



Global Positioning System (GPS) Data Creation

B-001-OWQ-WAP-XXX-22-T-R0

Technical Standard Operating Procedure

Office of Water Quality

Branch Watershed Assessment and Planning

Section All

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Purpose

This technical standard operating procedure (TSOP) provides instruction in the operation of handheld Global Positioning System (GPS) units used in the field by Watershed Assessment and Planning Branch staff for the purpose of generating accurate X, Y coordinates for each AIMS sampling location.

Scope

This TSOP is to be used by Watershed Assessment and Planning Branch field staff responsible for collecting GPS data for sampling locations in the field. Field staff complete each step of this procedure.


Method Summary

Field staff use one of the three different types of handheld units to collect GPS data for sampling locations. In this SOP, the step-by-step directions are provided for each of the three Trimble units: Juno SB, Juno 3D, and GeoXM. This verifies their sampling locations and provides accurate X, Y coordinates to upload or enter in AIMS. IDEM spatial data collection standards require all surface water sampling coordinates have a verified GPS accuracy within ≤ 25 meters root-mean-square error, and a 95% confidence level.

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Authorizing Signatures

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



Caleb Rennaker, Section Chief
Technical and Logistical Services, WAPB

10/17/22

Date

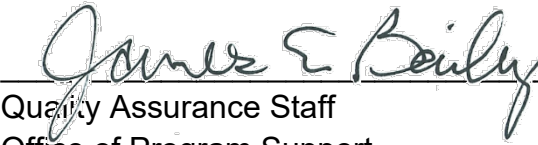


Kristen Arnold, Branch Chief
WAPB, OWQ

10/17/2022

Date

This TSOP is consistent with agency requirements.



Quality Assurance Staff
Office of Program Support

20 Oct 2022

Date

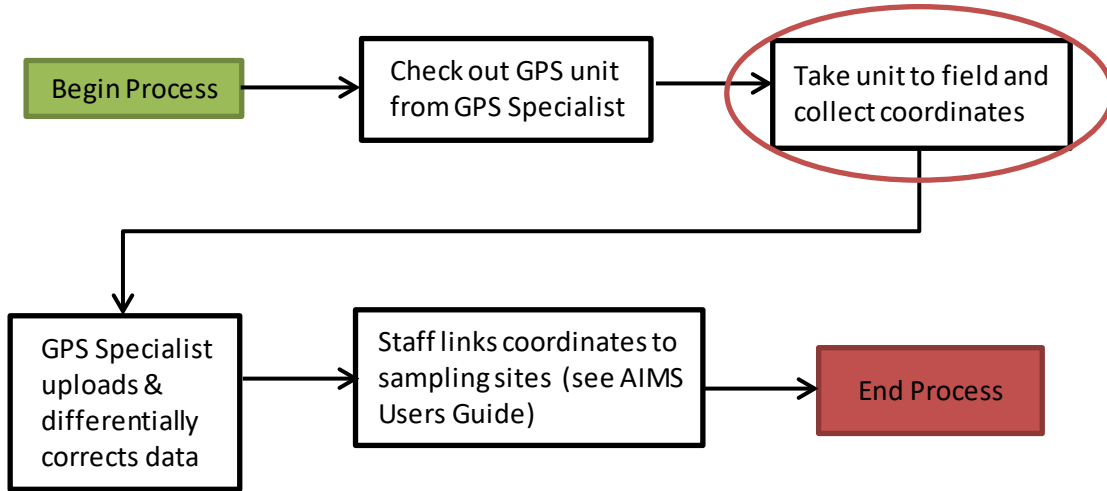
Table of Contents

Purpose.....	1
Scope.....	1
Authorizing Signatures	2
1.0. Overview Flowchart.....	4
2.0. Procedure.....	4
2.1. Procedural Flowchart	4
2.2. Procedural Steps.....	5
2.3. Related Technical Issues	6
3.0. Roles	7
4.0. Required Forms, Equipment, or Software List.....	8
5.0. Records Management	8
6.0. Definitions.....	8
7.0. Quality Assurance and Quality Control.....	9
8.0. References	9
9.0. Appendices.....	10



1.0. Overview Flowchart

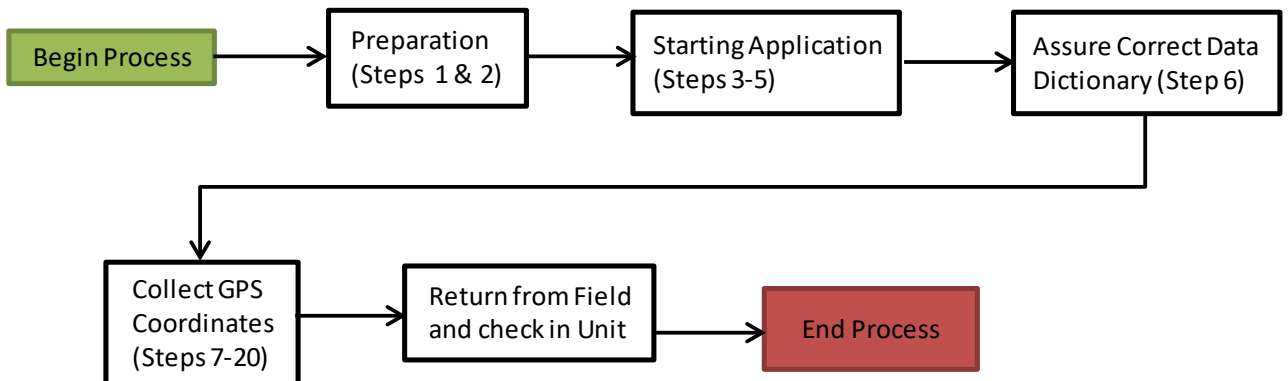
GPS Data Creation is an independent process which is a separate part of a formalized document review. The subject of this TSOP is identified by the box circled in red.



2.0. Procedure

2.1. Procedural Flowchart



The main steps in the procedure are displayed in this flowchart.

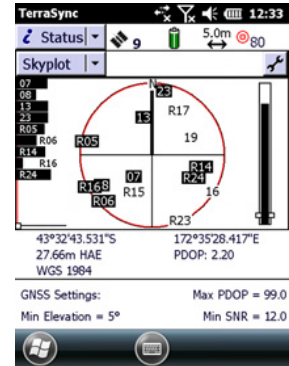


2.2. Procedural Steps

Step 1. Assure the unit is fully charged, the correct date and time are set on the unit, and always brings the unit's car charger to the field as well.

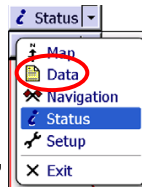
Step 2. Turn on the unit.

Step 3. Open the Terra Sync application and assure the GPS receiver in the unit connects. The connection icon  appears and a chime sounds when the connection is made. Then the satellite icon  shows how many satellites are being used to compute GPS positions. The number flashes when not enough satellites are available, and the satellite icon flashes when the geometry of the satellites is poor.



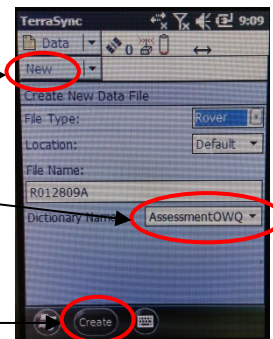
A. If there are not enough satellites available or the geometry is poor, wait 5-10 minutes for the reception to improve.

B. If it does not improve, return to the site to collect the coordinates at a different time of day.



Step 4. Choose "Data" in the top left drop down in the Terra Sync application.

Step 5. Assure the subsequent top left drop down shows "New".




Step 6. Scroll down to assure the Dictionary Name is set to Assessment OWQ.

Step 7. Click "Create".

Step 8. Confirm the antenna height as the default value of 1 meter, if prompted.

Step 9. Click "OK".

Step 10. Choose "sampling site" and make sure to stand still. The unit is logging the feature from this point forward. The field staff clicks "Create" again. At this point, the logging icon  will appear since the logging of the station coordinates has begun. It is extremely important to remain stationary during logging in order to obtain accurate coordinates as detailed in Section 2.3.1. The number at the bottom of the icon indicates the number of GNSS positions

logged. Logging of the feature may be paused briefly and resumed as required for safety or other concerns while in the field.

- Step 11. Select the site type from drop down menu.
- Step 12. Enter the Site ID which is the same as the Site # on the stream sampling field data sheet (Appendix A).
- Step 13. Enter the other Site ID if there is one. This is where the EPA Site ID, or Fixed Station Site ID would be entered as well as any other project specific site ID.
- Step 14. Enter the stream name which matches what is on the stream sampling field data sheet.
- Step 15. Enter the description, such as “CR 100 N”, which is the same as the site description on the stream sampling field data sheet (Appendix A).
- Step 16. Keep the default H collection method as Map Grade GPS.
- Step 17. Pick “data collector” from the dropdown list as their login.
- Step 18. Keep the date and time as set on the unit.
- Step 19. Pick the sampling program from the dropdown list. At this point, assure a minimum of 100 GNSS positions were logged.
- Step 20. Click either:
 - A. “OK” and “Close” if using a Juno SB or GeoXM unit.
 - B. “Done” if using a Juno 3D unit.This ensures each site has its own file name such as R11811A (assigned by the unit) so if an issue arises when the GPS specialist differentially corrects the data, they may isolate the individual sampling site file. (Refer to the image for steps 5-7)
- Step 21. Drive or walk to the next site and begins data collection of GPS data for the next site at Step 7 until the last site is completed.
- Step 22. Return from the field and check in the unit with the GPS specialist at the end of the week of sampling or reconnaissance.

2.3. Related Technical Issues

A. Health and Safety Warnings

- 1. AC adaptor safety
 - a. For the GeoXM, please see the User Guide p 10
 - b. For the Juno SB, please see the User Guide p 8
 - c. For the Juno 3D, please see the User Guide p 9
- 2. Battery safety
 - a. For the GeoXM, please see the User Guide p 9
 - b. For the Juno SB, please see the User Guide p 9
 - c. For the Juno 3D, please see the User Guide pp 9-10

3. SD/Memory card use
 - a. For the GeoXM, please see the User Guide p 11
 - b. For the Juno SB, please see the User Guide p 10
 - c. For the Juno 3D, please see the User Guide p 10

B. Cautions

1. Take care to not drop the unit in water as dropping will likely damage the unit.

C. Interferences

1. The accuracy of the GPS positions will degrade if the field staff does not remain stationary when logging the positions, does not collect at least 100 GNSS positions, or does not close the file prior to moving around and after collecting the GNSS positions.

D. Calibration

1. Not applicable

E. Troubleshooting

1. For the GeoXM, please see the User Guide pp 104-115.
2. For the Juno SB, please see the User Guide pp 103-111.
3. For the Juno 3D, please see the User Guide pp 83-90.
4. For issues within Terra Sync, please see the Getting Started Guide pp 295-303.

3.0. Roles

3.1. Responsibilities

A. GPS specialist

1. Trains personnel in use of Trimble GPS Units for data collection.
2. Revision of OWQ Global Positioning System (GPS) Data Creation SOP.

B. Field staff

1. Assures GPS unit is fully charged prior to taking it into the field.
2. Collects GPS data in the field.

3.2. Training requirements

A. GPS data collection using Trimble Terra Sync™

1. Field staff and GPS specialist

4.0. Required Forms, Equipment, or Software List

- 4.1. Forms
 - A. Stream Sampling Field Data Sheet (Appendix A)
- 4.2. Equipment
 - A. Trimble GeoXM 2005 Series
 - B. Trimble Juno SB
 - C. Trimble Juno 3D
- 4.3. Software
 - A. Trimble TerraSync™ GPS Software

5.0. Records Management

- 5.1. All raw, corrected, base files and export files are archived at the discretion of the office GPS specialist's discretion. This data is moved to archive folders on the GPS specialist PC external backup drive.

6.0. Definitions

- 6.1. "Differential correction" – A technique for increasing the accuracy of X, Y coordinates determined using GPS. A GPS receiver at a GPS base station of known coordinates logs the position calculated by the GPS receiver every few seconds. Those measurements are compared to the correct coordinates for the base station to derive a correction factor that can be applied to the positions of other GPS measurements taken by roving GPS receivers within 250 KM of the base station. Trimble Pathfinder Office software largely automates this process for GPS data collected using Trimble GPS receivers.
- 6.2. "Field staff" – The agency staff who conduct field sampling activities in the Watershed Assessment and Planning Branch.
- 6.3. "Global Navigation Satellite System (GNSS)" – A satellite system used to pinpoint the geographic location of a user's receiver anywhere in the world.
- 6.4. "Global Positioning System (GPS)" – A constellation of satellites developed by the U.S. Department of Defense which transmits 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.

- 6.5. “GPS specialist” – The WAPB staff member responsible for training staff in the use of Trimble GPS units for data collection, uploading data from Trimble GPS units, differentially correcting uploaded GPS data, and reviewing or revising of WAPB GPS related SOPs.
- 6.6. “Standard deviation (SD)” – A statistical measurement of dispersion around an average or mean.
- 6.7. “Trimble” – 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 GPS collected data is checked for data quality. All standard deviations are verified to be 8 meters or less. All horizontal precisions are verified to be 5 meters or less. This is done through the process of differential correction by the GPS specialist. If a point is found to not meet the standards by the GPS specialist, then the staff who collected the GPS data will be asked to collect it again.

8.0. References

8.1. User Guides

- A. Trimble Navigation Limited. April 2007. GeoExplorer® 2005 series Getting Started Guide (Version 1.10, Revision A). Web address. Chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://arf.berkeley.edu/files/webfiles/all/arf/equipment/field/gps/trimble/geoXH/GeoExpl2005_Getting_started.pdf
- B. Trimble Navigation Limited. May 2012. Trimble Juno Series Handhelds: Juno SB and Juno 3D User Guide (Version 1.00, Revision B) Web address. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/http://www.farmworks.com/files/manuals/Juno3Series_User%20Guide_V1_RevB_English.pdf
- C. Trimble Navigation Limited. May 2012. TerraSync™ software Getting Started Guide (Version 5.30, Revision B). Web address. <https://archive.org/details/manualzilla-id-5770351/mode/2up>

8.2. Technical Guidance Document

- A. Indiana Department of Environmental Management. IDEM Spatial Data Collection Standards 1.0. Web address: http://www.in.gov/idem/files/spatial_data_collection_standards.pdf.

9.0. Appendices

9.1. Appendix A: Field Stream Sampling Data Sheet

Appendix A: Stream Sampling Field Data Sheet

IDEM	Stream Sampling Field Data Sheet	Analysis Set #	EPA Site ID	Rank
		15BLW001	15T-001	1

Sample #	Site #	Sample Medium		Sample Type	Duplicate Sample #					
AB20111	OBS130-0002	Water		Normal						
Stream Name:	South Fork Blue River		River Mile:	County: Washington						
Site Description:	Fredericksburg Road									
Survey Crew Chief	Sample Collectors		Sample Collected		Hydrolab #	Water Depth/Gage Ht (ft)	Water Flow (cf/sec)	Flow Estimated?	Algae?	Aquatic Life?
CEF	TJB			01/05/2015	10:35 AM	YSI 3			<input type="checkbox"/>	<input type="checkbox"/>
Sample Taken?		Aliquots		Water Flow Type		Water Appearance		Canopy Closed %		
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No; Frozen		<input checked="" type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4		<input type="checkbox"/> Riffle <input type="checkbox"/> Dry <input type="checkbox"/> Stagnant		<input type="checkbox"/> Clear <input type="checkbox"/> Green <input type="checkbox"/> Sheen		<input type="checkbox"/> 0-20% <input type="checkbox"/> 60-80%		
<input type="checkbox"/> No; Stream Dry <input type="checkbox"/> No; Other		<input type="checkbox"/> 6 <input type="checkbox"/> 8 <input type="checkbox"/> 12 <input type="checkbox"/> 24		<input type="checkbox"/> Pool <input type="checkbox"/> Run <input type="checkbox"/> Flood		<input type="checkbox"/> Murky <input type="checkbox"/> Black <input type="checkbox"/> Other		<input type="checkbox"/> 20-40% <input type="checkbox"/> 80-100%		
<input type="checkbox"/> No; Owner refused Access		<input type="checkbox"/> 48 <input type="checkbox"/> 72 <input type="checkbox"/> AS-Flow		<input type="checkbox"/> Glide <input checked="" type="checkbox"/> Eddy <input type="checkbox"/> Other		<input checked="" type="checkbox"/> Brown <input type="checkbox"/> Gray (Septic/Sewage)		<input type="checkbox"/> 40-60%		
Special Notes:	Streamflow not taken due to high flow event and extreme cold weather.									

Field Data:

Date (m/d/yy)	24-hr Time (hh:mm)	D.O. (mg/l)	pH	Water Temp (°C)	Spec Cond (µmhos/cm)	Turbidity (NTU)	% Sat.	Chlorine (mg/l)	Chloride (mg/l)	Chlorophyll (mg/l)	Weather Codes			
											SC	WD	WS	AT
01-05-2015	10:35	11.82	7.46	4.71	233	88.7	91.8				1	0	1	1
Comments	Streamflow not taken due to high flow event and extreme cold weather.													
Comments														
Comments														
Comments														
Comments														
Comments														
Comments														

Measurement Flags	<	< Min. Meter Measurement	Weather Code Definitions			
	>	> Max. Meter Measurement	SC	WD	WS	AT
	E	Estimated (See Comments)	Sky Conditions	Wind Direction	Wind Strength	Air Temp
	R	Rejected (See Comments)				

Field Calibrations:

Date (m/d/yy)	Time (hh:mm)	Calibrator Initials	Calibrations			
			Type	Meter #	Value	Units

Calibration Type	pH
	DO
	Turbidity

Preservatives/Bottle Lots:

Group: Preservative	Preservative Lot #	Bottle Type	Bottle Lot #	Groups: Preservatives	Bottle Types
GC: Ice	NA	1000P	00059180	General Chemistry: Ice	2000P 2000mL Plastic, Narrow Mouth
Nx: H2SO4	SA3308020	1000P	00059180	Nutrients: H2SO4	1000P 1000mL Plastic, Narrow Mouth
Metals: HNO3	NA4174080	1000P	00059180	Metals: HNO3	500P 500mL Plastic, Narrow Mouth
Ecoli: Ice	NA	120PB	AK004	CN Cyanide: NaOH	250P 250mL Plastic, Narrow Mouth
				O&G Oil & Grease: H2SO4	1000G 1000mL Glass, Narrow Mouth
				Toxics Toxics: Ice	500G 500mL Glass, Wide Mouth
				Eooli Bacteriology: Ice	250G 250mL Glass, Wide Mouth
				VOA Volatile Organics: HCl & Thiosulfate	125G 125mL Glass, Wide Mouth
				Pest Pesticides: Ice	40GV 40mL Glass Vial
				Phen Phenols: H2SO4	120PB 120mL Plastic (Bacteria Only)
				Sed Sediment: Ice	1000PF 1000mL Plastic, Coming Filter
				Gly Glyphosate: Thiosulfate	500PF 500mL Plastic, Coming Filter
				Hg Mercury(1831): HCl	80P 80mL Plastic
				Cr6 ChromiumVI(1836): NaOH	250T 250mL Teflon
				MeHg Methyl Mercury(1830): HCl	500T 500mL Teflon
					125T 125mL Teflon

Data Entered By: _____ QC1: _____
QC2: _____