Using ArcPro and Trimble GPS
with a boundary survey for posting & identifying property lines.

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Download location: http://skralston.com/USFWS/

This tutorial is designed for the USFWS Windom District to assist in using land survey files and transferring that into survey grade GPS for use in identifying and posting property boundaries for management purposes. This is written as an individual reference and method for specific location and needs and does not represent official policy of the USFWS. It may be utilized as a reference by others only as a example of types of techniques used in similar scenarios.
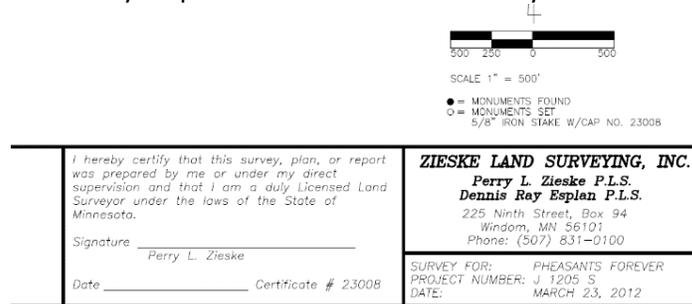
Getting the Survey File:

- If you don't have surveyor files and plan to work strictly off boundary pins in the field you can skip this section and go straight to the GPS field section.
- Obtain a Survey Map and if possible get Digital Files from the Surveyor
- On the Bottom of the Survey map it will list who did the Survey and the Job Number for Reference


Using a DWG or other digital survey:

- Contact them to request a DWG file for the project or depending on the surveyor a shapefile is easier if they are able to provide that. Many surveyors only work in Autocad so can export a DWG file which we can view in GIS.
- If they don't have digital files you can pull up in GIS, see if you can request a GPS points list for all corners which would have coordinated you can enter in GIS.
- Make sure to ask what Coordinate system it was collected in. Most likely the County Coordinate system and in feet for units. The DWG will usually not be defined on its own.
- Open ArcGIS and create a new map or use an existing map.
- **COORDINATE SYSTEMS are very Important!** CAD files and the Trimble GPS aren't as sophisticated as GIS and can not deal with multiple different coordinate system or project on the fly. You MUST define your coordinate systems and both the map/project AND the survey file or shapefile have to be defined in the SAME coordinate system or it will not line up with the GPS!
- Set your map coordinate system. In the Contents pane right click on the main map layer and choose Properties. In the Map Properties windows choose Coordinate System. In MN most surveyors will use the most local coordinate system they can which will be under Projected/County Systems/ Minnesota/US Feet/ then choose the county you are in. Hit OK to apply it.
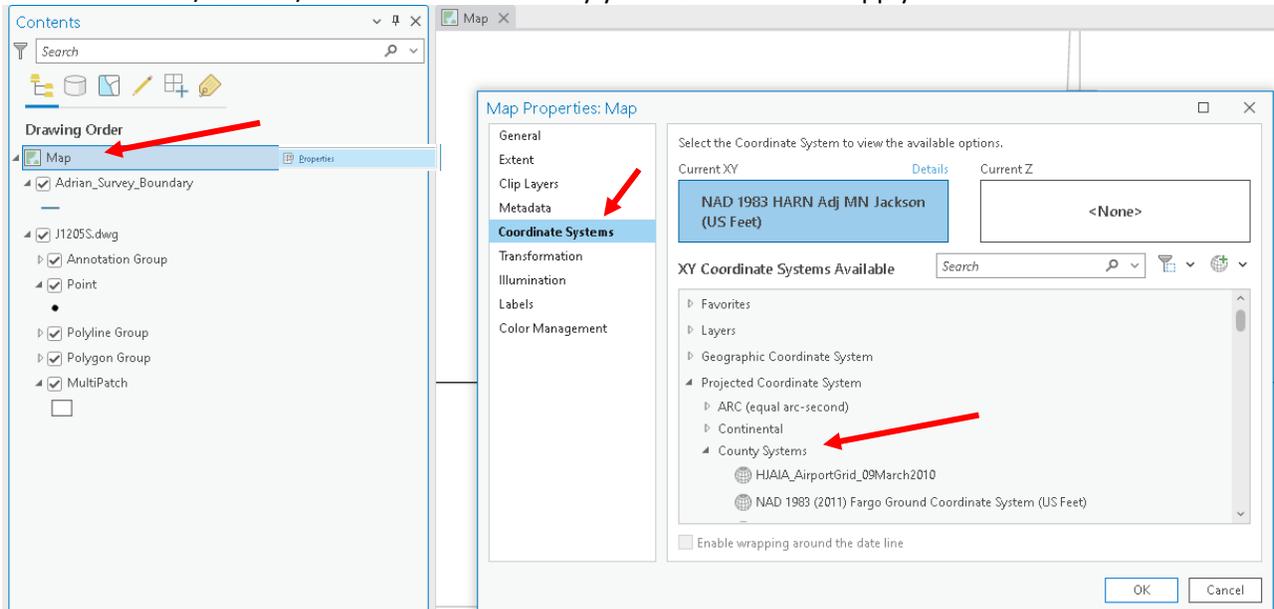

- Add your DWG file or if they had a shapefile you can add that to your map. To add data go to the view menu on the top and choose Catalog Pane which will then open on the right side. Go to Folders. If your

path to your data is not there then Right click on Folders and choose Add Folder Connection. Navigate to the path where your data is stored and hit OK to add it. Then select the DWG layer or any other data layers you need to your map. Just click and drag the file you want on to the map.
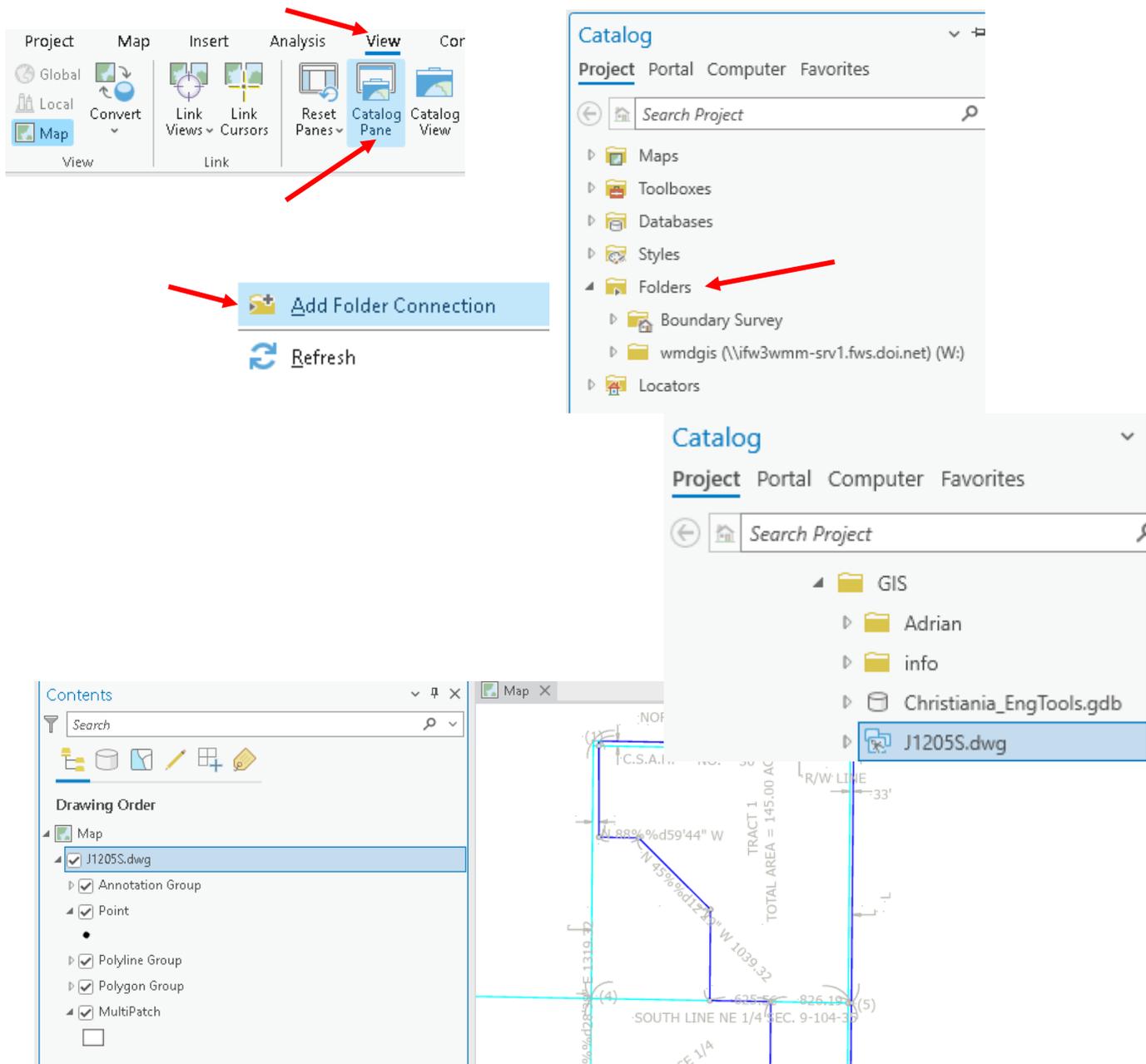

- Skip this step if they gave you a shapefile already. If transferring from a DWG to shapefile, create a Polyline or Polygon Shapefile you will use for your Boundary. Go to the Catalog Pane again and find the folder where you want to save this such as your project folder. Right click on the location and choose New > Shapefile. In the Create Feature Class screen confirm where you are saving it. Give it an intuitive descriptive name (No spaces allowed). Pick either a polygon or polyline type depending if you want the interior or just the boundary line. IMPORTANT! Pick your coordinate system to match the same as the survey file and your map!
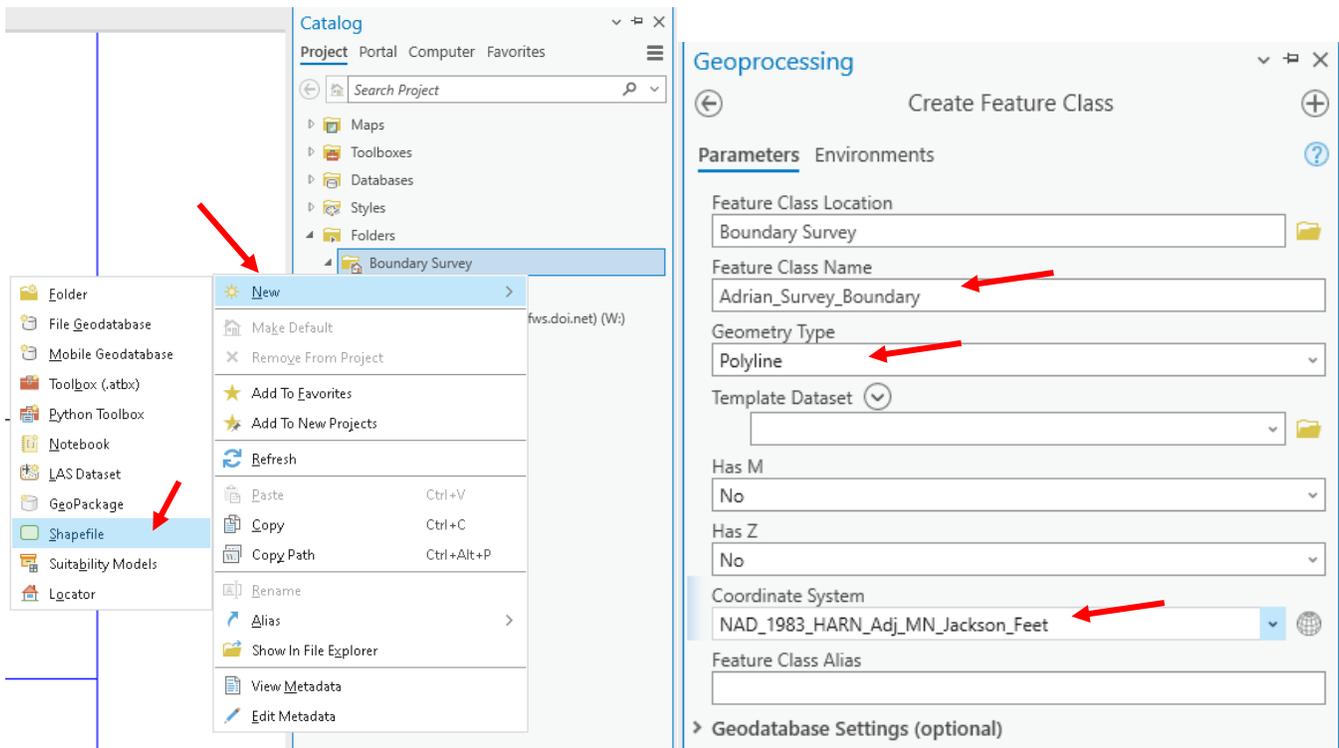
- Make sure "Snapping" is on so when editing the cursor snaps exactly to the point or line you are tracing from the DWG. This is on the Edit Menu and Snapping button. Also if you want to control which layers it will snap to you can control that from the Snapping Contents pane and toggle on or off certain layers.
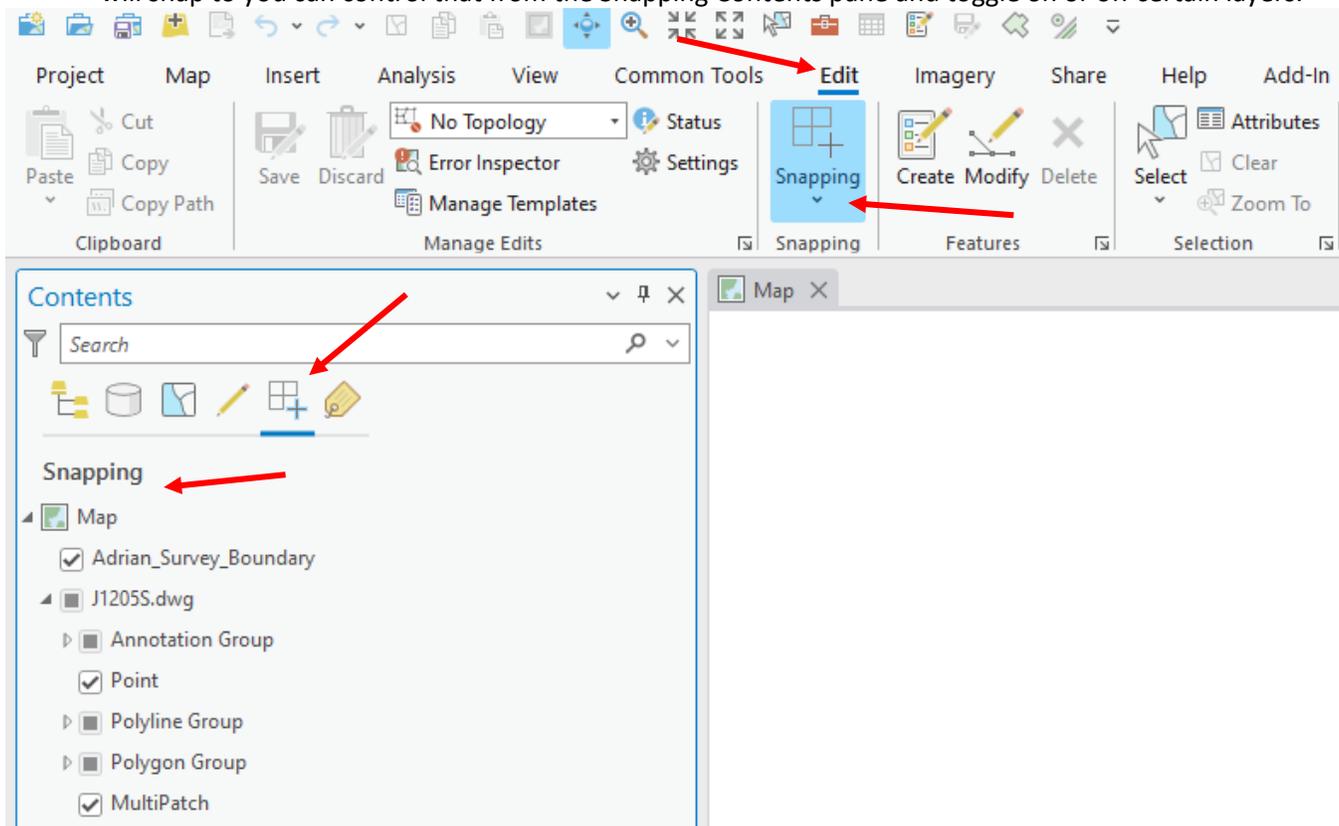
- Start Editing your Boundary Line Layer. Depending on your settings in ArcPro may either always be in edit mode or my have to turn on edit mode. Can hit the "Create" button on the Edit menu to get the Create features pane open on the Right side. From there just select the layer you want to draw on which would be your boundary shapefile.
- Zoom in to your 1st corner point on the map. Hover your mouse over it and if Snapping is on it should snap to a feature and show a label of what it is snapped to so you get the right object. Click to place a vertex.
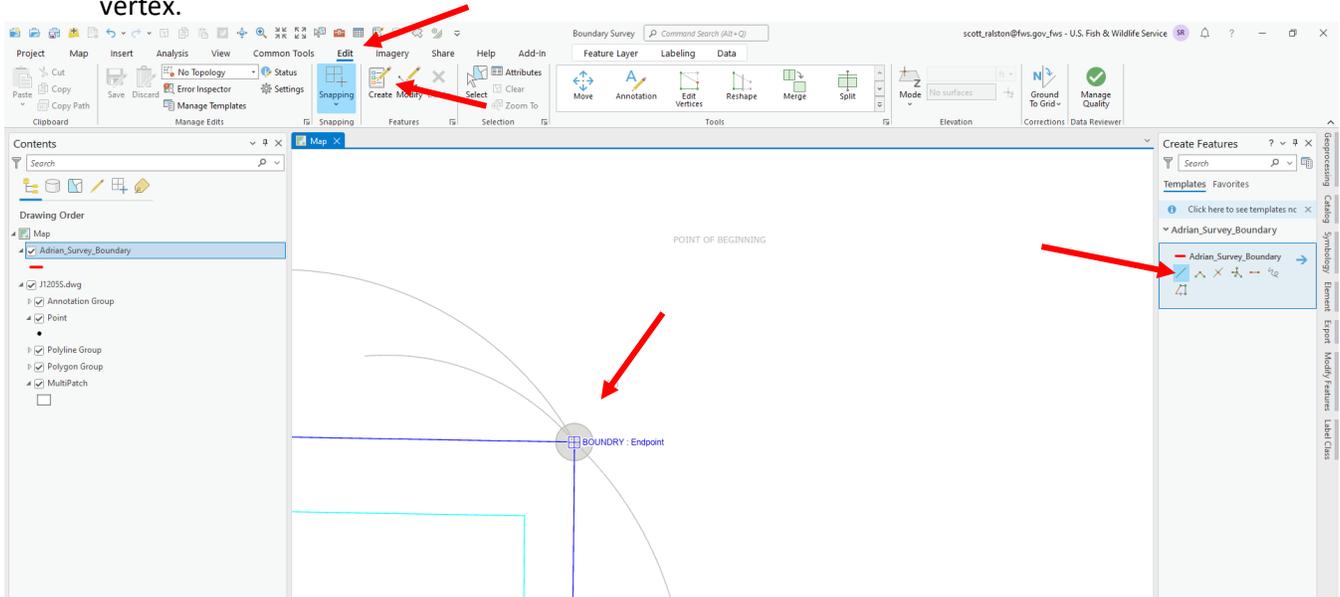
- To navigate to your next point while still editing, hold down the "C" key t drag and pan the map. Mouse scroll wheel can zoom in or out.
- In a simple survey you would just follow the boundary edge around and put a vertex at every corner back to the beginning. Double click the last one r hit F2 or right click and choose "Finish' to stop the sketch. In a perfect scenario you would be done and move on to the GPS.
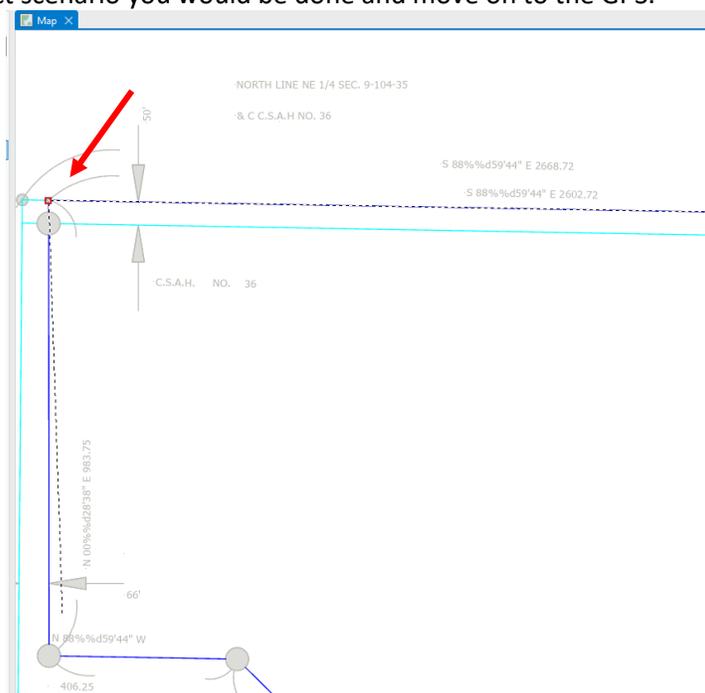
- What to do if there is no point to snap to? Some survey files don't have an exact corner point. It has something to do with how the surveyor creates it in AutoCAD and what type of display or annotations they use. In this example the lines exist but at the corners are just a polygon circle not a point.
    - These situations are where using a polyline instead of a polygon is more useful. You will extrapolate the existing lines.
    - Start editing and snap to the existing line that runs to the corner of interest. Put 1 point on the line then move farther down the line towards the corner and snap another vertex.
    - Next right click and you will see the option for "Deflection" (Not "Direction"). In the deflection enter 0. This will restrict your drawing to the same Deflection angle from your last 2 points making a continuation of a straight line.
    - Extend that line through your corner and F2/Double click or finish that line.
    - Next repeat these steps for the opposing line coming into that corner with a 0 Deflection.
    - Now you will have to boundary lines that extend through your corner. You can zoom in as tight as it can go and click on the intersection of the 2 lines to make your vertex point for that boundary corner. Repeat on all other corners as needed. Can delete the temporary deflection lines if needed when done.
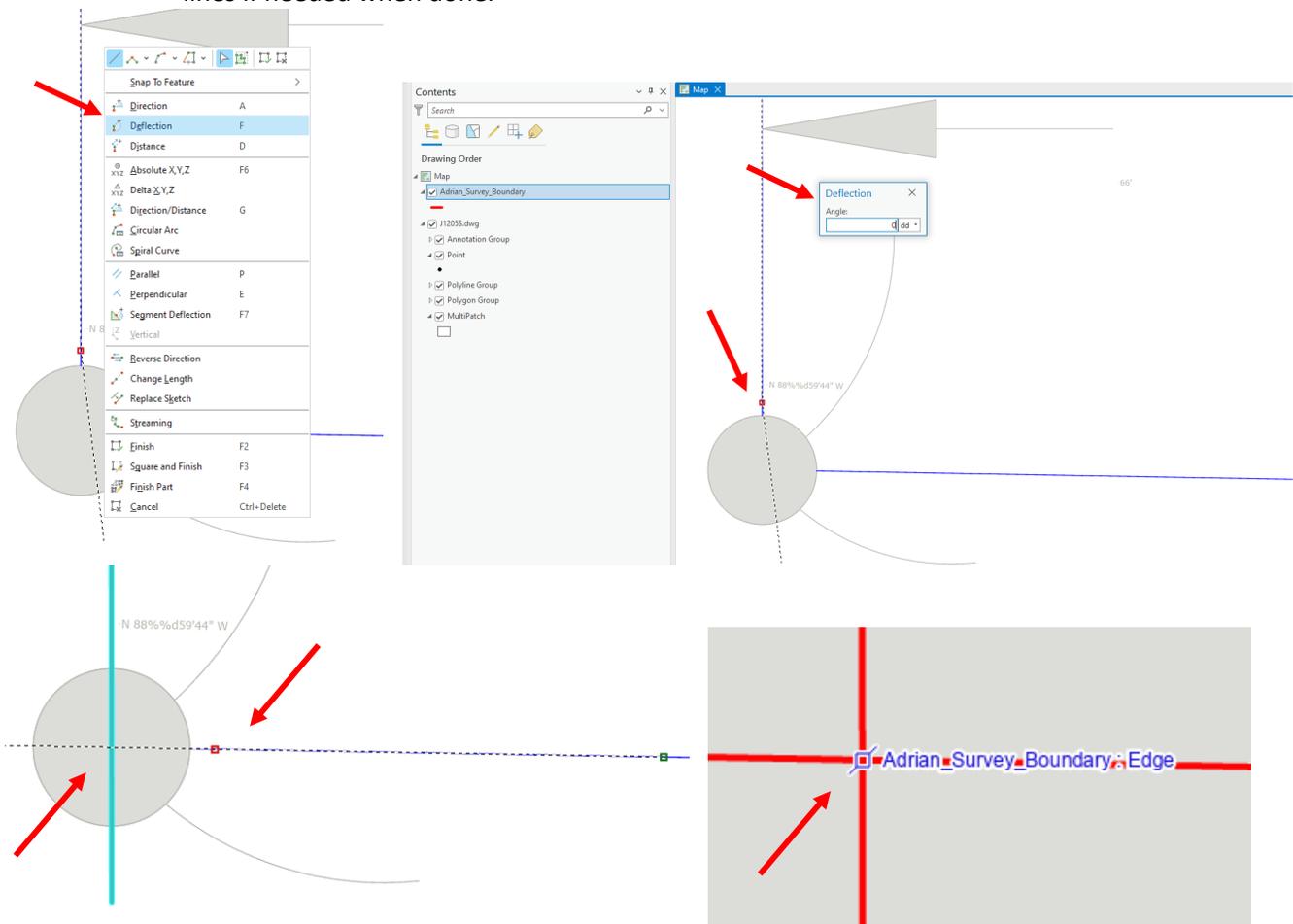

Key In Boundary Corners – Meets and Bounds
- Alternative to snapping to a DWG and tracing is to key in corners via coordinates or Meets and Bounds. This could work if all you had was a hardcopy map not a digital file or just a X,Y points list.
- You must have a beginning point to key in a boundary. This could be from your own survey where maybe you used a survey grade GPS and got an exact shot of one corner pin but are missing the others. Or a surveyor may have given you a GPS point list that has a lat/long.

- In the case of a Lat/Long Survey simply start editing by having your boundary layer selected in the Create Feature pane. Right click in your map and choose Absolute X, Y, Z. In that window type the X and Y coordinates
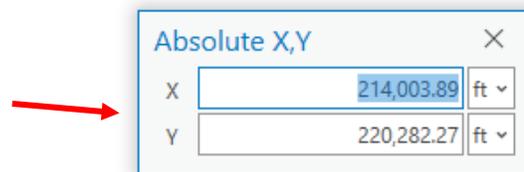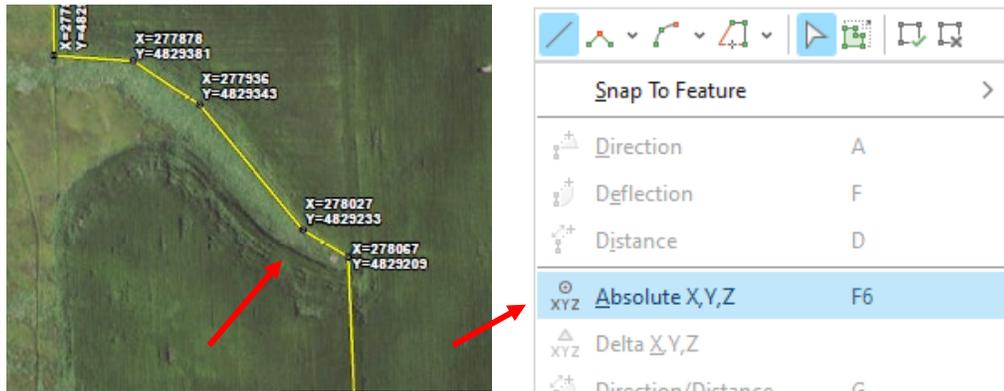

- o Note again 1st must be in the same coordinate system on your map and boundary layer as the source information. Then key in the same units. Could be in feet, meters, decimal degrees etc. If you are unsure then look at the bottom of the screen for the map coordinates. Can click that to change the unit types. Hover your cursor on the map near where you think the target coordinates will be and the map coordinates should be fairly close. If the units appear the same then use that or if they look very different then try changing the unit type in the display until one matches.
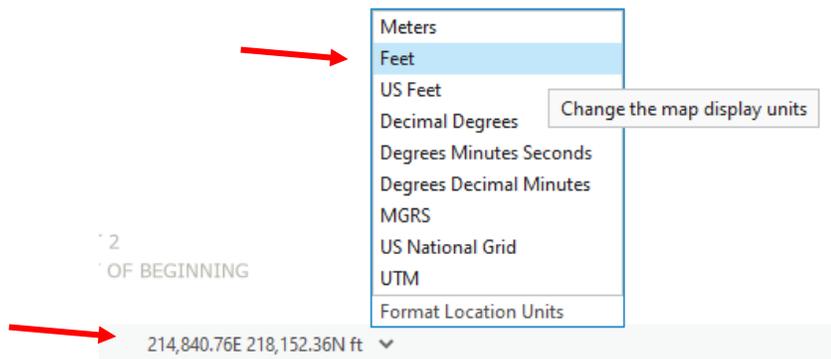

- o Once you key it in you will have that vertex placed and can move to the next one.
- **To Use Bearing and Distance/meets & bounds**
  - o For this you again need a starting point. Often labeled on Survey maps as "Point of Beginning". Some surveys will give a lat/long for that point then bearing and distance for others. Or again may go out and find 1 corner then use these bearing and distance to get the other corners.
  - o On a survey map usually labeled on each line is the bearing and distance from the last point.
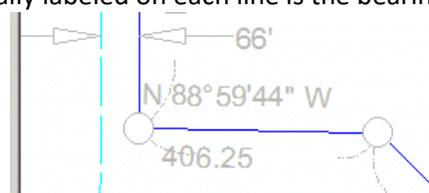
- o Make a vertex at your first point then right click and in the context menu choose Direction/Distance.
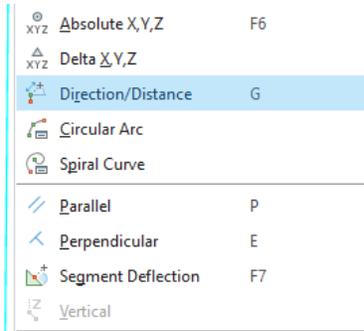
- o Enter the direction angle. Note different surveys may use different units so select the same one. Often they will use "Quadrant Bearing" format but pick the one that matches as well as the distance units. Hit enter to create the point. Note these only work in 1 direction. Your survey may have it labeled if they are going clockwise or counter. If you enter it backwards it will place the point at an inverse location. If that happens then re-do but swap N and S as well as E & W in the entry.
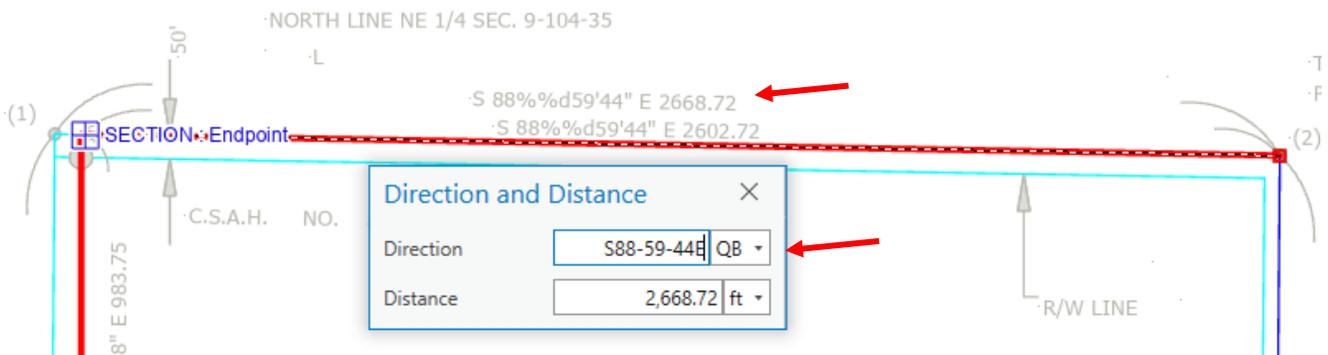
- For more complex surveys with curves use the same methods for bearing and distance but use the option for Circular Arc which should match notations made on the survey.
- Other additional options are available such as parallel and perpendicular lines etc if making offsets or ROW's.
- When finished with your final boundary lines hit Save on the edit menu to save all edits.
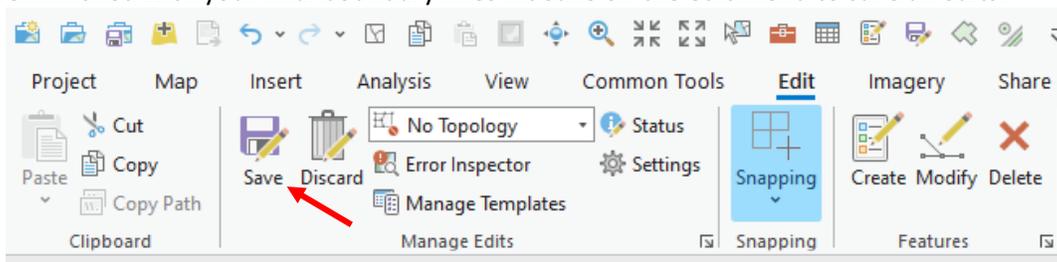

- You are now ready to move to the GPS. Close ArcPro and go to file Explore wherever your data is stored. Copy all associated parts of the shapefile which is made up of multiple files. To be safe just copy all of the same name but primarily for the GPS unit you need ones with extensions: dbf, shp, and shx. Transfer them to a flash drive to put on your GPS.

Adrian_Survey_Boundary.cpg
Adrian_Survey_Boundary.dbf
Adrian_Survey_Boundary.prj
Adrian_Survey_Boundary.sbn
Adrian_Survey_Boundary.sbx
Adrian_Survey_Boundary.shp
Adrian_Survey_Boundary.shp.xml
Adrian_Survey_Boundary.shx

Using Trimble GPS to locate boundaries or lines for a survey

- On your trimble use the flash drive to transfer your survey shapefile from your desktop to the TSC7 or whichever model you are using. Save in the data folder on the device where projects are stored.
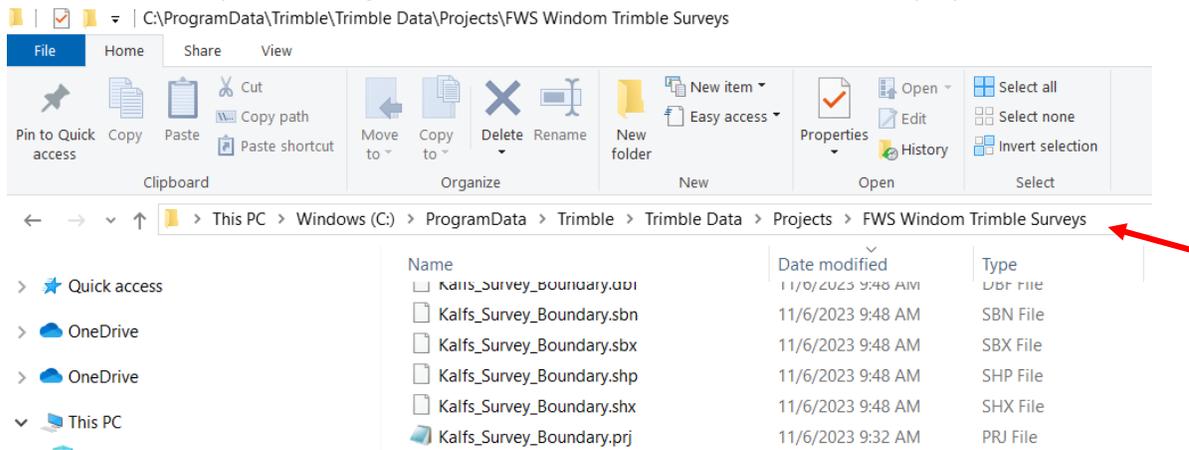
- In the field to help with reducing connection problems turn on equipment in this order
- WiFi hotspot. If you device has it's own sim card it should already be connected but if not turn on the hotspot and let it boot up and get signal. If you are using a hotspot off your phone you may need to have the phone on the share a hotspot screen in order to be recognized.
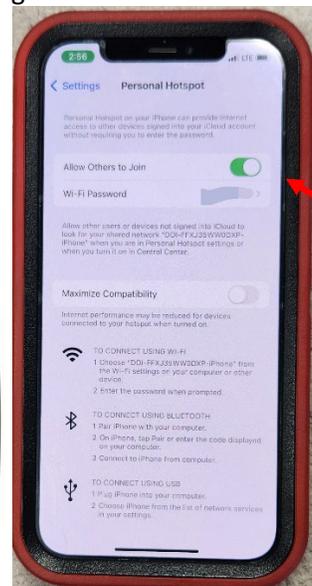
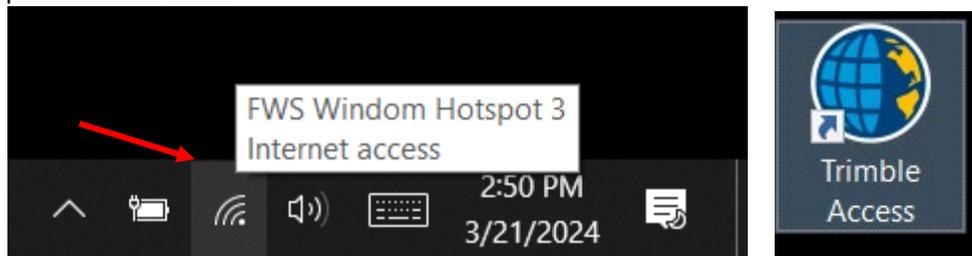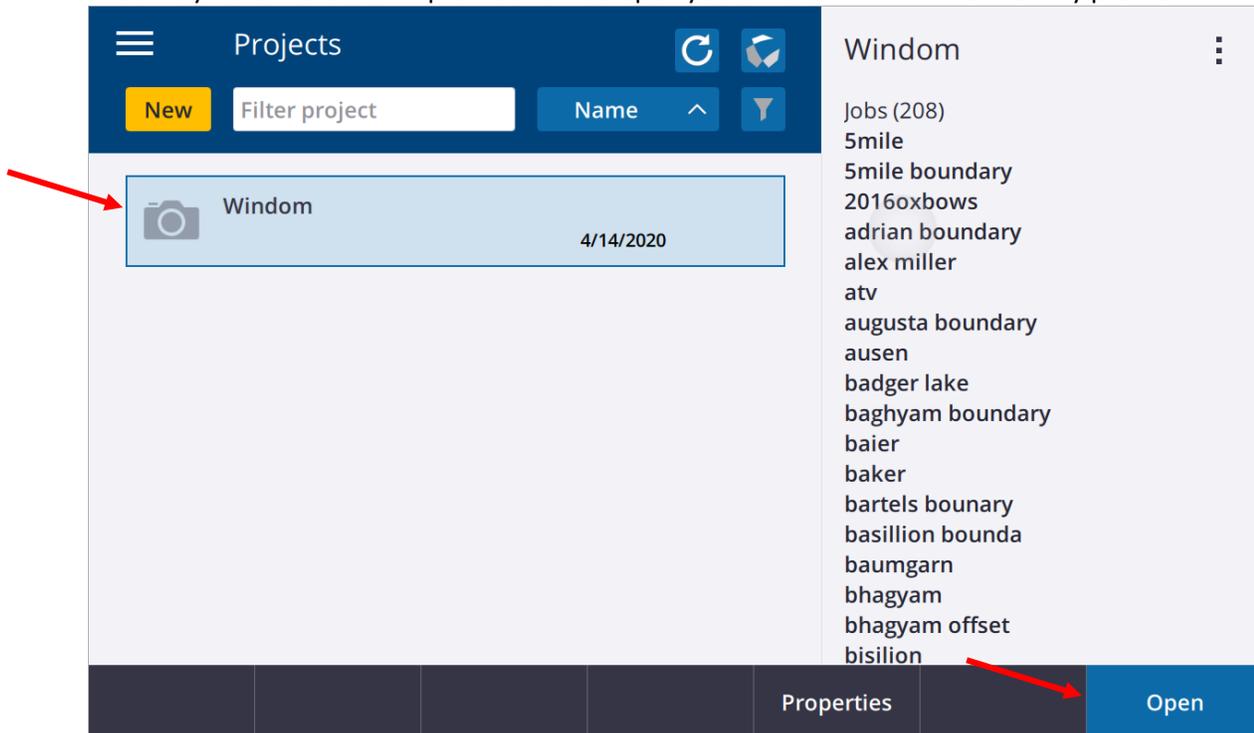- Next turn on the Receiver R10 or R12 or whichever model.

- Then turn on the Data Collector TSC7 etc.
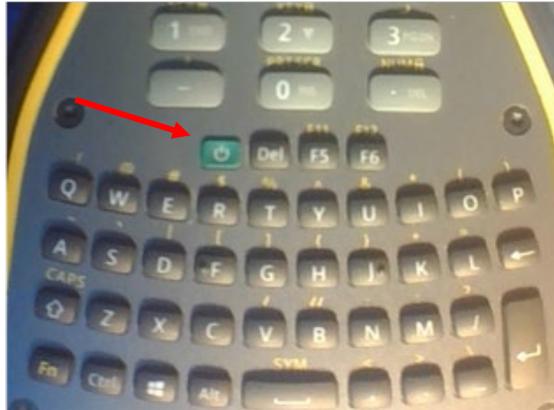
- Check on the bottom right taskbar that you are connected to the internet.
- Then open Trimble Access

- You may have more than 1 profile and if so open yours. Here "Windom" is the only profile.

- If you already have a job created you can search for it and open it but if not Hit New to create one.

- Give it a name then pick your coordinate system

- Coordinate systems from Library

- Very likely your survey was done in the County Coordiante system. You MUST match whatever the system was in your survey data to your GPS project or they will not line up! Assuming the county system, In the system Dropdown menu find United States/NAD83/MN or may be named slightly different depending on your version but should be the MN County system. Once selected you will also have a Zone drop down menu which you select your county. Geoid probably doesn't matter here unless you are doing elevation as well but can leave on default or the newest or most common one you use for other elevation surveys such as 2012. Hit Store to Save

- Back on the Job setup screen check your Units. Most like should be in Survey Feet. If your survey was something else then match the units such as if it was in Meters. Also here good 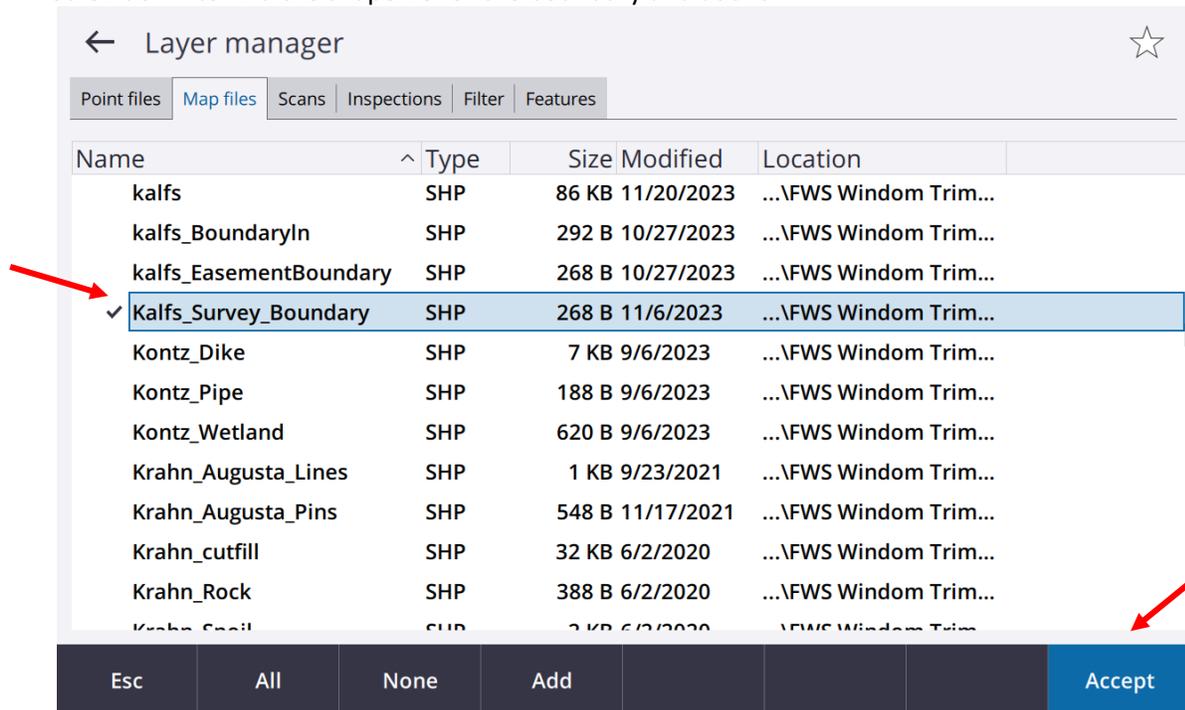to also match your angle units to whatever was used in the survey particularly if you plan to key in on the screen in the field.

Units (Dist.)	Meters

Units

Distance and grid coords

US survey feet ▼

Angles

DDD.MMSS ▼

Height

US survey feet ▼

Quadrant bearings

☐
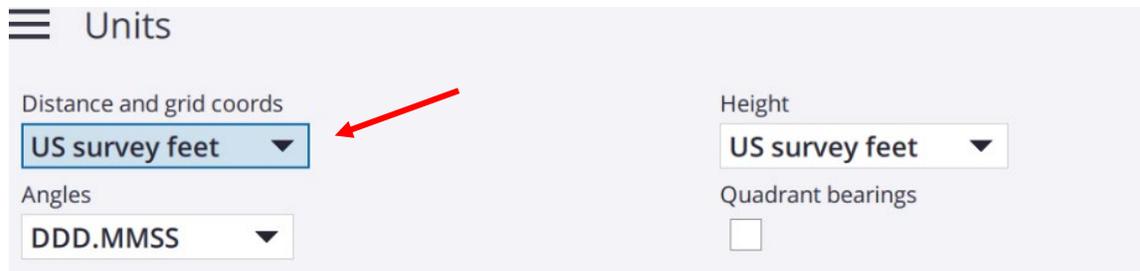
- Click on "Active Map" or "Layer Manager" depending on your version which are the layers in your map and where you add your boundary shapefile.

Layer manager	1

- Scroll down to find the shapefile for the boundary and add it.

← Layer manager ☆

Point files | Map files | Scans | Inspections | Filter | Features

Name ⌃	Type	Size	Modified	Location
kalfs	SHP	86 KB	11/20/2023	...\FWS Windom Trim...
kalfs_BoundaryIn	SHP	292 B	10/27/2023	...\FWS Windom Trim...
kalfs_EasementBoundary	SHP	268 B	10/27/2023	...\FWS Windom Trim...
✓ Kalfs_Survey_Boundary	SHP	268 B	11/6/2023	...\FWS Windom Trim...
Kontz_Dike	SHP	7 KB	9/6/2023	...\FWS Windom Trim...
Kontz_Pipe	SHP	188 B	9/6/2023	...\FWS Windom Trim...
Kontz_Wetland	SHP	620 B	9/6/2023	...\FWS Windom Trim...
Krahn_Augusta_Lines	SHP	1 KB	9/23/2021	...\FWS Windom Trim...
Krahn_Augusta_Pins	SHP	548 B	11/17/2021	...\FWS Windom Trim...
Krahn_cutfill	SHP	32 KB	6/2/2020	...\FWS Windom Trim...
Krahn_Rock	SHP	388 B	6/2/2020	...\FWS Windom Trim...
Krahn_Spoil	SHP	2 KB	6/2/2020	...\FWS Windom Trim...

| Esc | All | None | Add | | | Accept |

- That should be all your critical settings. Hit enter to save and open the new job.
- Assuming you had your GPS receiver head turned on already it should show on the top toolbar as an icon and is connected.
- To activate high accuracy differential GPS hit the Measure button in the bottom right

50m

Measure
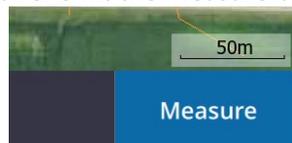
- A screen with a list of Mount points will appear. Unless otherwise specified use CMRx_NAD83 (2011). Highlight it and hit Accept
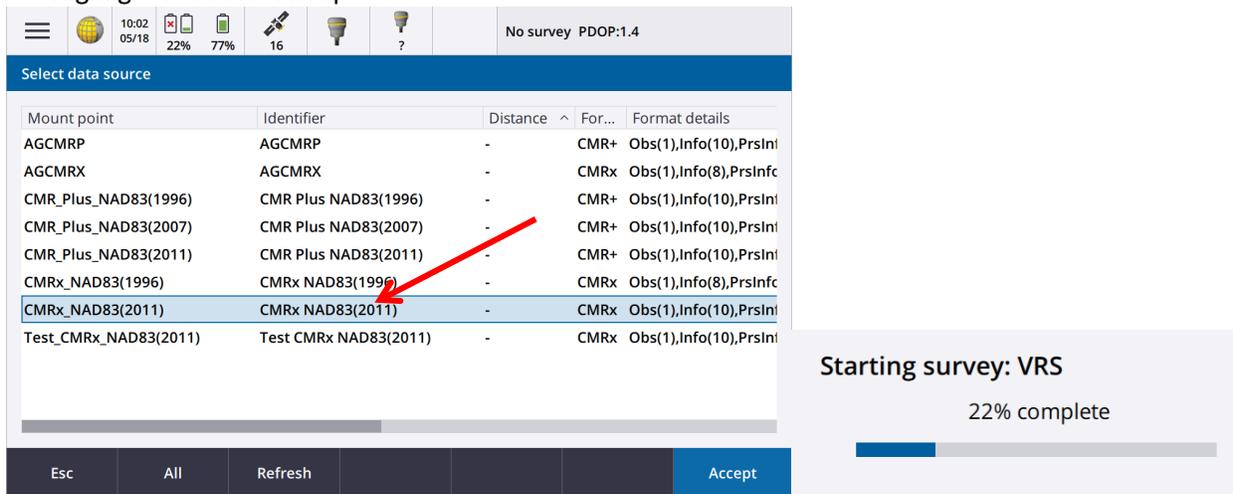
- You could get a warning about **calibration**. Ignore if you don't need specific features like compensated point for tilted survey rods. Otherwise can take the time to calibrate using the built in directions that will walk you through it. You will need a leveled surface to reference.
- On some devices if they were set up for multiple survey types you may have a list such as RTK, VRS etc. In most cases choose **VRS**.
- Once logged in the GPS should initialize which will be indicated by the red X changing to a green check box in the top toolbar next to the GPS icon. Some units particularly the R12i need movement to initialize and to calibrate it's IMU so walk around or wobble the unit in a circle until it initialized with a position fix. Also may need to be in a clear air space.


If red X, may need movement to initialize and calibrate

- Confirm your GPS heigh is set correct which should be 2 meters or 6.562 feet for a standard survey rod

- At this point it is as easy as walking around the boundary and following the screen. Use the zoom in and out and pan tools to change scale and position but you should see the boundary line from the shapefile on screen along with your cross hair for a position. Walk to a line or corner where you wish and use that as the reference where to place your marker.
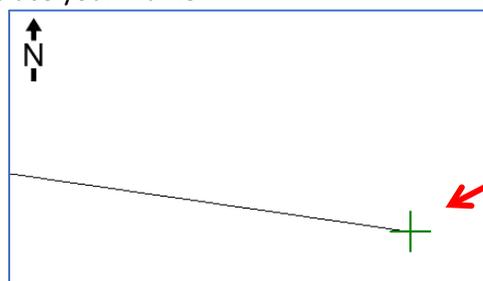
- If you need to key in points in the field you can similar to described in Arc Pro. In the job menu under General Survey choose Key in
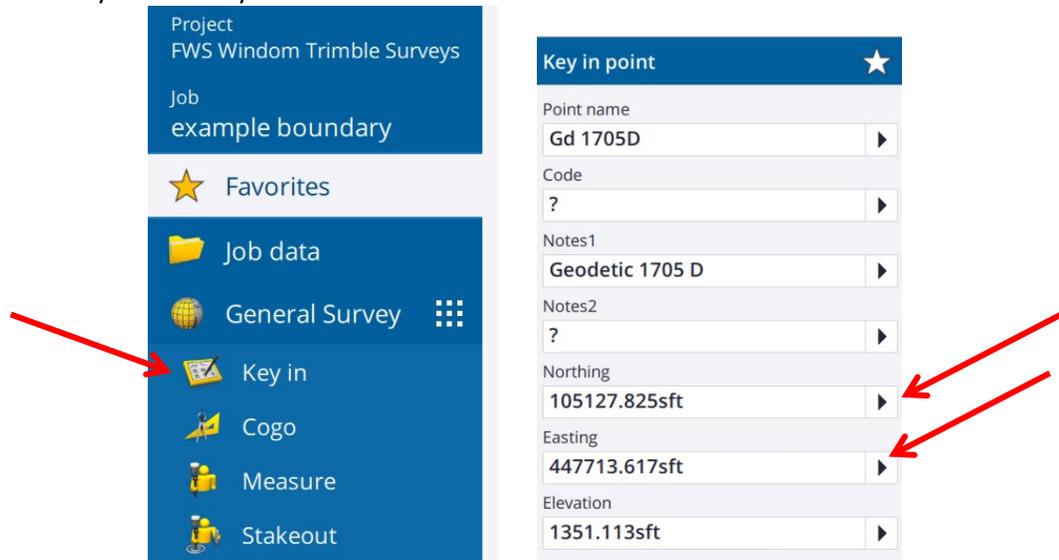
- Type in a point name then the coordinates using the correct units. Northing is a Y Value and Easting is a X value. Elevation can be a guess or 0 if you don't know and not relevant to boundaries
- **Creating a line on-site**
  - o If you are posting a line and did not have a previous survey file but can locate the corner pins on-site (or key in the points), first go to those pins and take a topo survey shot which is an averaged reading over several seconds or a minute to get a more accurate location. Do this for the 2 ends of a line.
  - o Next go to Key in an choose Line
  - o In the Key in Line menu put in the names of the 2 points you shot for the two corners as the start and end points. Give the line a name and save the line. Then you can navigate with this line to post it.