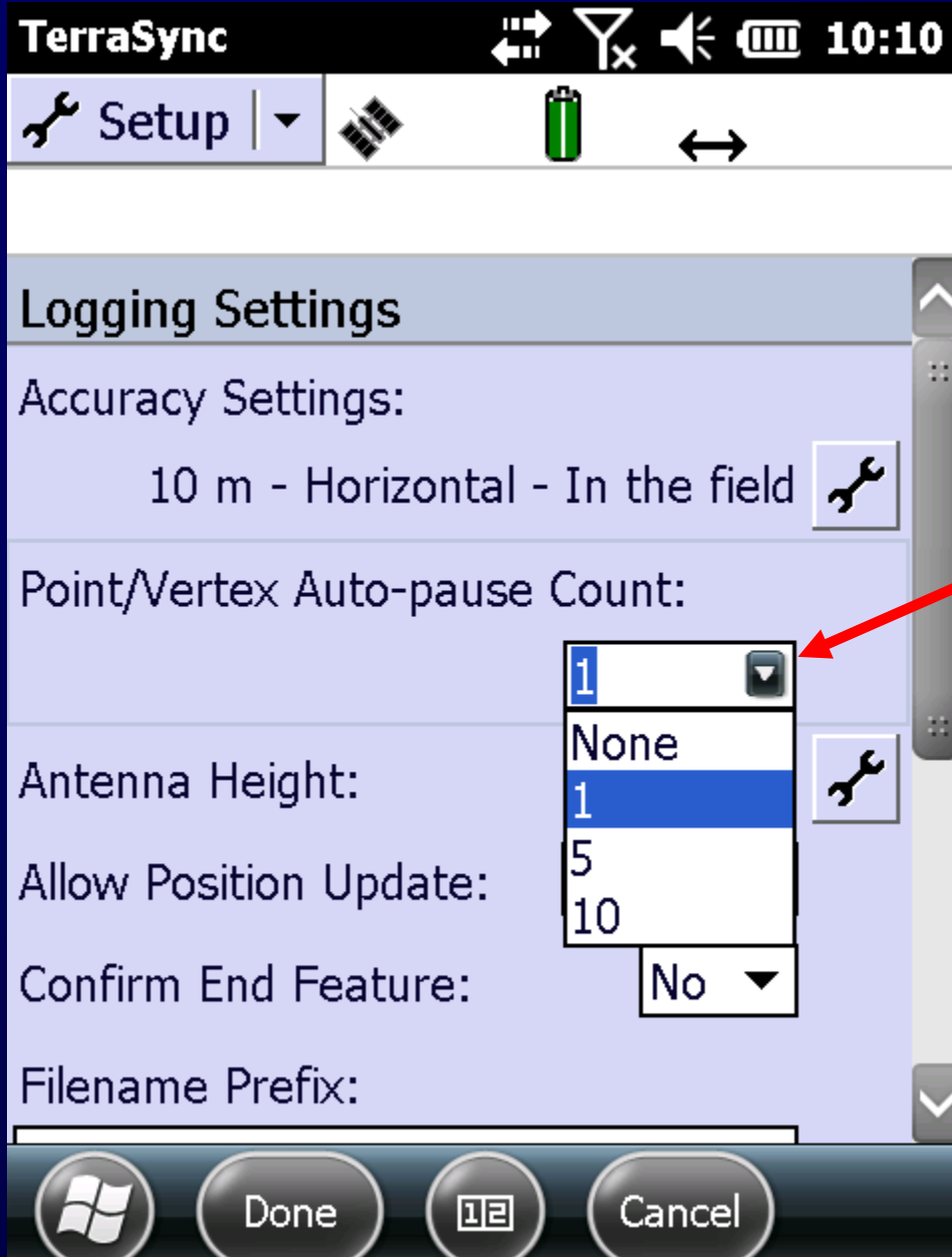
**The default is 1
Point/Vertex Auto-
pause Count:**

Minimum Positions



- The DEAR Standard is a count of 30 Positions. These positions are averaged to make a single point feature

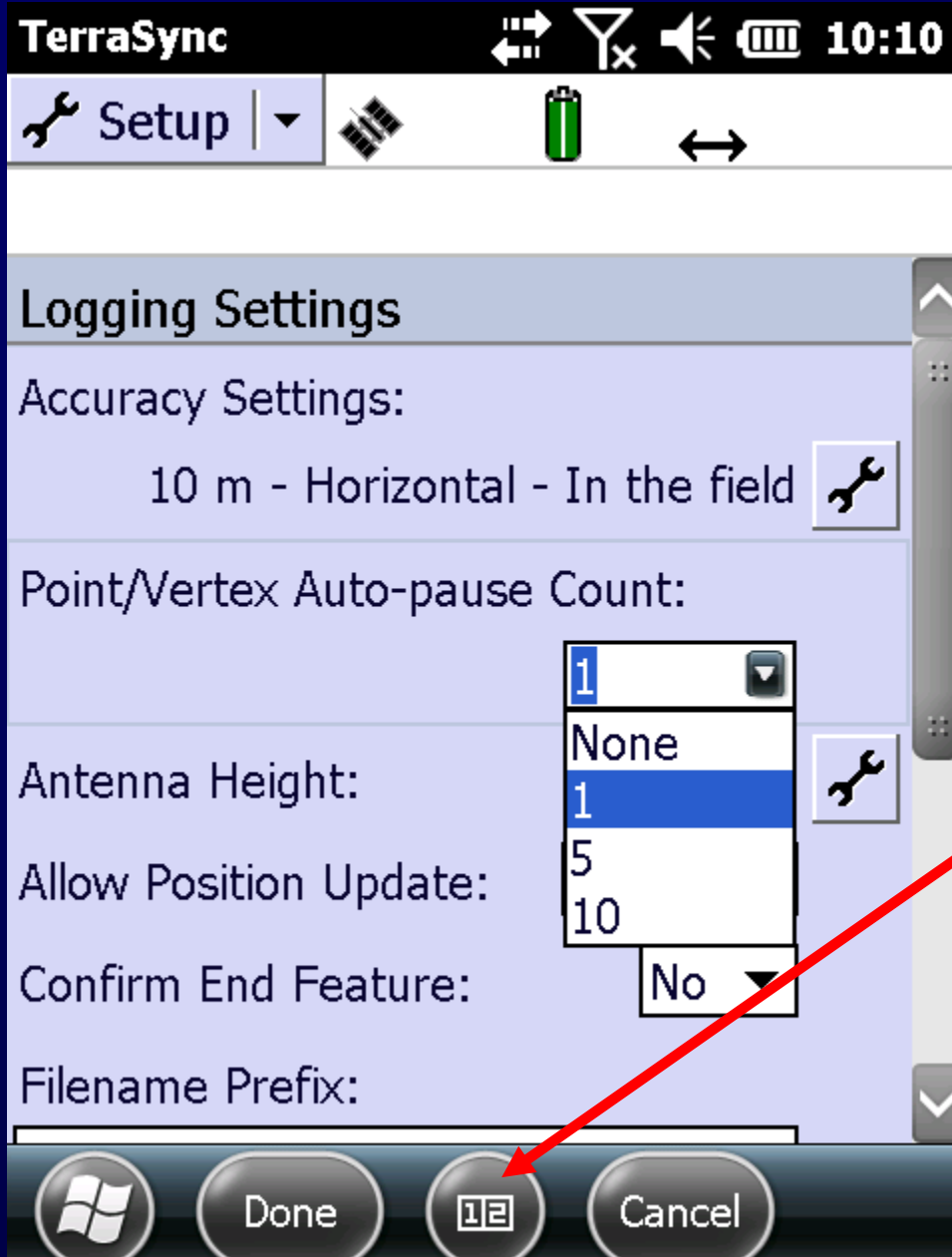
Minimum Positions



- Select drop down button.

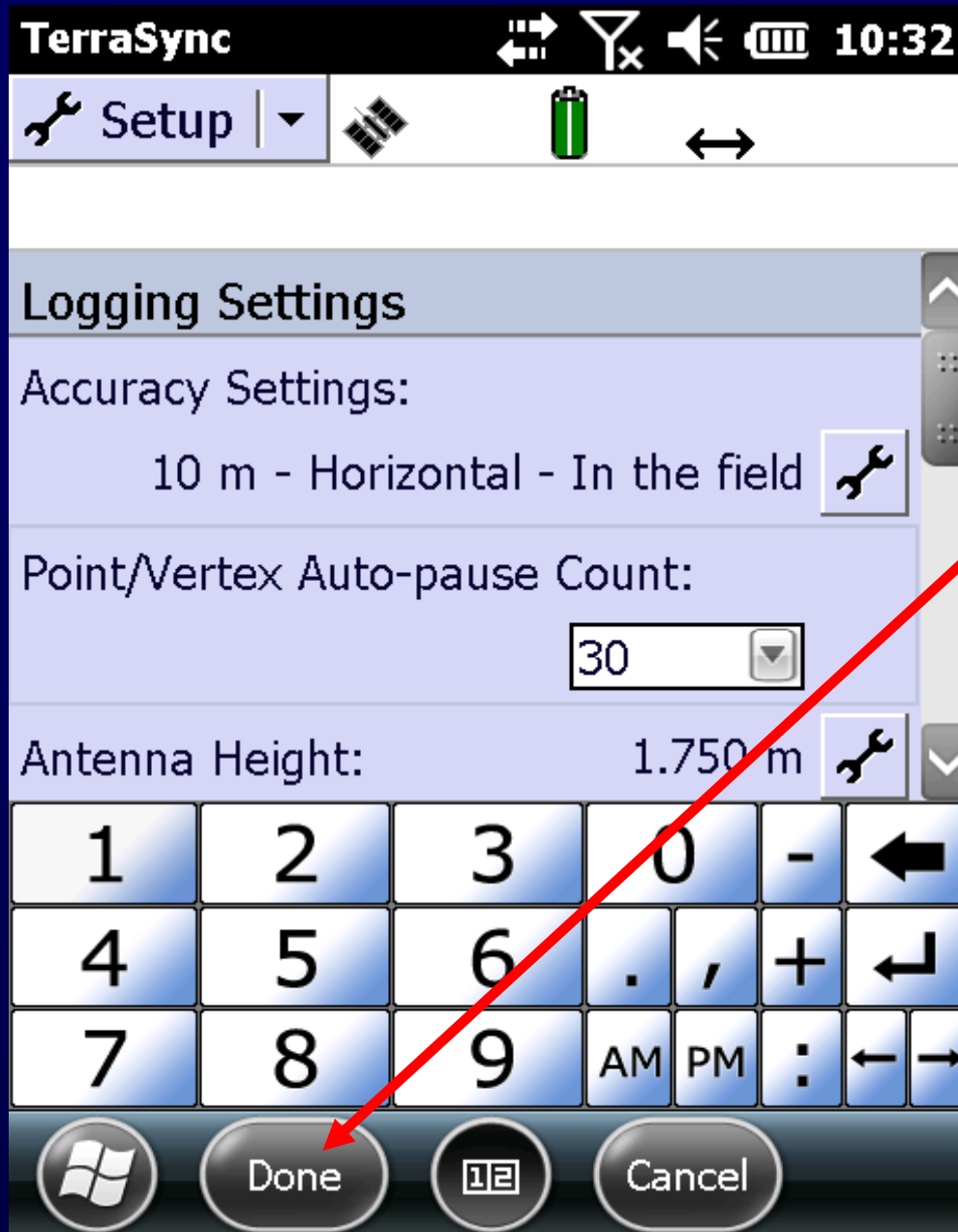
30 positions is not a choice in the menu.

Minimum Positions



- So, Use Number Pad to type in “30”

Minimum Positions



- Select “Done” When finished

Between Feature Logging

TerraSync    2:51

 Setup |   

Logging Settings 

Confirm End Feature:

Filename Prefix:

Waypoint Filename Prefix:

Between Feature Logging

Style:

Interval:

Between Feature Logging

TerraSync [Icons] 2:51

Setup [Icons]

Logging Settings

Confirm End Feature: No ▼

Filename Prefix:
R

Waypoint Filename Prefix:
W

Between Feature Logging

Style: Time ▼

Interval: Off ▼

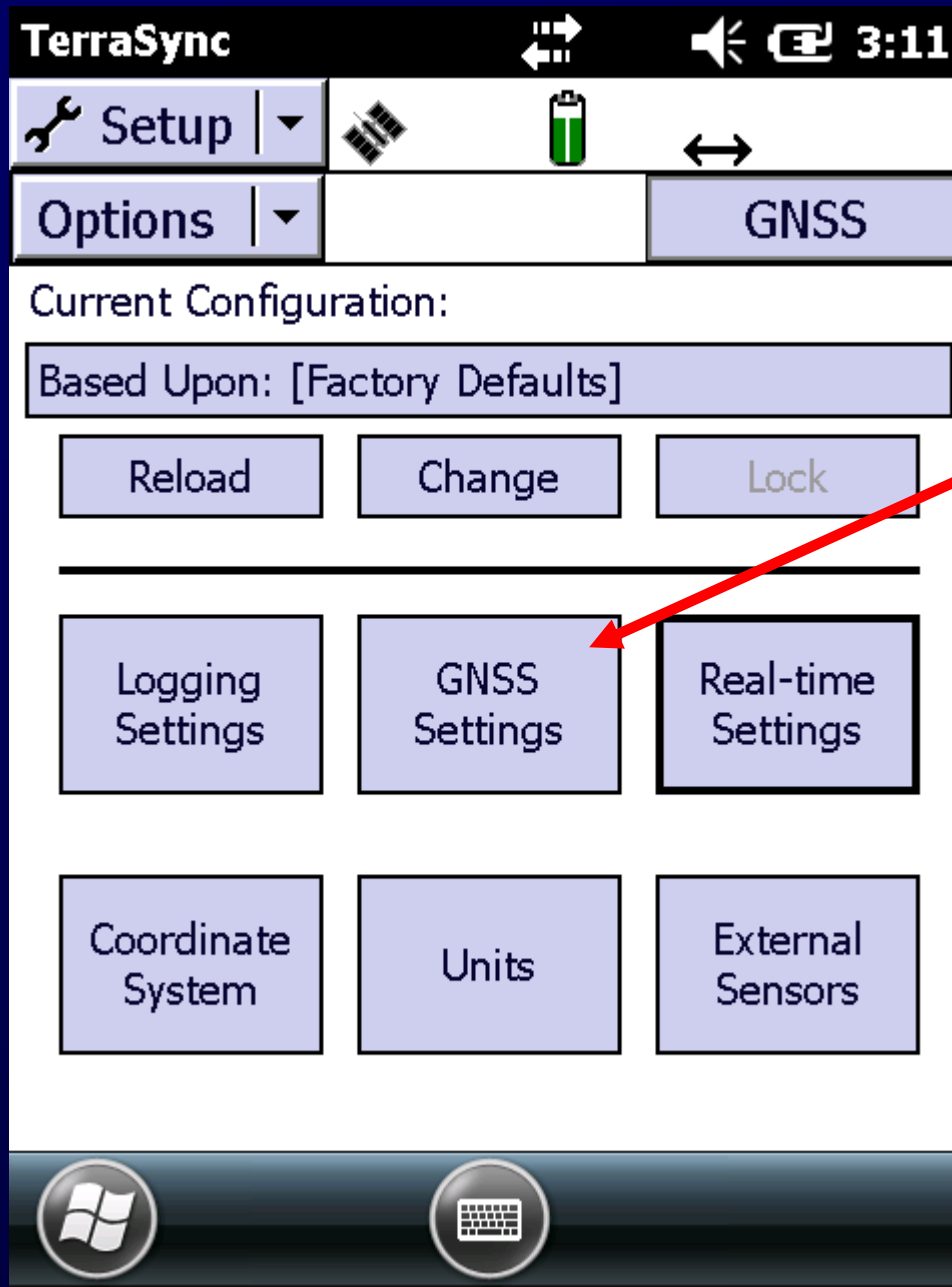
[Windows] [Done] [Keyboard] [Cancel]

**Set Interval
to OFF**

Orphan Position Avoidance

- Orphan Position are positions collected that are not part of a point feature.
- Positions are Orphans because they are “Between Feature Positions”.

GNSS Settings



**GNSS
Settings**

GNSS Settings

TerraSync     6:56

 **Setup** |  0   

GNSS Settings

GNSS Receiver Port:



Use Smart Settings ☒

NMEA Output: 

Enables you to configure the GNSS receiver to output NMEA messages

Port is set to Com3

GNSS Settings

TerraSync     6:56

 **Setup** |  0   

GNSS Settings

GNSS Receiver Port:

COM3: GNSS Serial port ▼

Use Smart Settings ☒

NMEA Output:

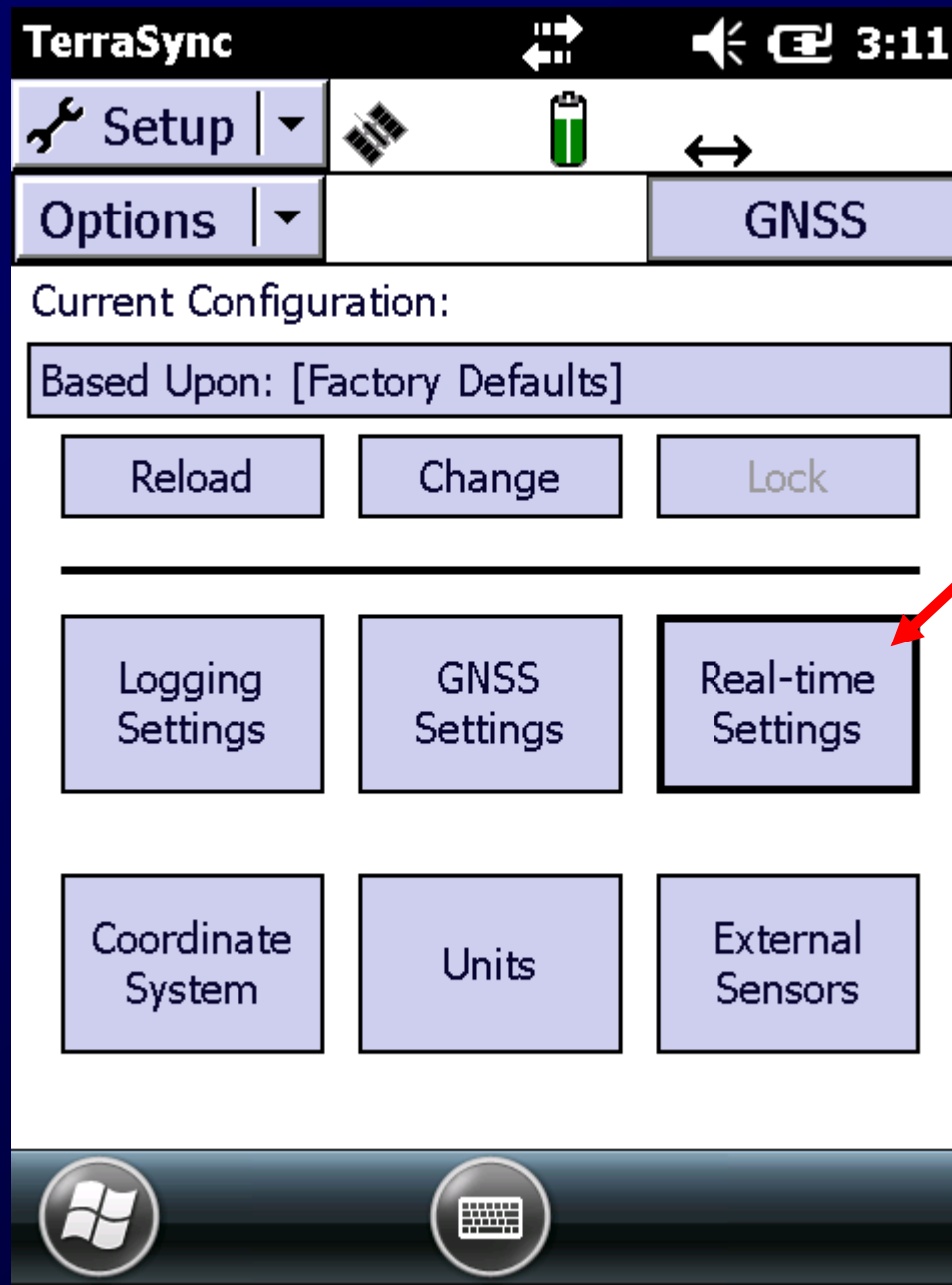
Off 

Enables you to configure the GNSS receiver to output NMEA messages

 **Done**  **Cancel**

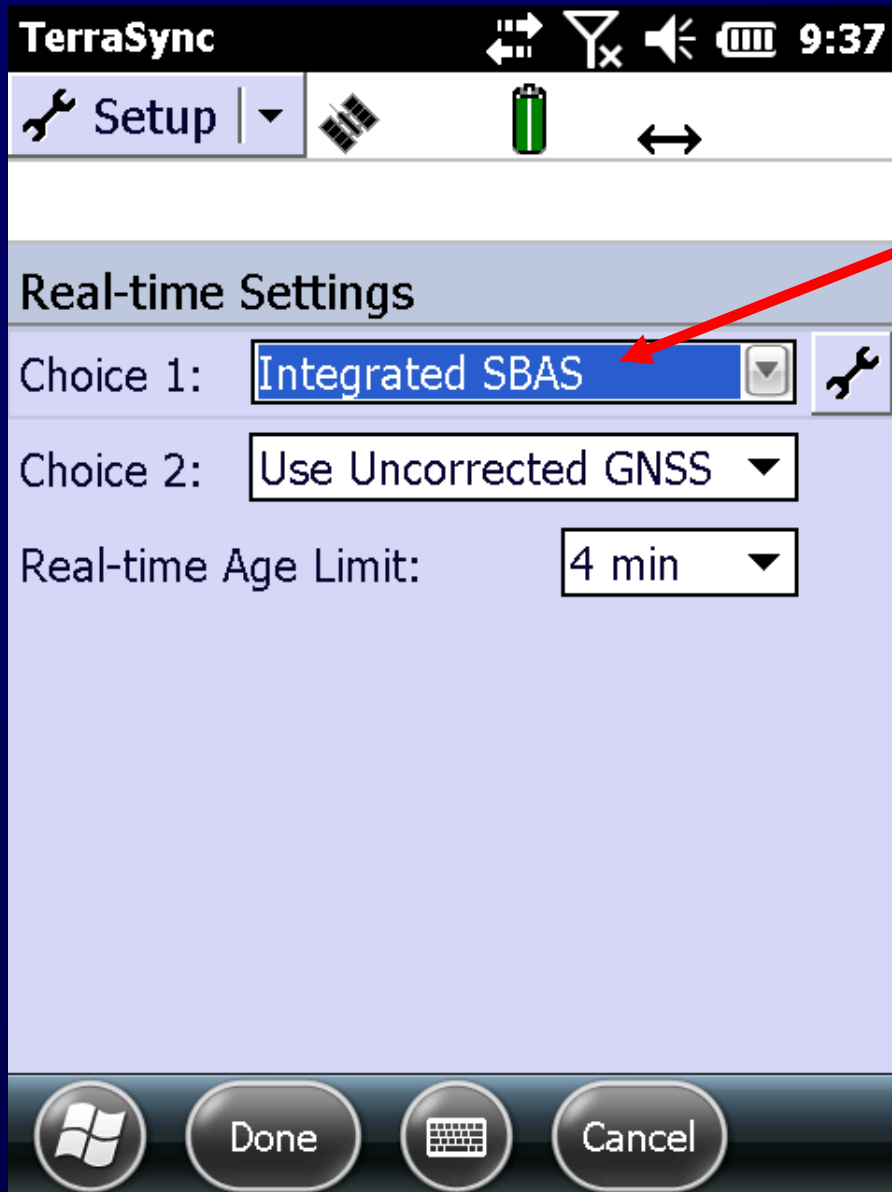
NMEA is OFF

Real-time Settings



**Real Time
Settings**

Real-time Settings



**For choice 1 Select
"Use Integrated SBAS"**

**SBAS = Satellite-based
Augmentation System**

Real-time Settings

TerraSync 9:37

Setup

Real-time Settings

Choice 1: Integrated SBAS

Choice 2: Use Uncorrected GNSS

Real-time Age Limit: 4 min

Done Cancel

**For choice 2 Select
"Use Uncorrected GNSS"**

Real-time Settings

TerraSync 9:37

Setup

Real-time Settings

Choice 1: Integrated SBAS

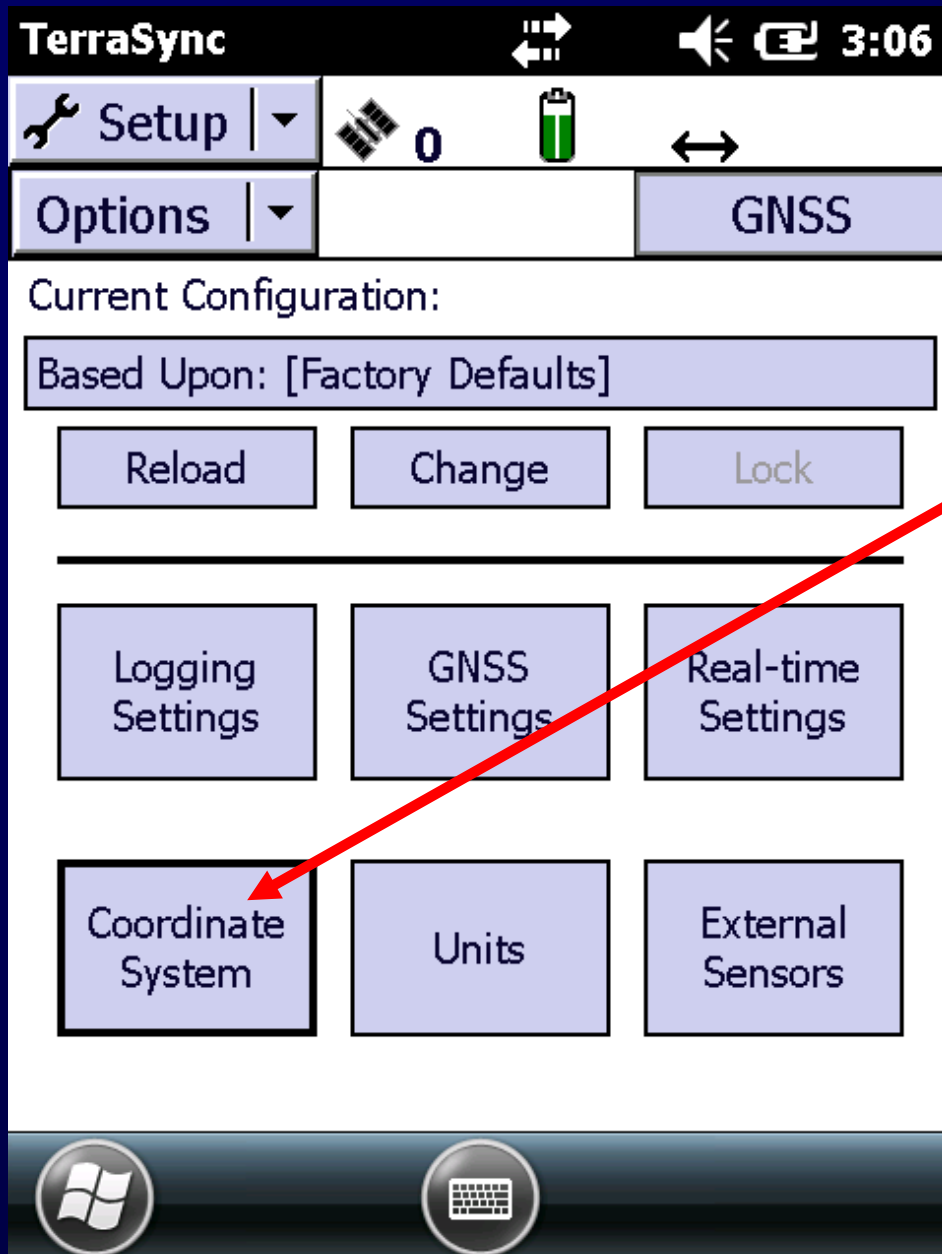
Choice 2: Use Uncorrected GNSS

Real-time Age Limit: 4 min

Done Cancel

**Set Real-Time Age Limit
To “ 4 Min ”**

Coordinate System



**Select
Coordinate System**

Coordinate System

TerraSync 3:14

Setup

Coordinate System

Select By: Coordinate System and Zone

System:

Latitude/Longitude

Datum: WGS 1984

Altitude Reference:

Height Above Ellipsoid (HAE)

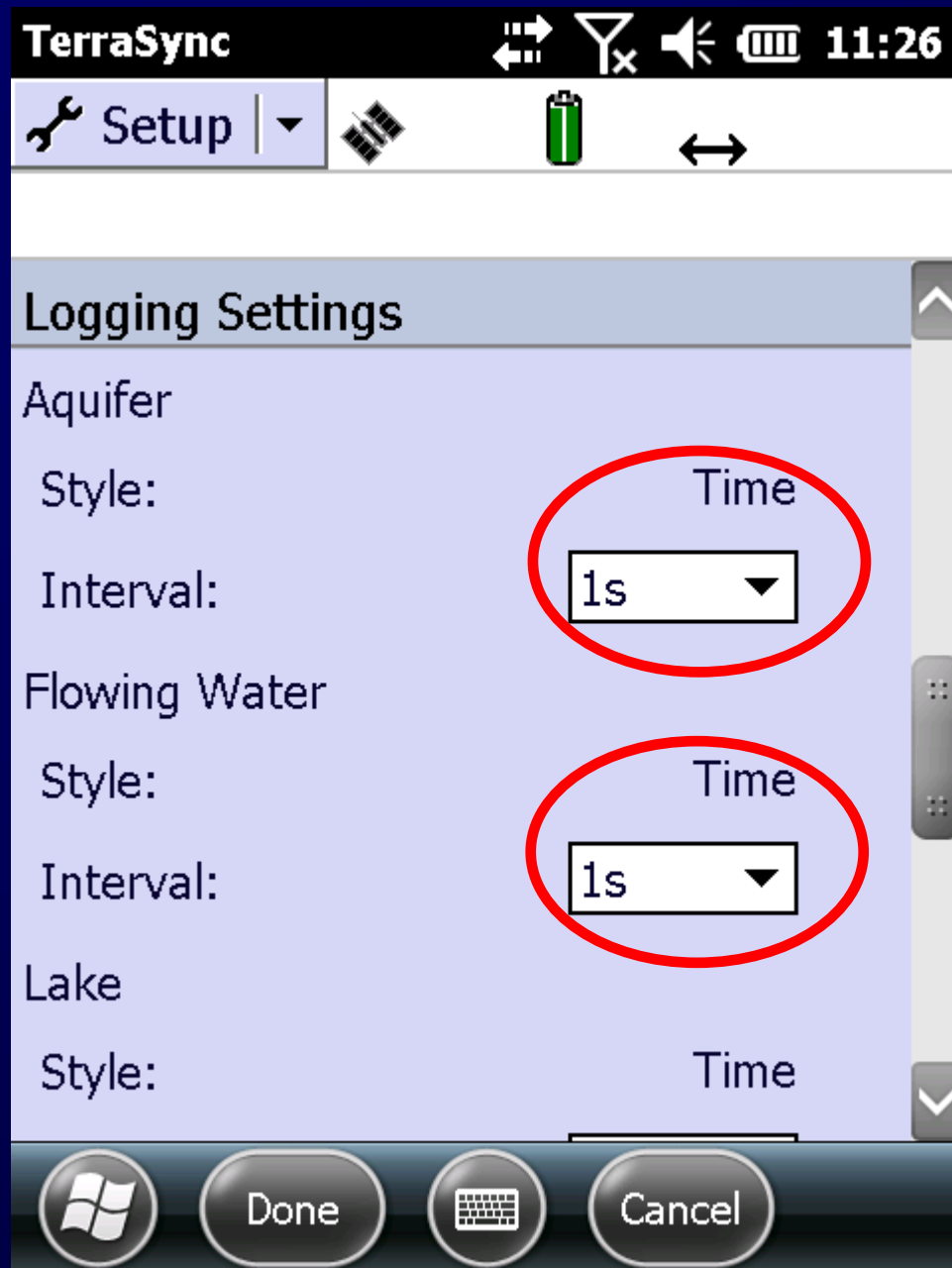
Altitude Units: Meters

Display USNG: Off

Done Cancel

Set:
System to:
Latitude/ Longitude
Datum to:
WGS 1984

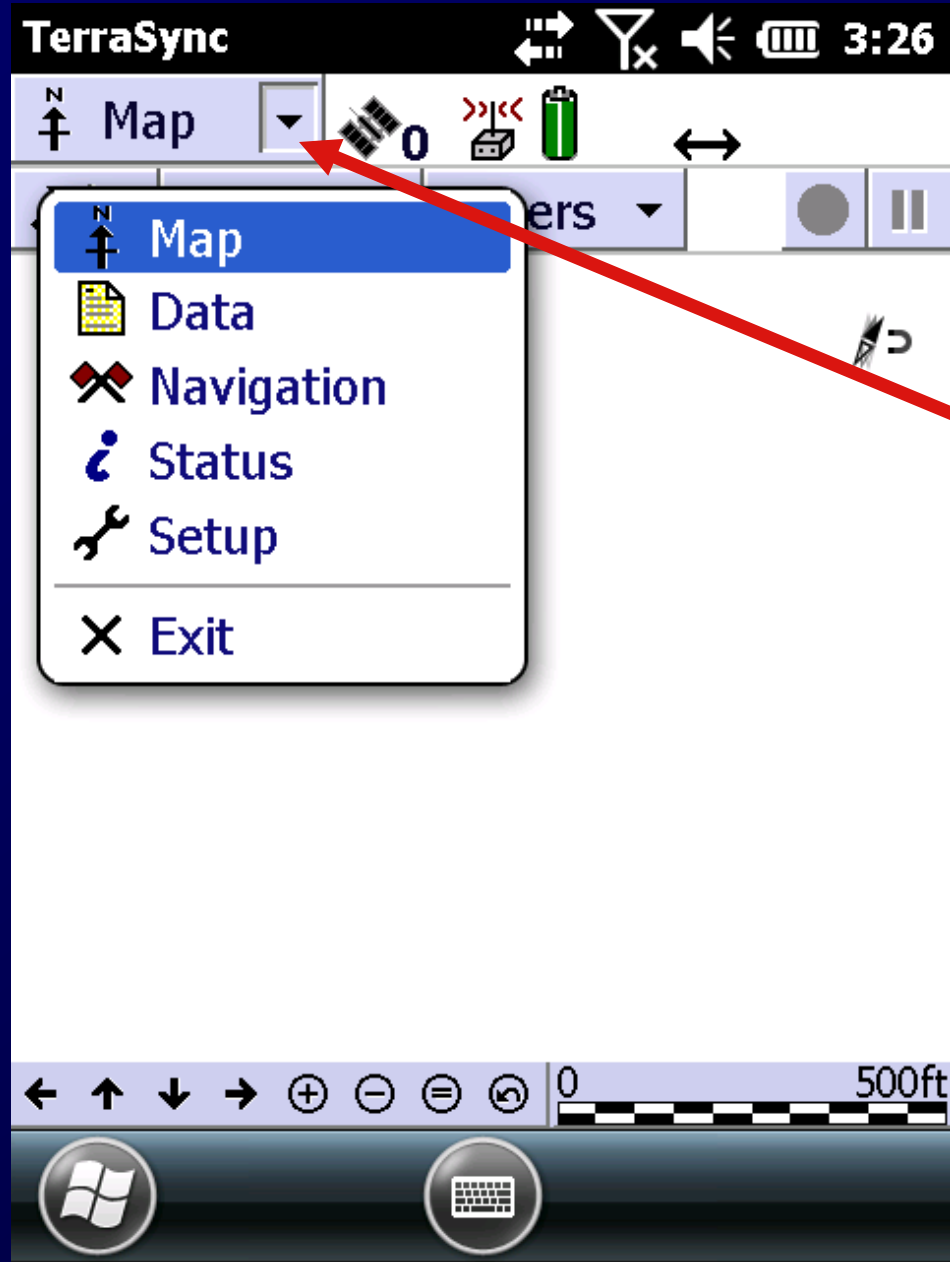
Feature Logging



**All resources
should be
set to 1s**

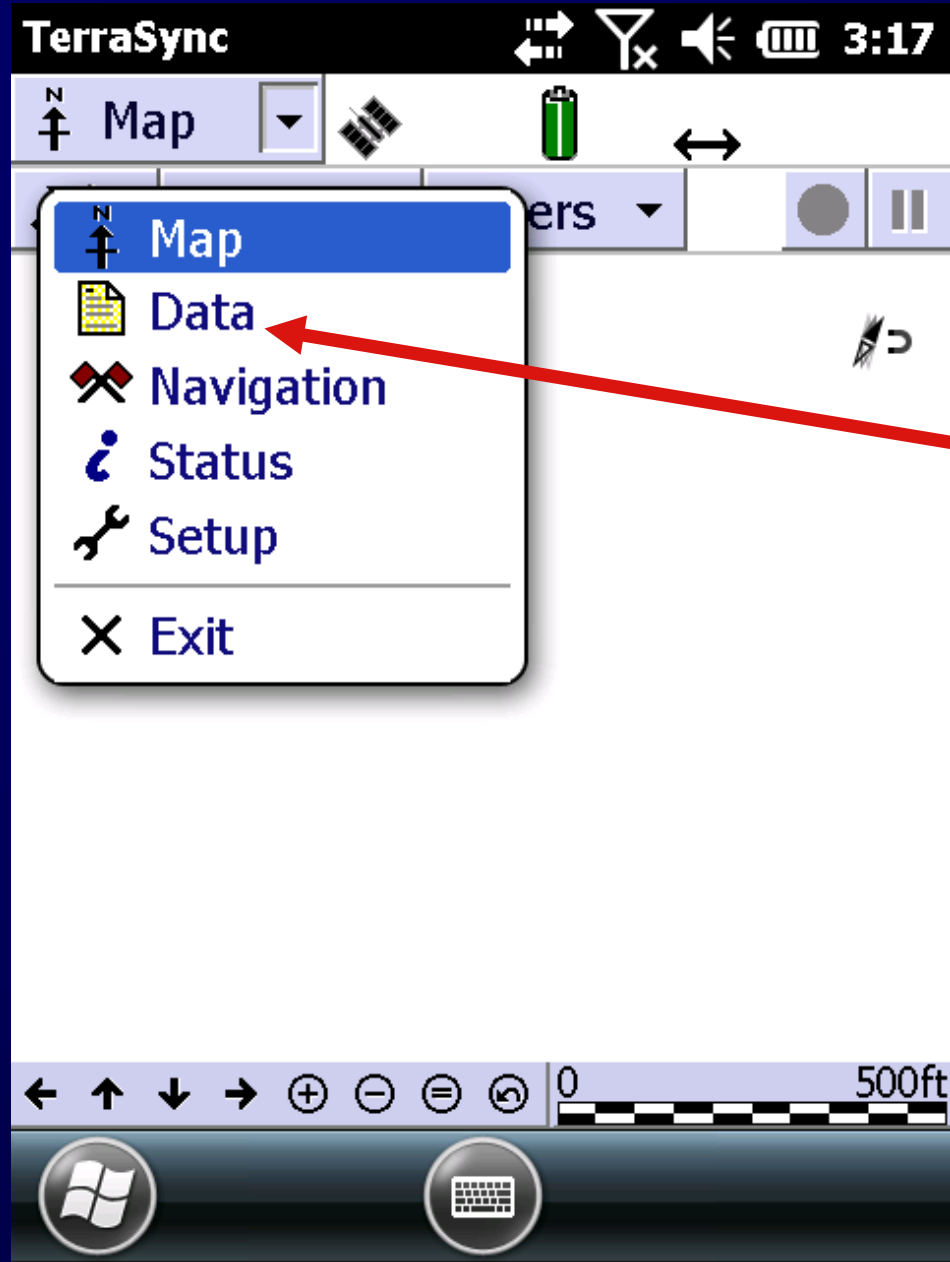
3. Using the Equipment

Using Import Data Files for Navigation



Select drop down
button

Using Import Data Files for Navigation



Select Data

Using Import Data Files for Navigation

TerraSync 3:19

Data ▾

New ▾

Create New Data File

File Type: Rover ▾

Location: Default ▾

File Name:

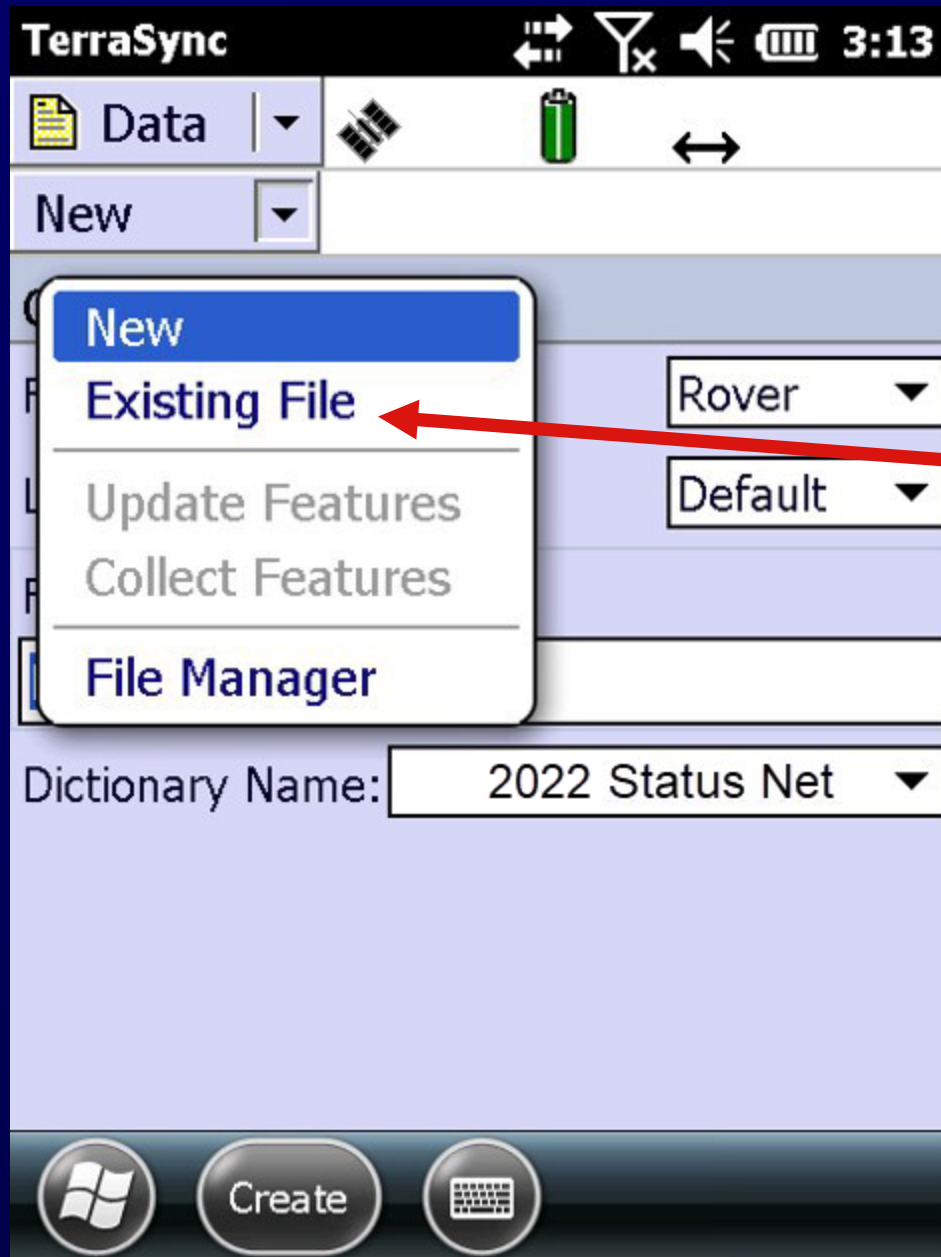
R021315A

Dictionary Name: 2022 Status Net ▾

Create

Use drop down to
open existing files.

Using Import Data Files for Navigation



Select 'Existing'

Using Import Data Files for Navigation

TerraSync 3:08

Data | Existing

Choose Existing Data File:

Location: Default

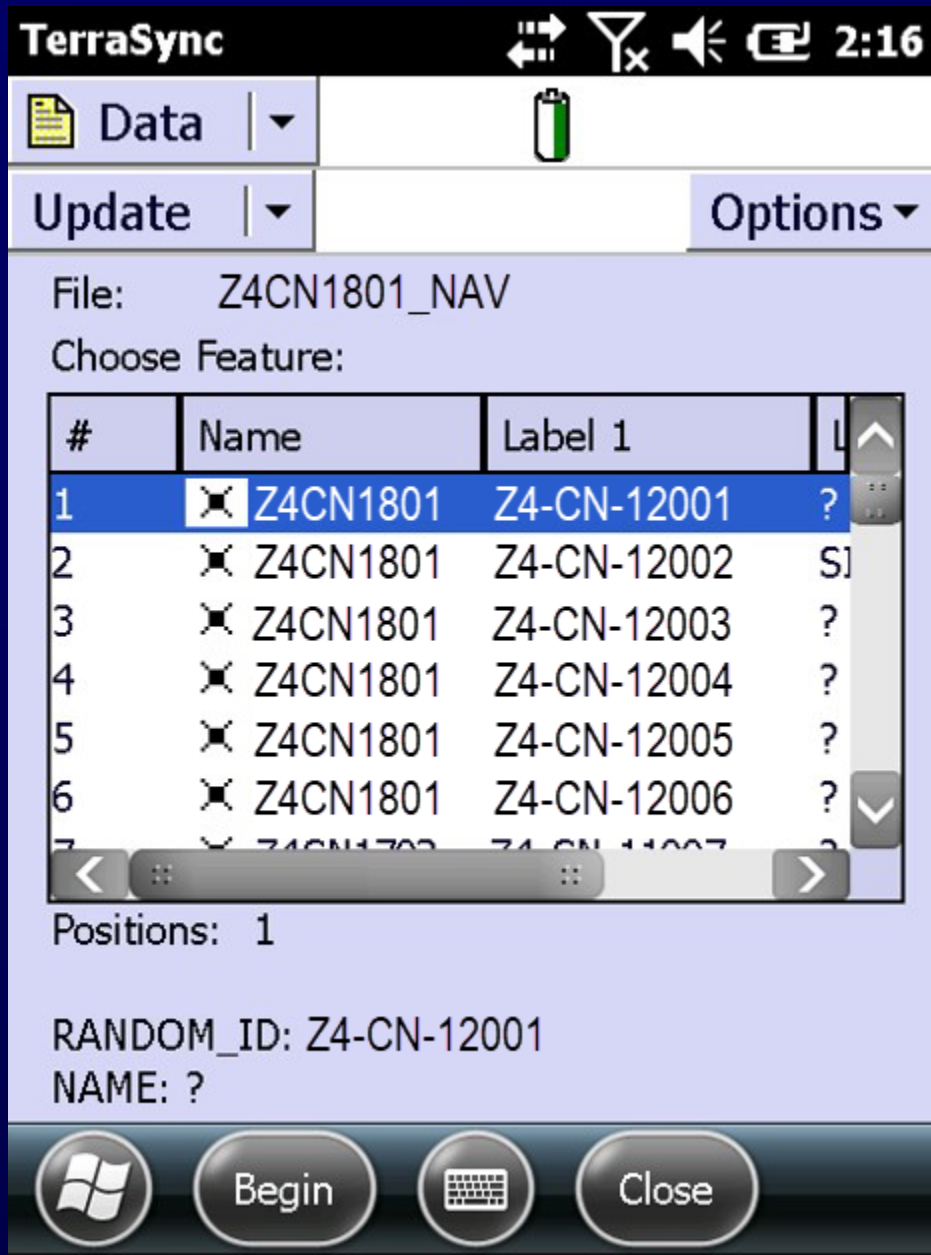
Name	Start Time	Size
Temp 1-13...	02/13/17 11:38 am	85 KB
Z4-CN-11003	02/09/17 07:06 pm	85 KB
Z4-CN-11002	02/09/17 07:05 pm	85 KB
Z4-CN-11001	02/09/17 07:04 pm	85 KB
SJ - for site...	02/08/17 03:45 pm	85 KB
Z4CN1801_...	02/01/18 11:10 am	30 KB
Temp	02/01/17 10:37 am	85 KB
Z1SL1709_...	02/01/17 10:11 am	30 KB
Z1SS1707_...	01/25/17 03:28 pm	31 KB

Features: 150 Positions: 150
Status: Not Transferred DD: Generated by..

Open

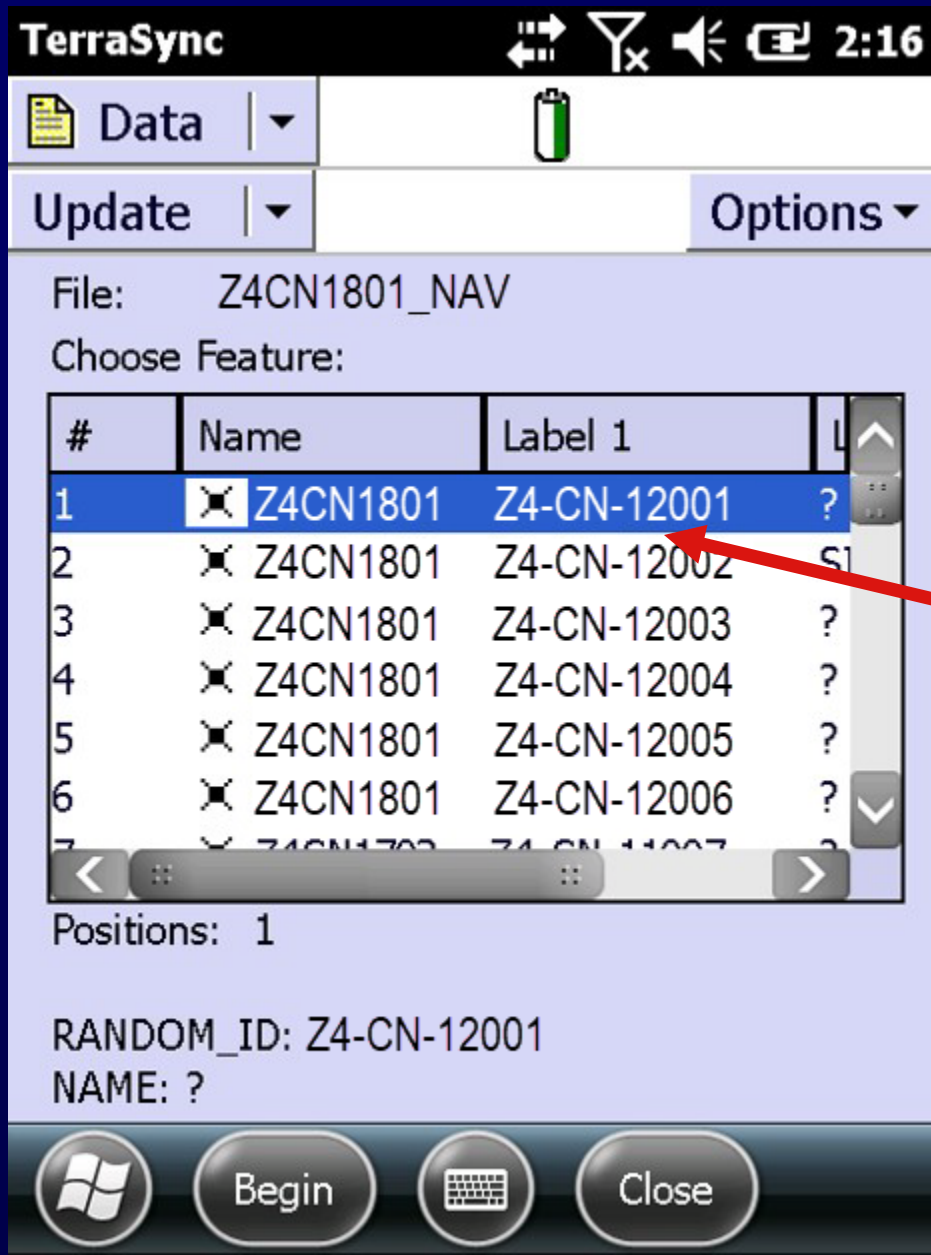
Select Data File for the resource you are sampling.

Using Import data files for Navigation



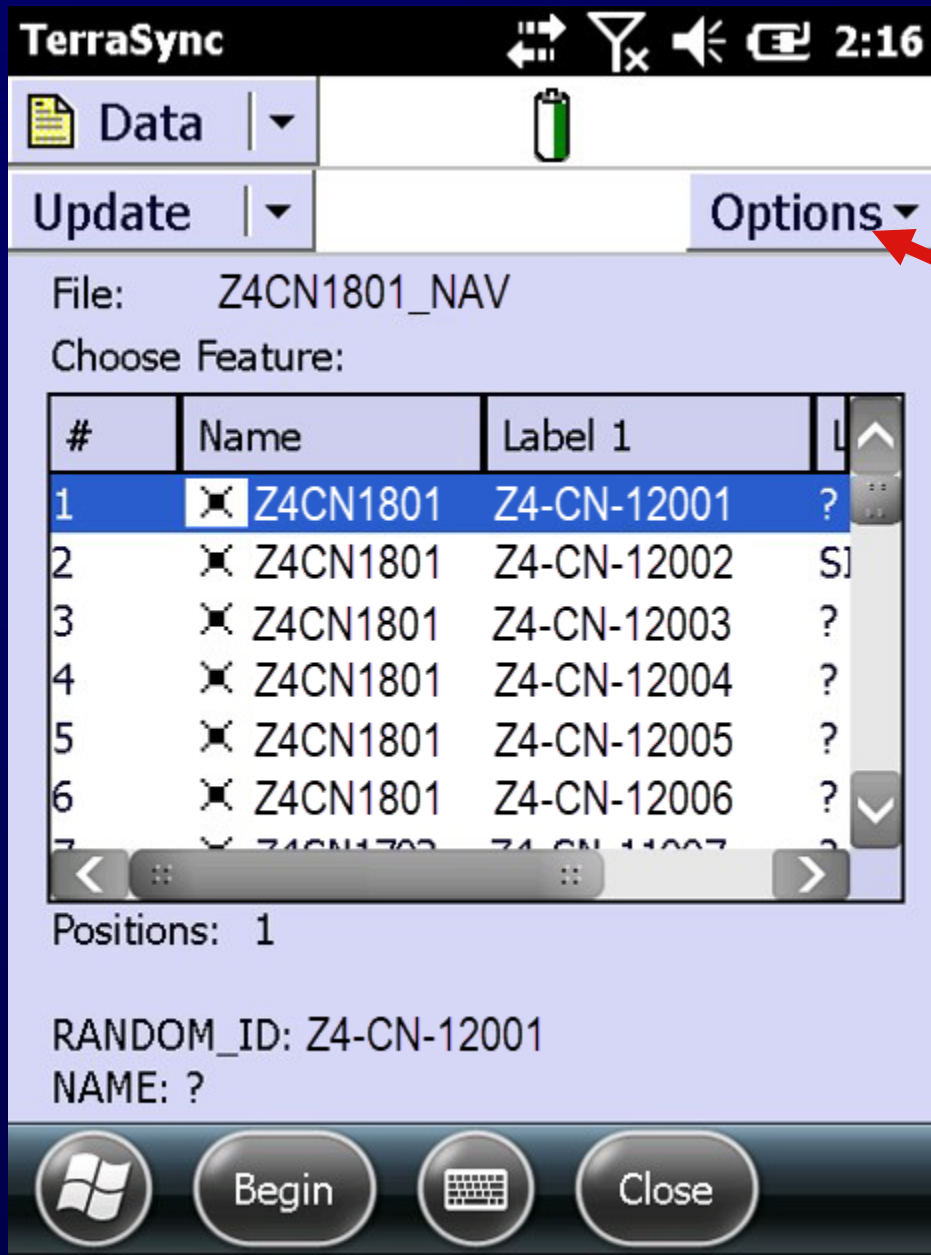
**All Site
selections for
each resource
are now
waypoints.**

Using Import data files for Navigation



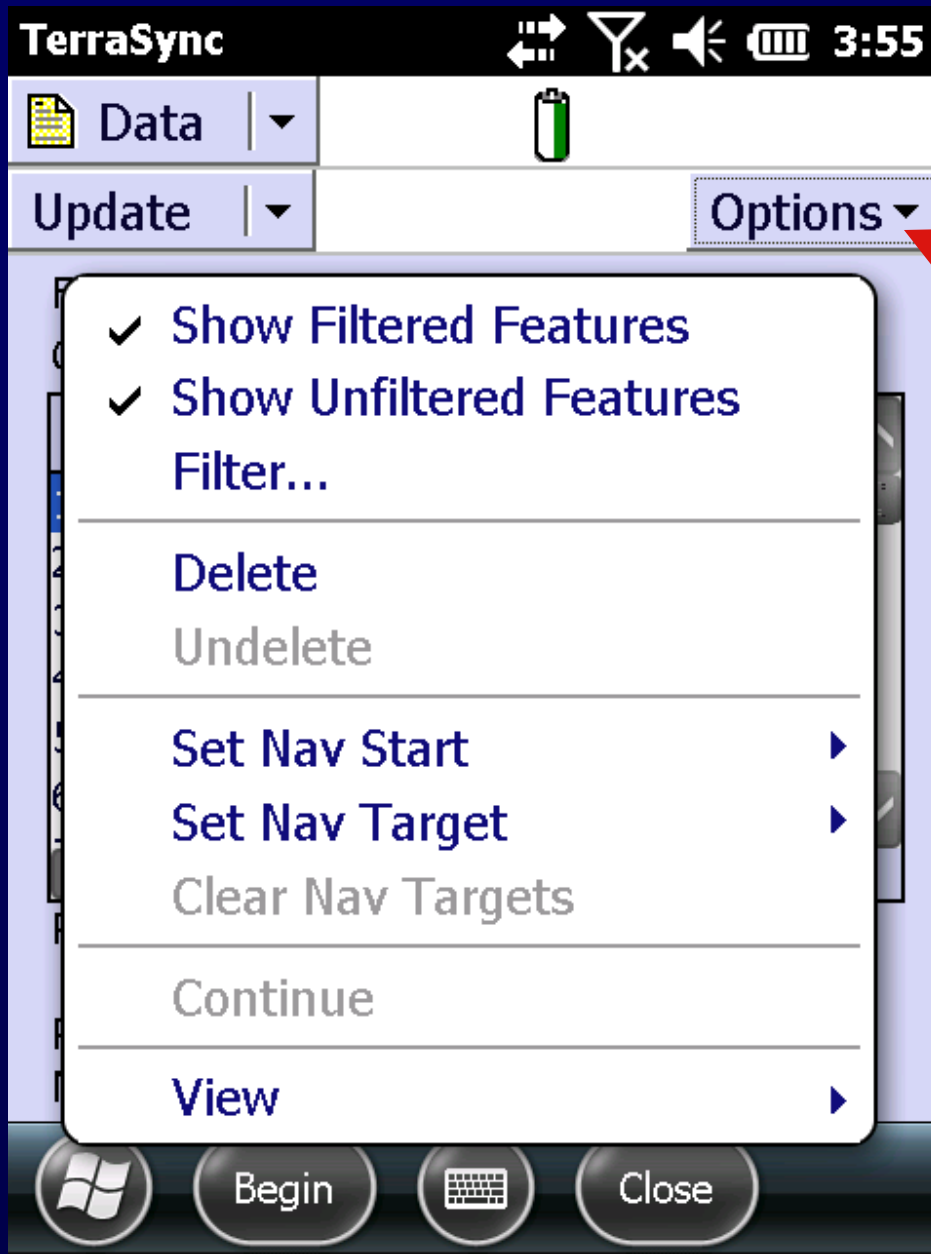
- Select the site you want to navigate to.

Using Import data files for Navigation



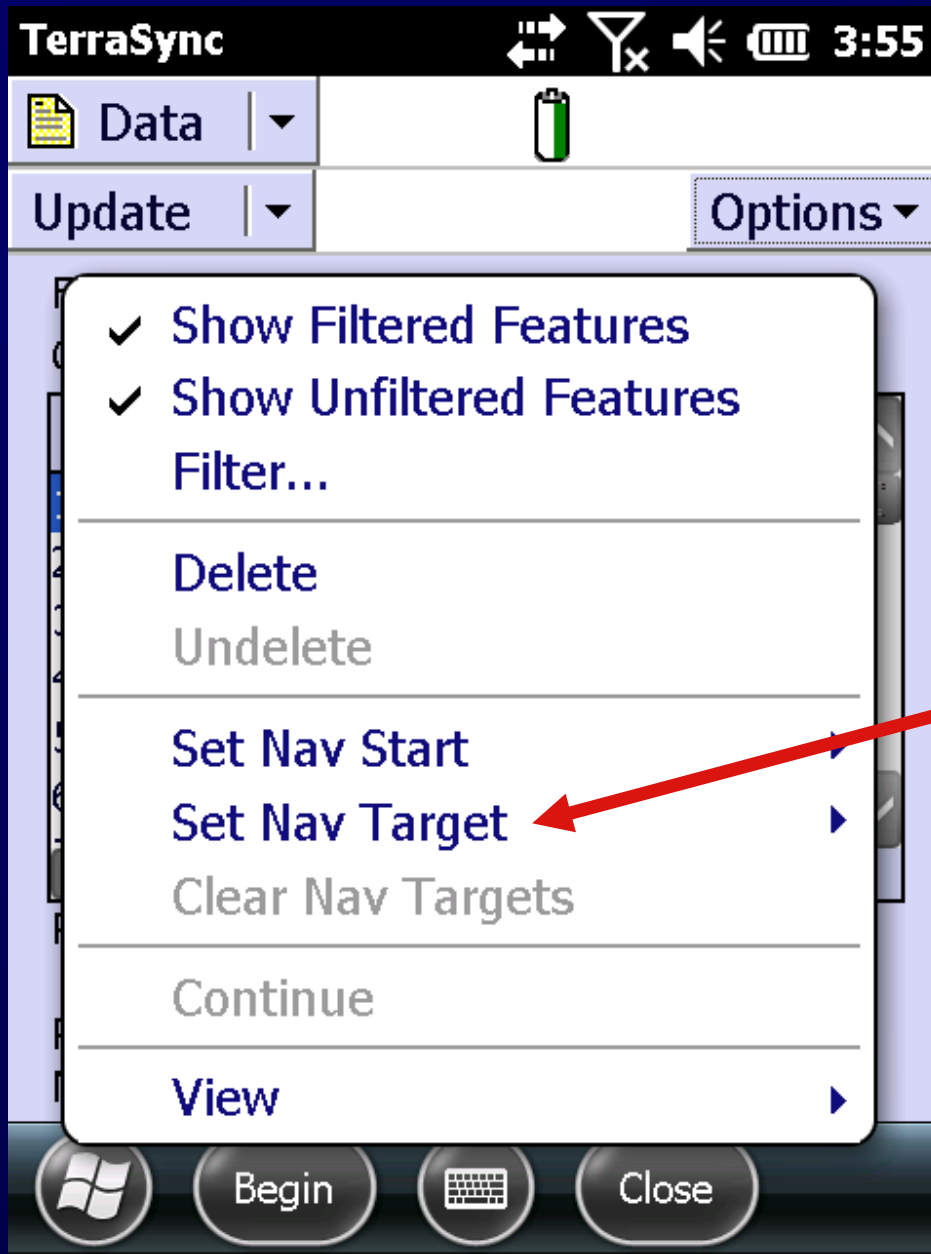
- Select Options

Using Import data files for Navigation



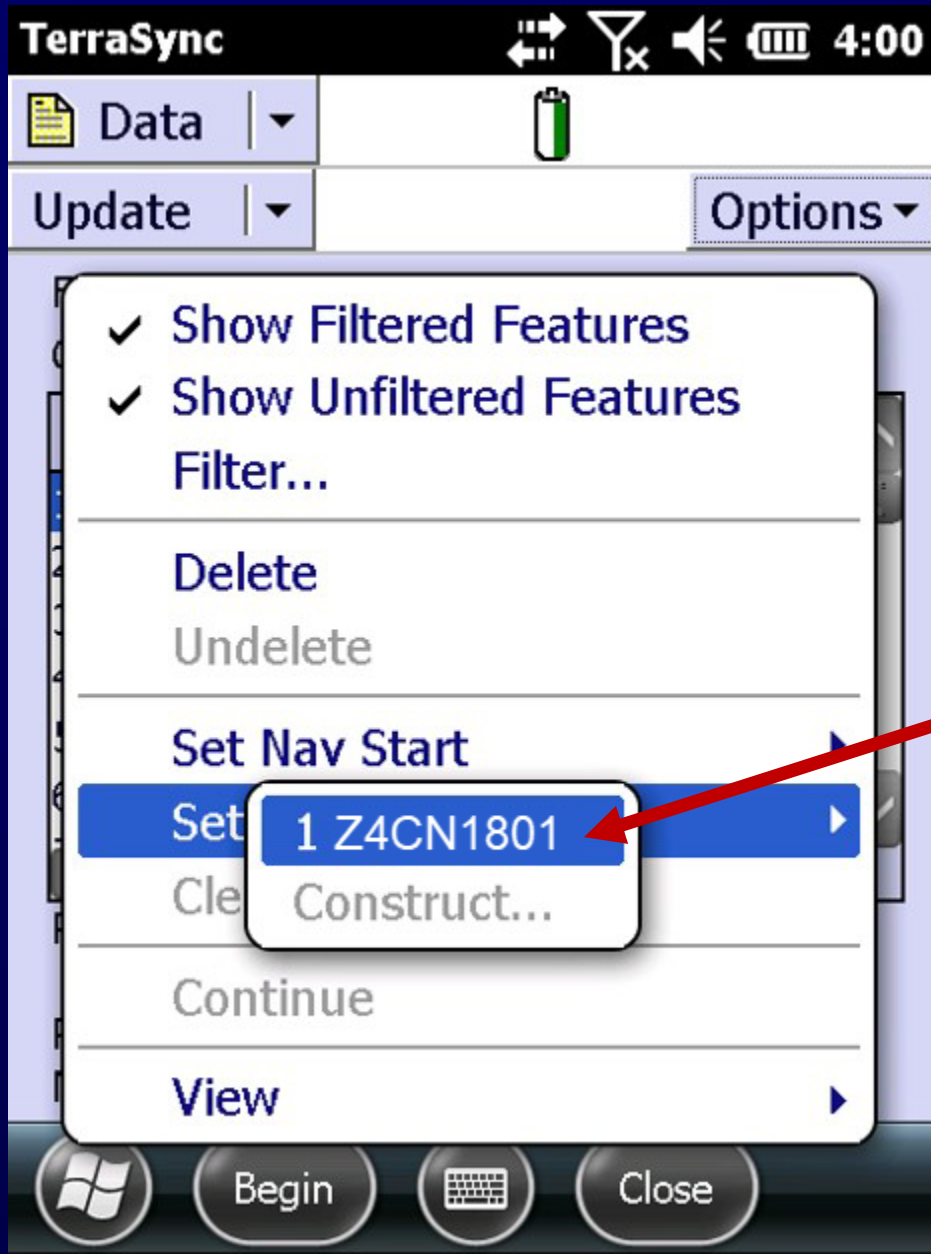
- **Select Options**

Using Import data files for Navigation



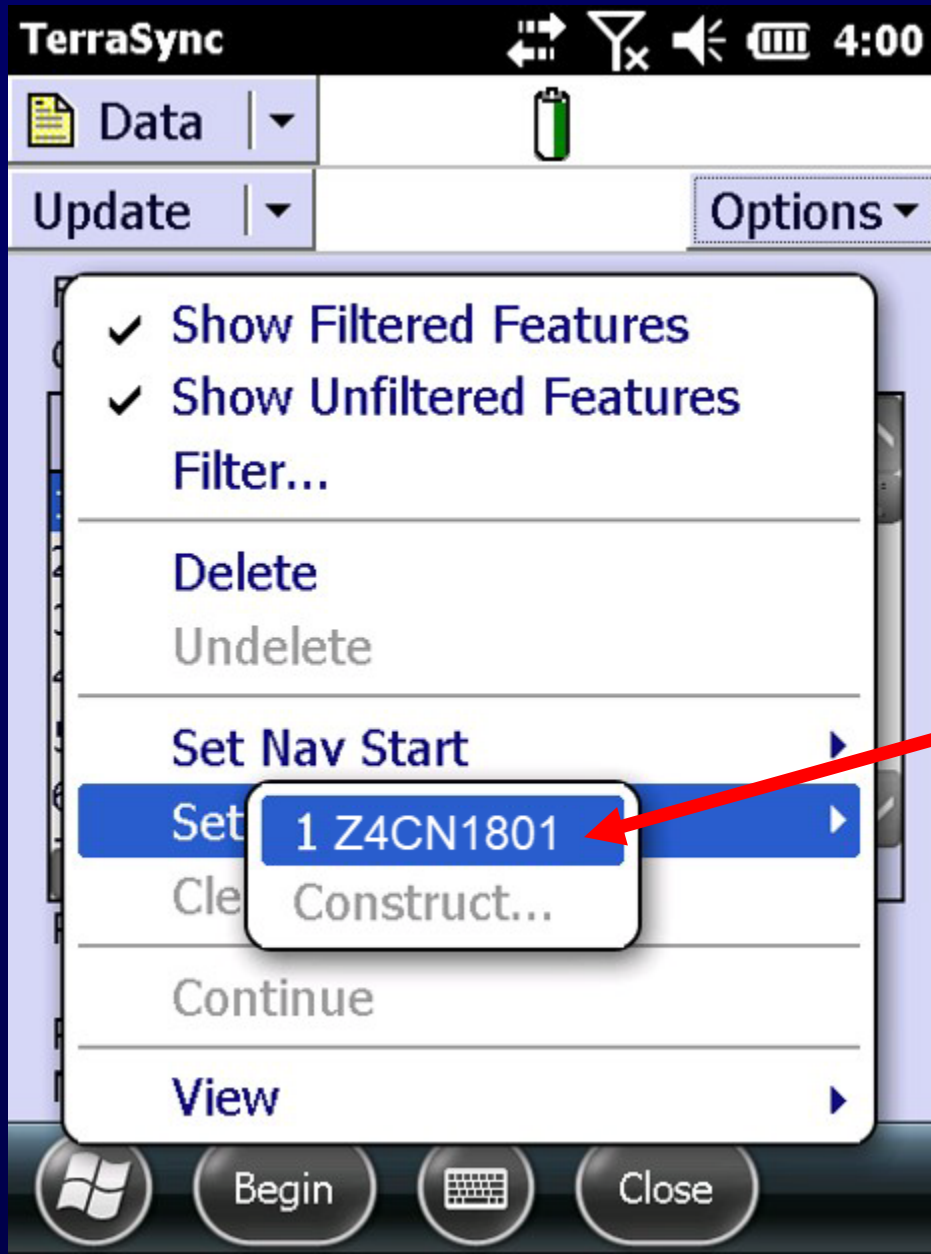
Select: “Set Nav Target”

Using Import data files for Navigation



Select: "Set Nav Target"

Using Import data files for Navigation

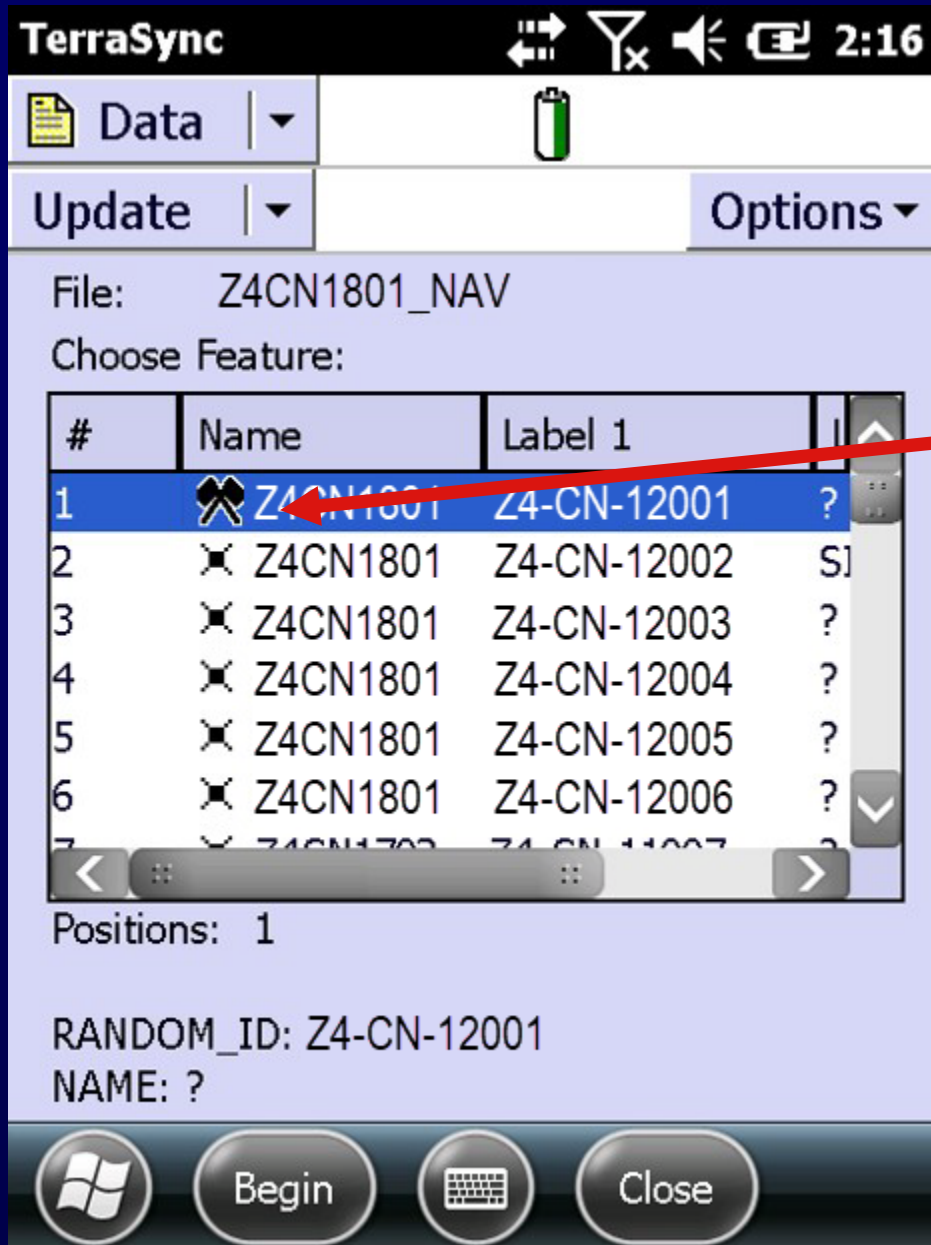


Select: "Set Nav Target"

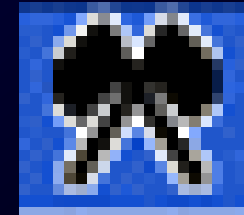
"1" for station #1
Z4CN1801 is Project name

Using Import data files for Navigation

Nav Target



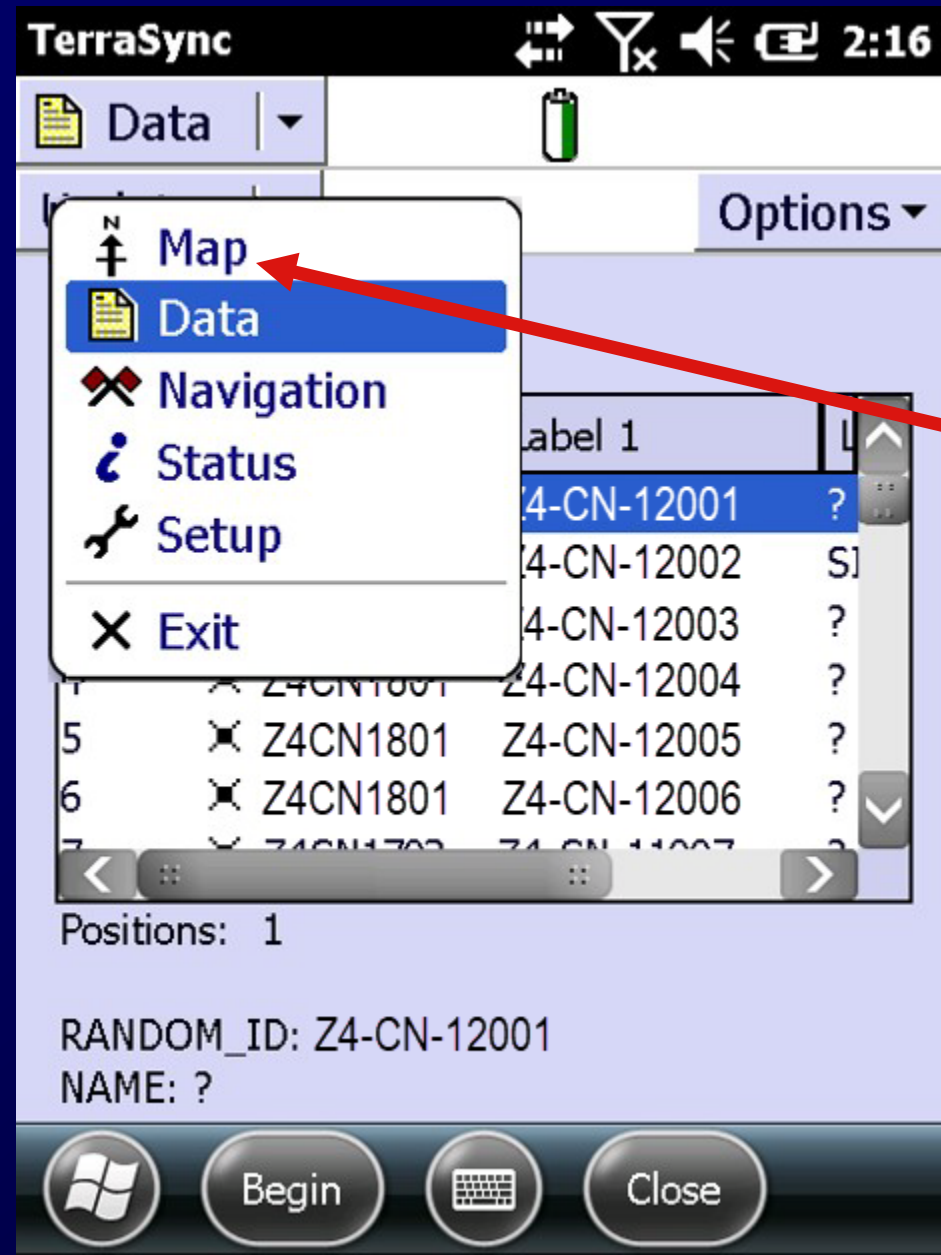
Notice the



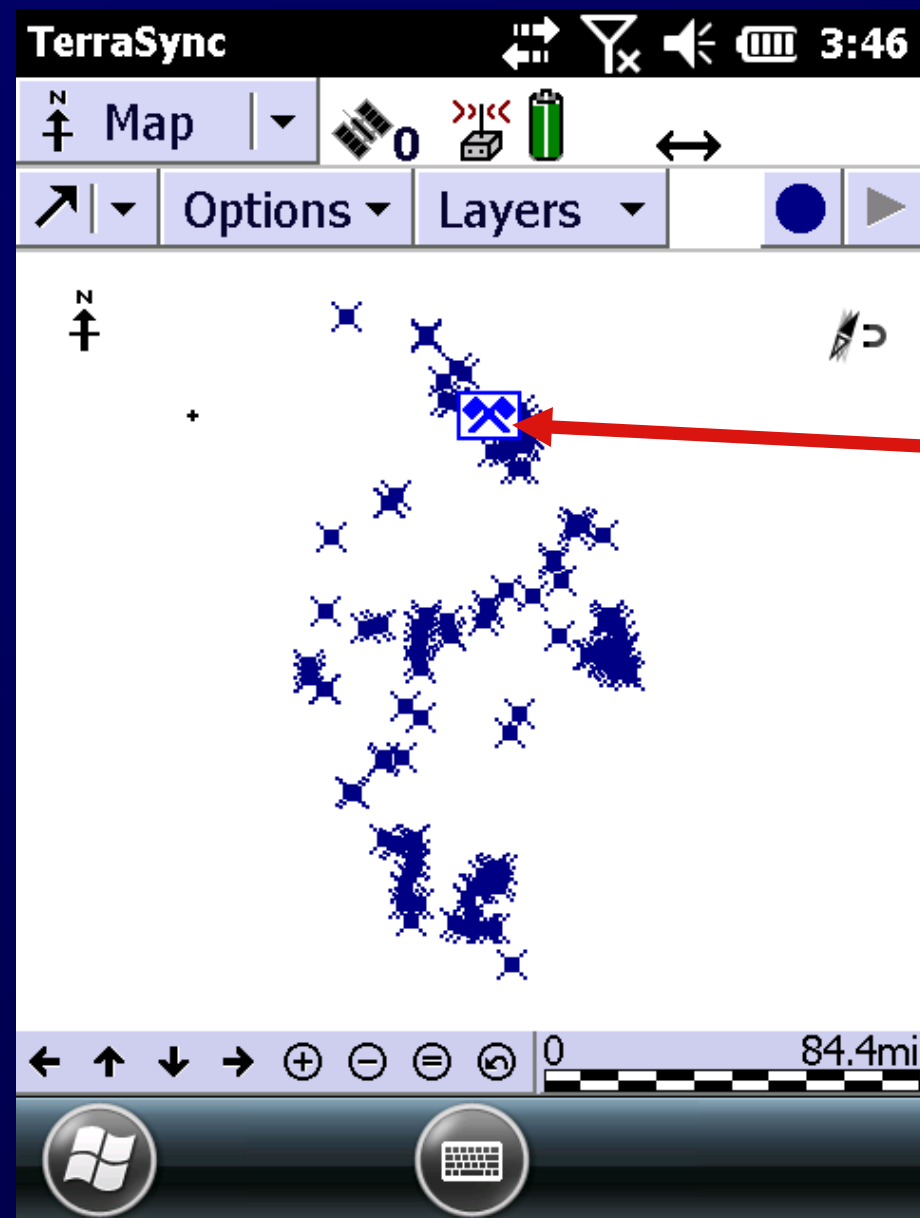
icon.

Using Import data files for Navigation

Select Map for map of sites.

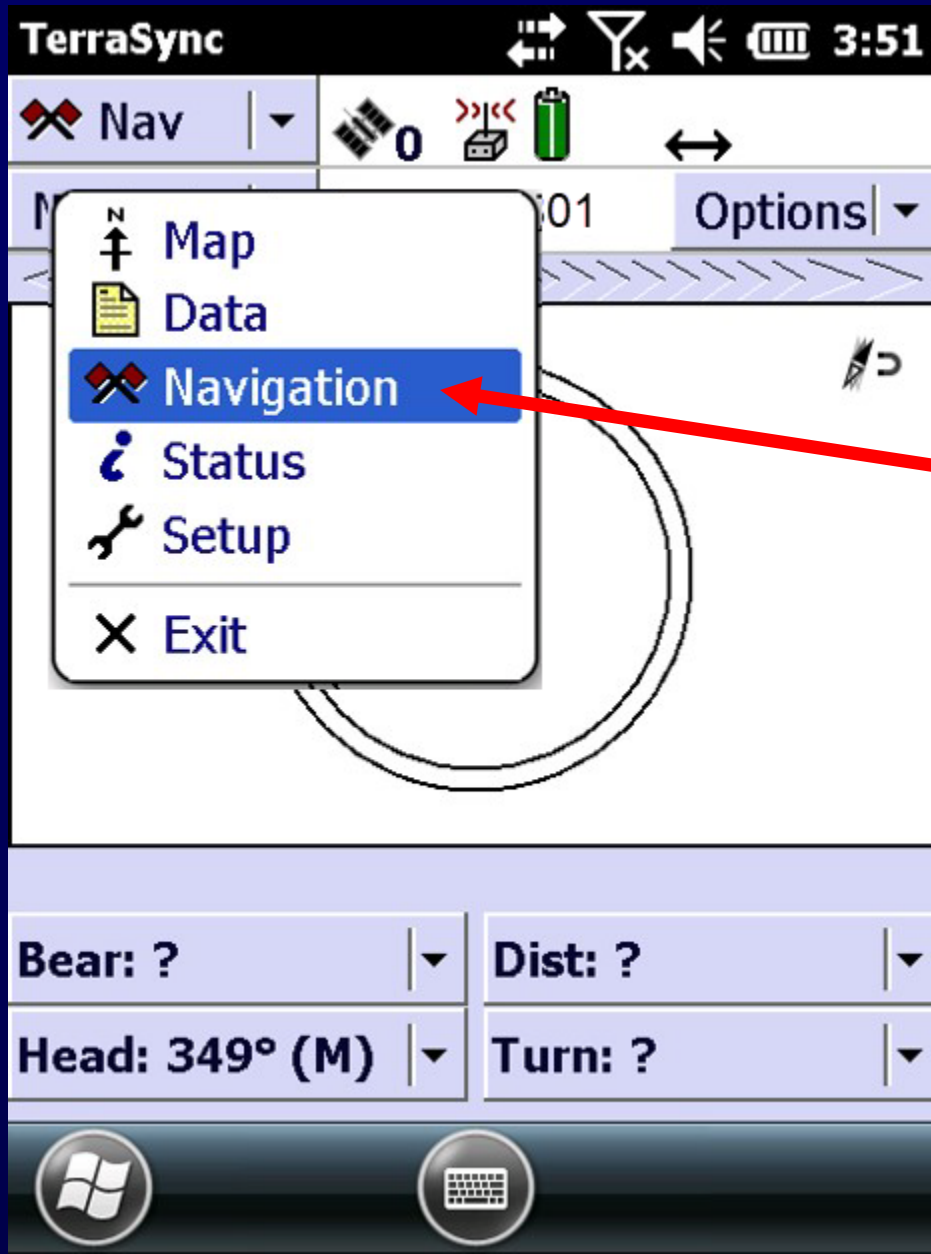


Using Import data files for Navigation



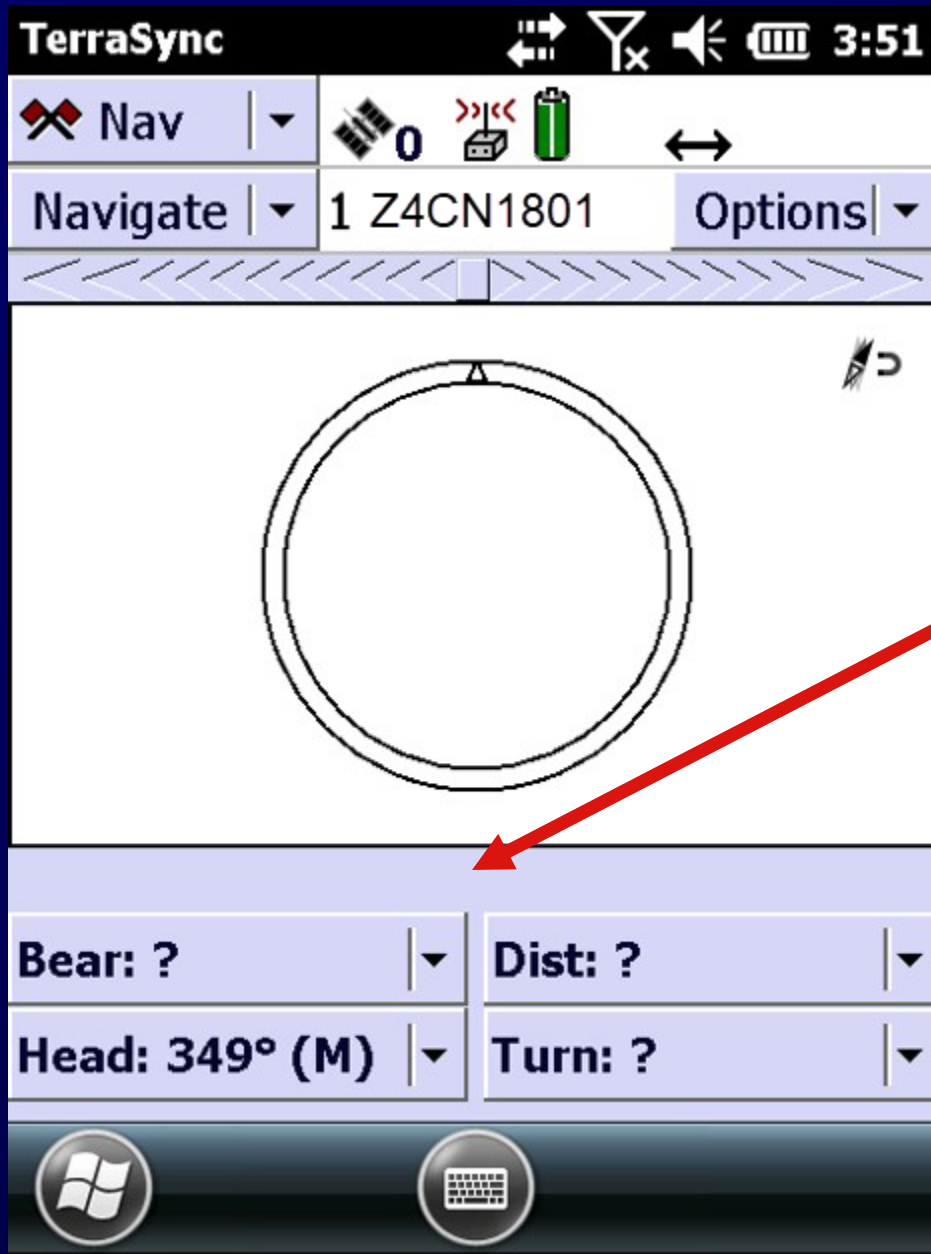
**Selected site
waypoint.**

Using Import data files for Navigation



Select Navigation

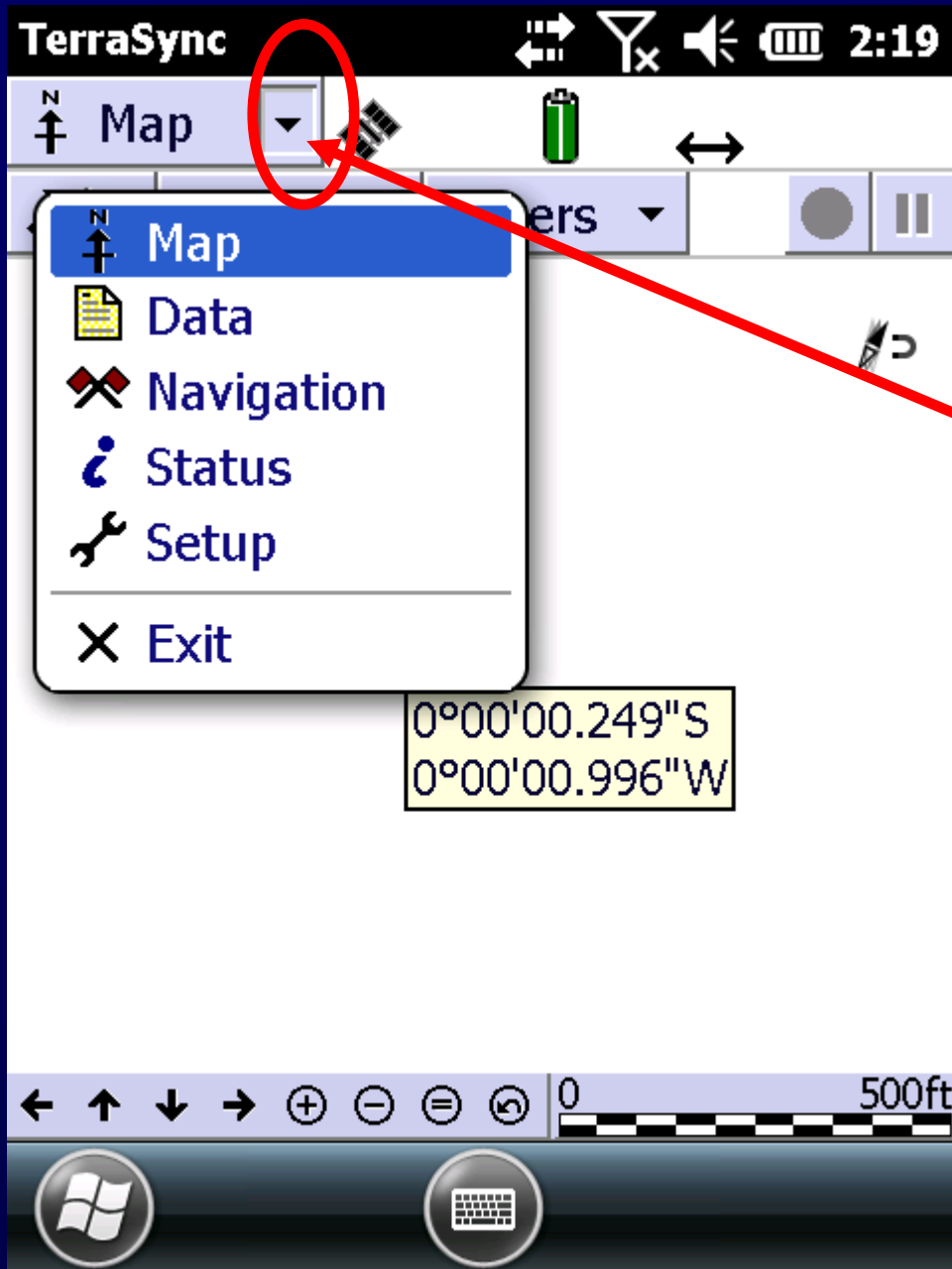
Using Import data files for Navigation



This will show you which way to go to get to your selected site.

Creating Data File

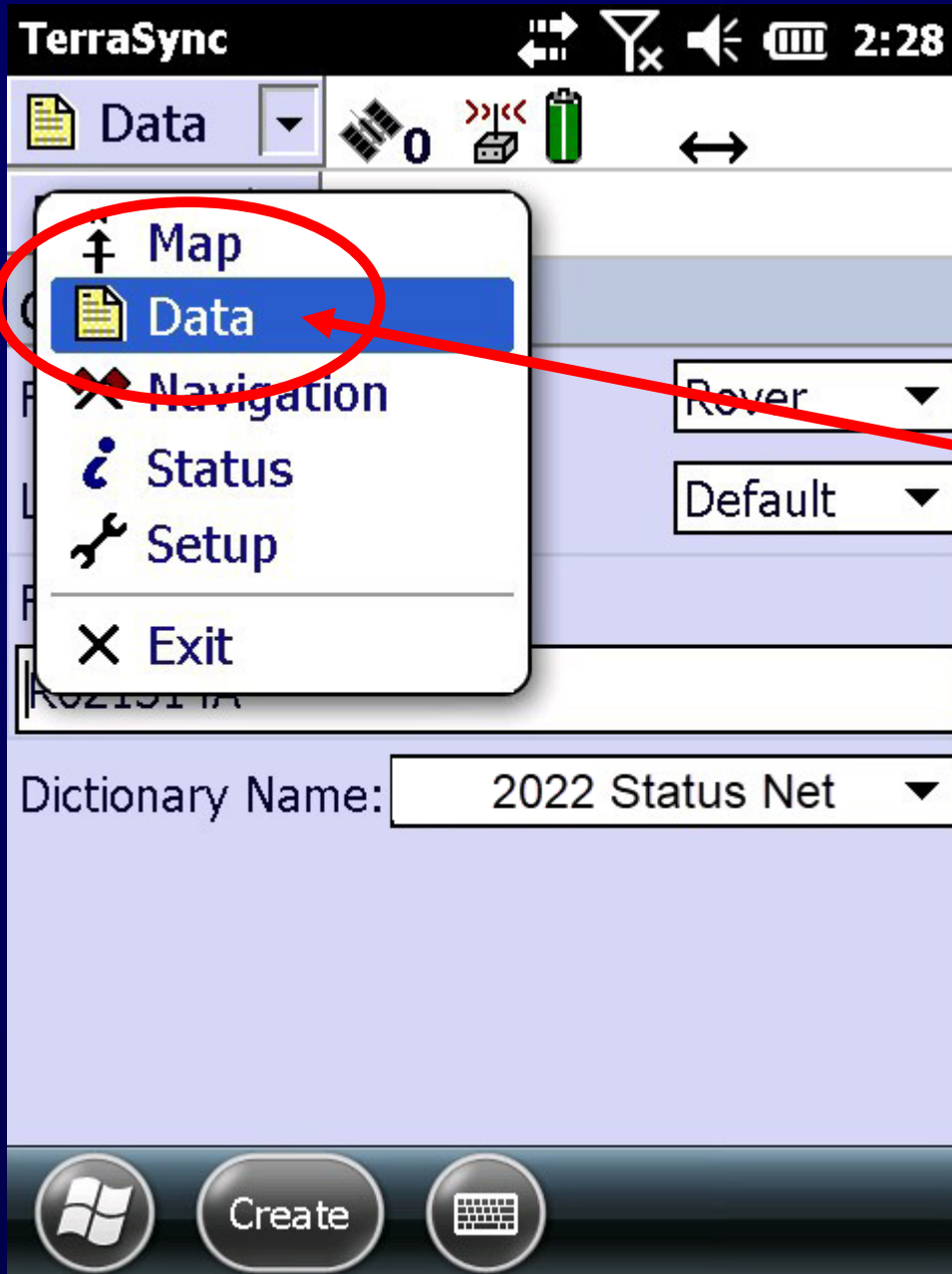
(Also known as SSF File)



Select the Down Arrow

Creating Data File

(Also known as SSF File)



**Select Data in
The drop down box**

Creating Data File

(Also known as SSF File)

TerraSync     2:36

 Data | ▾  0   

New | ▾

Create New Data File

File Type: ▾

Location: ▾

File Name:

Dictionary Name: ▾

Key in Resource ID

Creating Data File

(Also known as SSF File)

TerraSync 12:57

Data | ▾

New | ▾

Create New Data File

File Type: Rover ▾

Location: Default ▾

File Name:

R021312A

Dictionary Name:

123 1 2 3 4 5 6 7 8 9 0 - = <

Tab q w e r t y u i o p []

CAP a s d f g h j k l ; ' "

Shift z x c v b n m , . / <

Ctl áü ` \ _ { } | >

Windows Create Keyboard

By using the key pad

Creating Data File

(Also known as SSF File)

TerraSync     2:37

 Data | ▾  0   

New | ▾

Create New Data File

File Type: ▾

Location: ▾

File Name:

Dictionary Name: ▾

**Remember one
sample station per file**

Creating Data File

TerraSync 11:04

Data | ▾

New | ▾

Create New Data File

File Type: Rover ▾

Location: Default ▾

File Name:

Z4-CN-12001

Dictionary Name:

2022 Status Net ▾

Generic

2022 Status Net

Create

**Select proper
Data Dictionary**

Confirm Antenna Height

TerraSync 10:34

Confirm Antenna Height

Height:

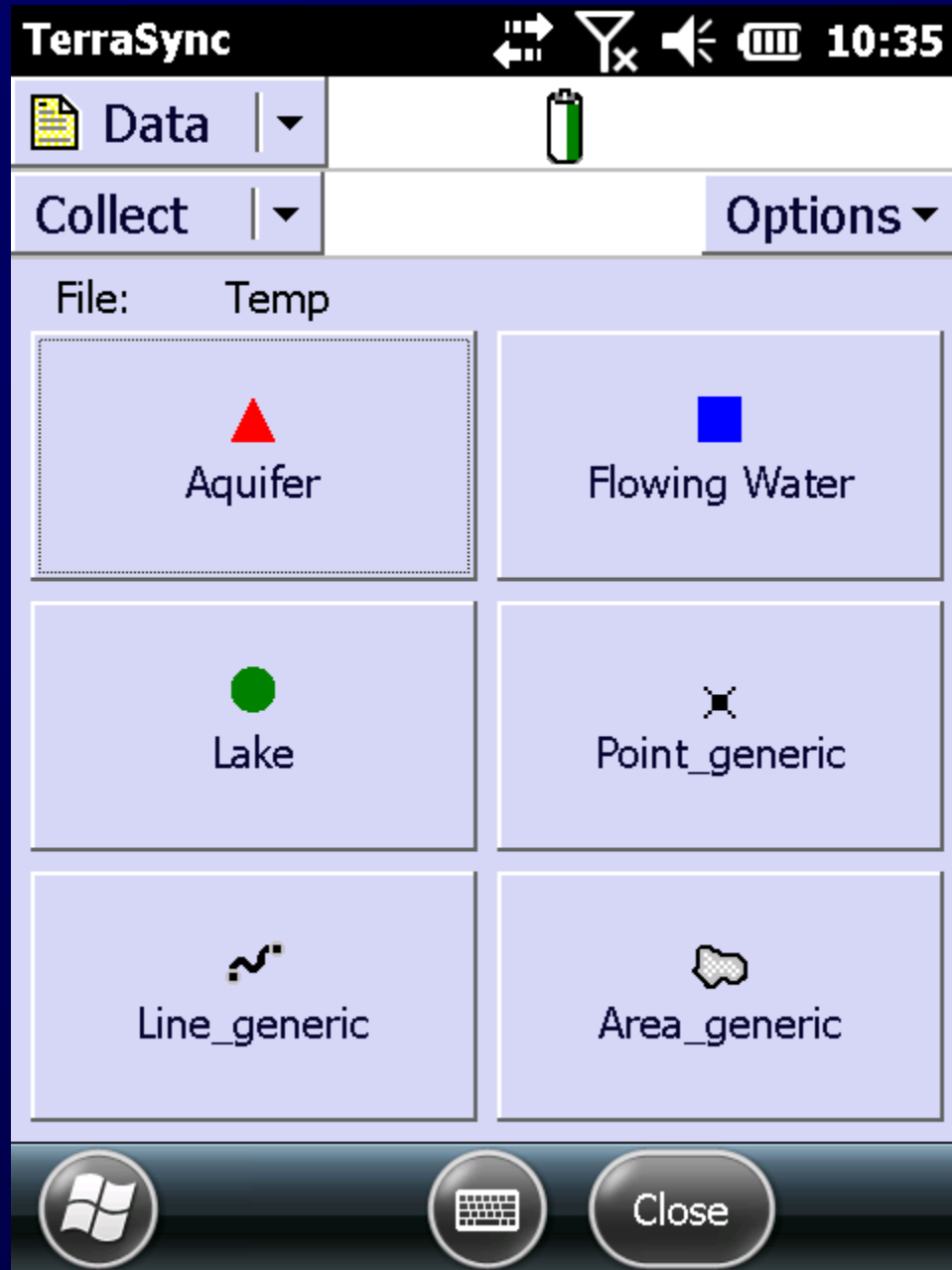
Type:

Measure To:

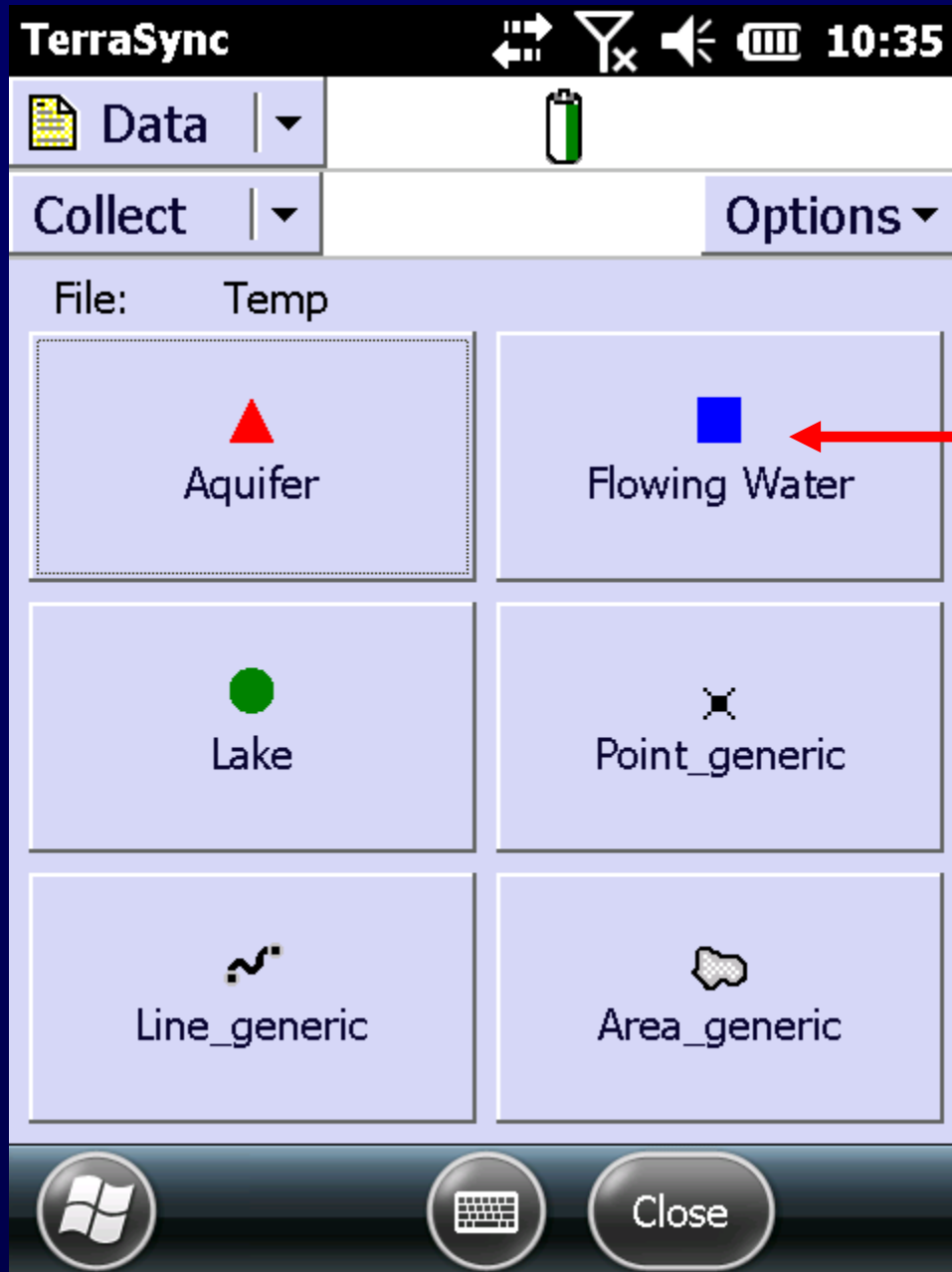
Enter a value for the height that you would normally hold the unit at.

Select Resource Type



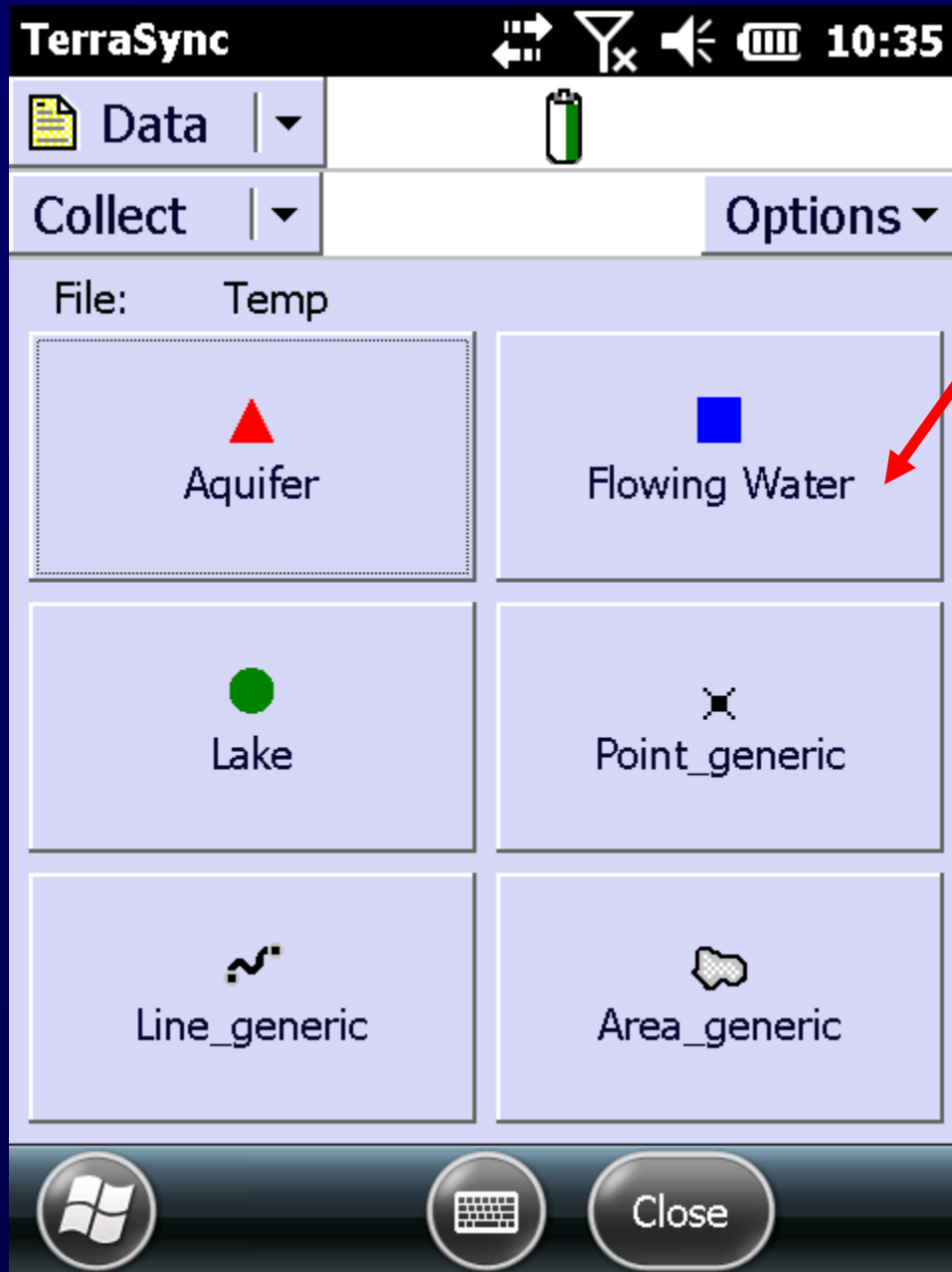
Which resource type are you sampling?

Select Resource Type



**Select Proper
resource
that corresponds
to the file name**

Select Resource Type



Select Proper resource that corresponds to the file name

Z4-CN-12001 is the name for a Zone 4 Canal resource

Data Dictionary entry menu

TerraSync 11:16

Data | 12 30

Collect | Options

1 Flowing Water Cancel

Zone: Z4-

Resource: CN-

5 Digit Random ID: 12001

Address Info: ?

Name:

Agency:

Done Log

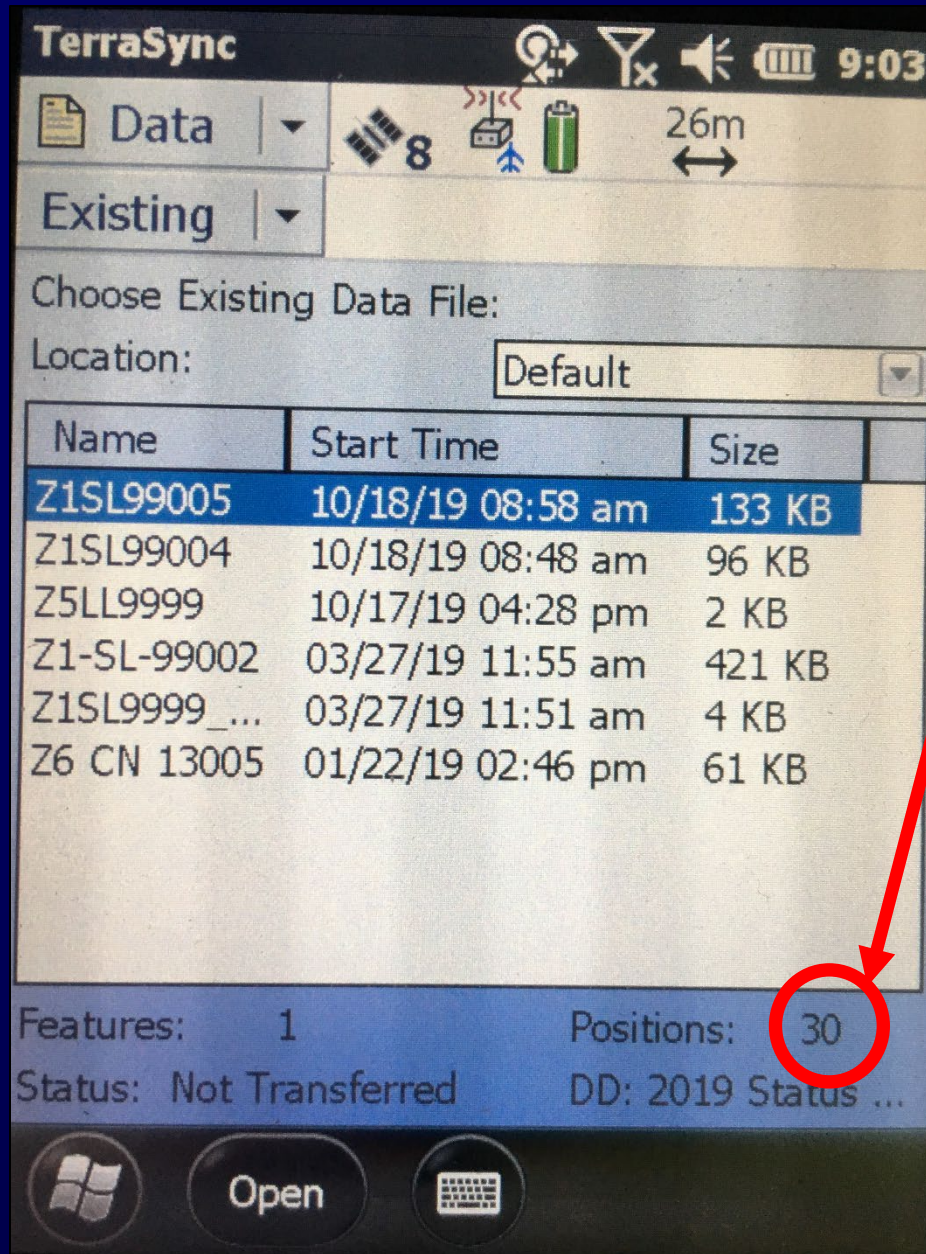
Make sure 30 positions are collected for each sample location.

Data Dictionary entry menu



Typically this means the receiver was not on or the unit was paused. Correct the issue by collecting 30 positions before closing the data file.

Before Leaving Sampling Location



Close File and Inspect

Make sure 30 positions are collected for each feature (sample location).

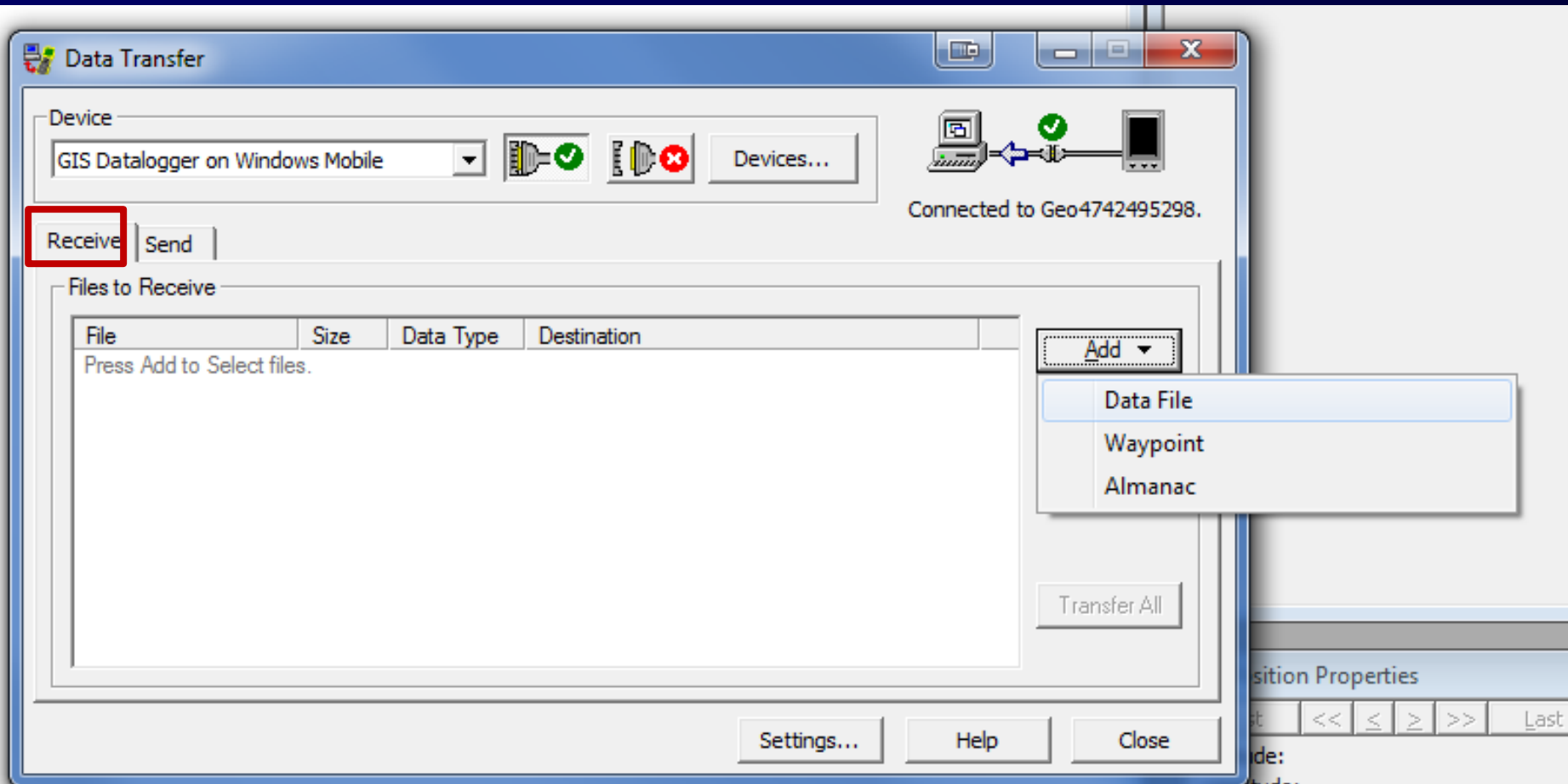
If fewer positions are present, open file again and use "Log" button to collect new positions.

- Back at the Office -

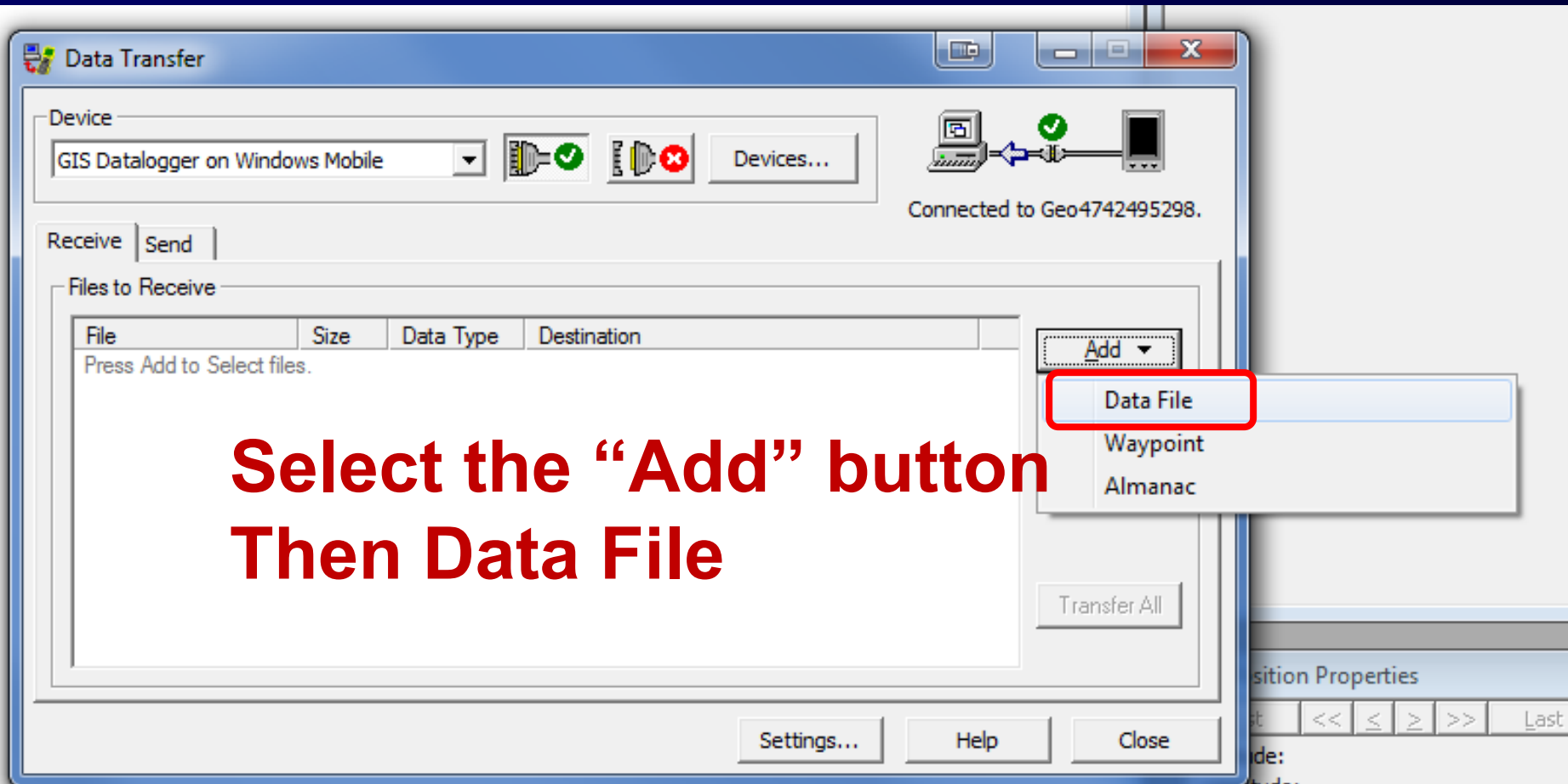
**Always download the SSF
files as soon as you get
back to the Office**

**Download the SSF files
by using the File Transfer
Utility again.**

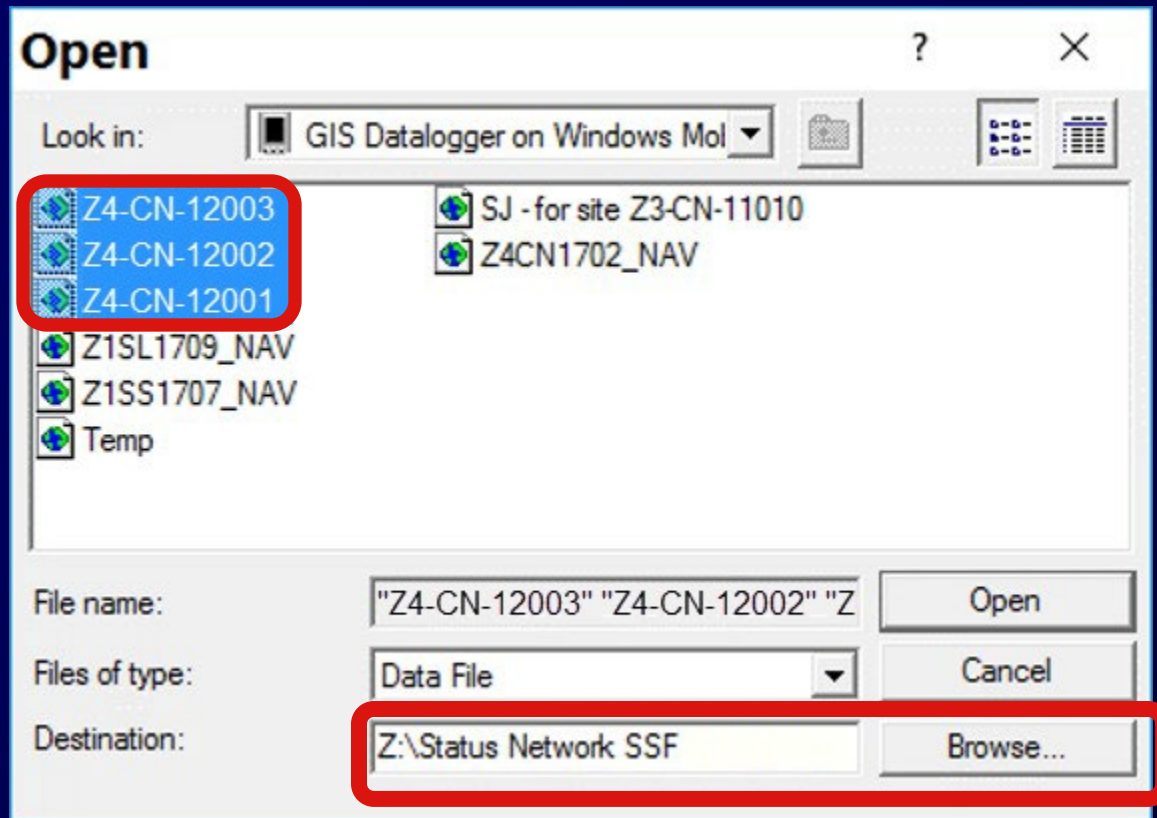
Select the Receive tab to download SSF files



Select the Receive tab to download SSF files

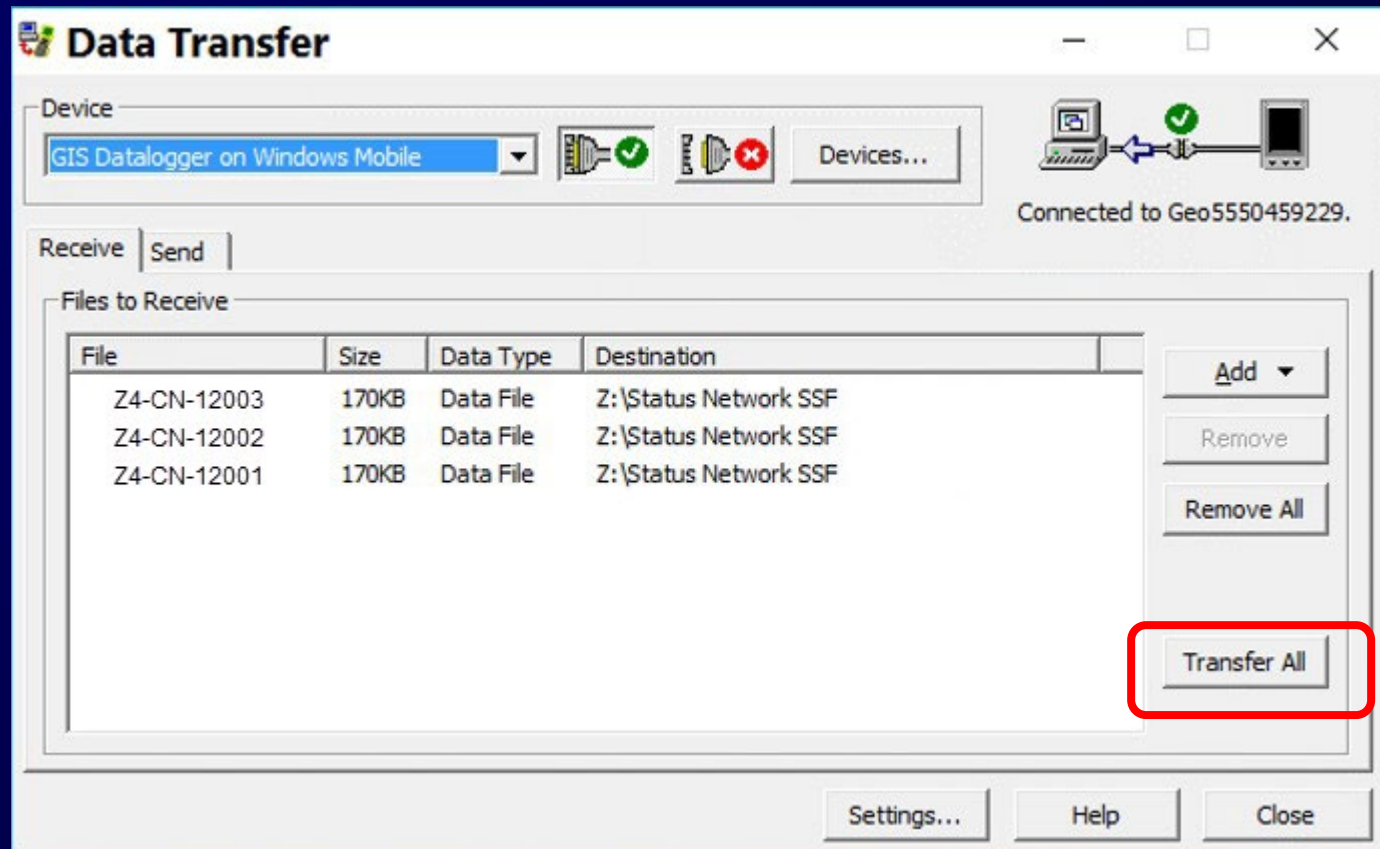


Select the Receive tab to download SSF files



Make sure the Destination is correct so you'll know where to find your data.

Select the Receive tab to download SSF files



Select the Transfer All button.

Questions?

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Tallahassee, Florida 32399**

**(850) 245-8515
Thomas.Biernacki@FloridaDEP.gov**