DIGITAL MAPPING TECHNIQUES 2025

The following was presented at DMT'25
May 18 - 21, 2025

The contents of this document are provisional

See Presentations and Proceedings
from the DMT Meetings (1997-2025)
http://ngmdb.usgs.gov/info/dmt/

Bringing Data Into The Field

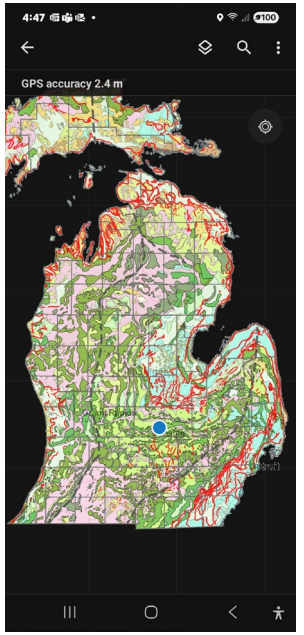
ESRI's Field Data Collection apps like Field Maps have changed how people collect field data, but many folks just need geological data in the field for reference in an offline mode. This presentation will focus not on field data collection, but on creating mobile map packages and basemaps (vector tile base maps and tiled basemaps like LiDAR DEMs, aerial imagery mosaics and geological raster surfaces), essentially having a mini-GIS on your phone or tablet. This same data can be published and shared to the public so anyone can use Field Maps for free with these mobile map packages and basemaps without needing to have an ESRI named user account or an internet connection to use them.

Bringing Data Into The Field

ESRI's Field Data Collection apps have changed how people collect field data

- -Collector>**Field Maps**
- -Survey 123
- -QuickCapture

But…. many folks just need data in the field for reference!



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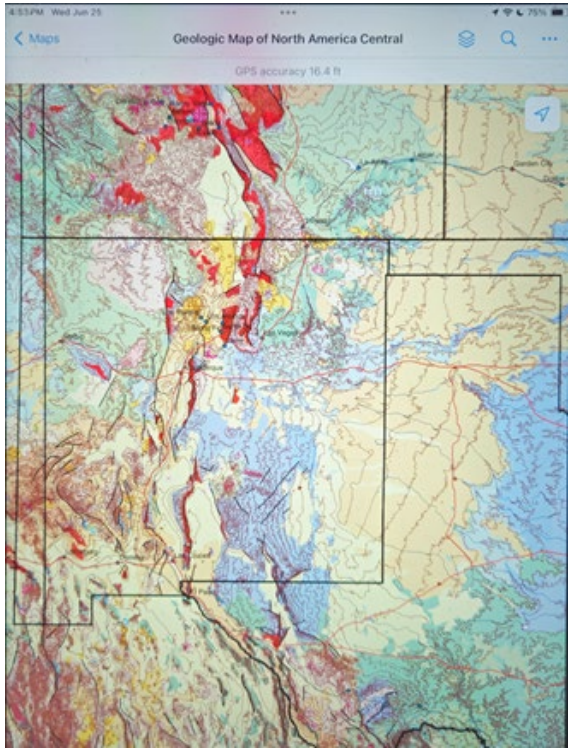
May 19, 2025

Michigan Geological Survey EST. 1837



Abstract

ESRI's Field Data Collection apps like Field Maps have changed how people collect field data, but many folks just need geological data in the field for reference in an offline mode. This presentation will focus not on field data collection, but on creating mobile map packages and basemaps (vector tile base maps and tiled basemaps like LiDAR DEMs, aerial imagery mosaics and geological raster surfaces), essentially having a mini-GIS on your phone or tablet. This same data can be published and shared to the public so anyone can use Field Maps for free with these mobile map packages and basemaps without needing to have an ESRI named user account or an internet connection to use them.

This is very useful for accessing and reviewing a wide variety of geological data while driving across your 7.5 minute quad, across the county, across the state or country. This can also be useful for public outreach and education and geology courses.

Why

- Many if not most states are using ESRI's Field Maps and or Survey 123 for field data collection and these field apps are great for that. But Field Maps is also very useful for just having geological reference data in the field, driving across the state, or on vacation. It is also useful for public outreach and education.
- Newer staff or sister agencies who may not be familiar with the geology of the state can learn about the geology as they drive across the state.
- Essentially a mini-GIS in the field for online or offline data reviewing or collecting
- Can switch back and forth from data evaluation/review from a MMPK to a data collection map in the same app.
- This allows your data collection map to be lean and mean, which is really helpful in syncing your offline data you collected back to ArcGIS Online.
- Having a lean and mean data collection map also allows for quicker offline areas downloading.

Bringing Data Into The Field: Field Maps

Internal Use

- Need an ArcGIS Online Named User account
- More through, detailed and larger MMPKs and basemaps
- Generally side-load MMPKs and Basemaps to device due to their often large file sizes
- Generally don’t embed Basemaps in MMPKs to keep them lean and mean and allow flexibility to use the Basemaps across multiple MMPKs
- Many more MMPKs

Public Use

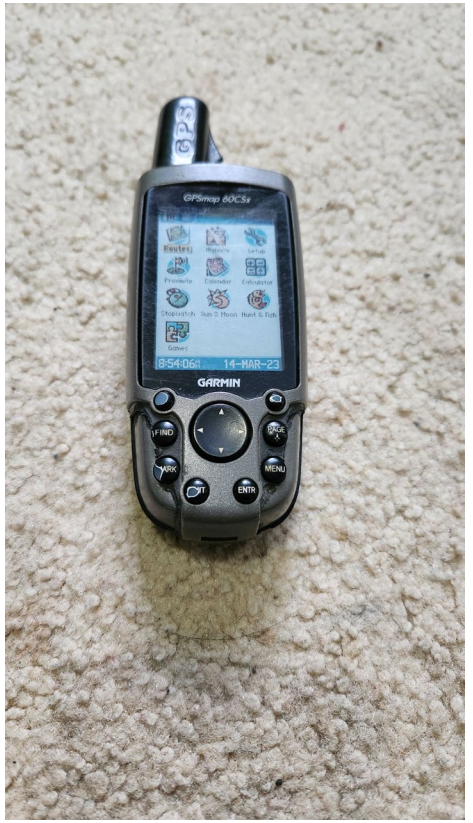
- Don’t need an ArcGIS Online Named User account
- Simpler MMPKs, fewer layers with internal basemaps
- Outreach to the public and stakeholders
- Citizen science
- Can be published to ArcGIS Online with the ArcGIS Publisher extension and shared with Everyone so anyone can use the MMPK without an ArcGIS Online Named User account

A Little History

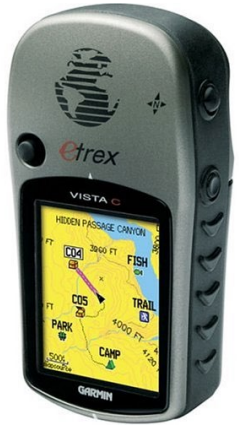
5

Today all of our GIS data in on tablet and/or a phone in Field Maps, either for data collection, for reference of both

4



1



2

Boy we though we were hip with our GPS unit live linked to ArcView the later ArcMap on a laptop as we drove down the road!

3

Old school: Trimble ProXR GPS submeter real-time

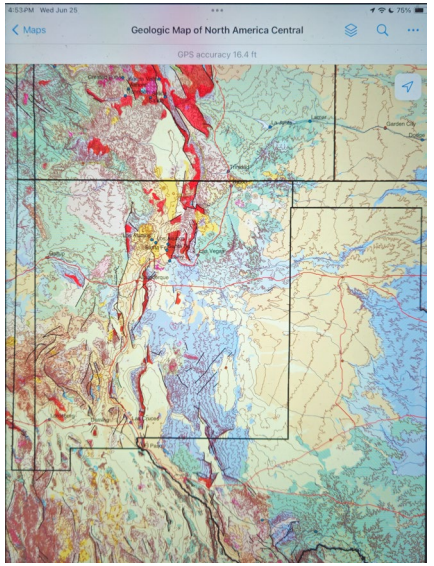
- Trusty Garmin GPSMAP60CSx
- Barometric Altimeter!
- Never (rarely ever) let me down
- But I don’t take it out of my backpack much anymore
- Used to hack the Garmin basemap format to get better basemaps

Bringing Data Into The Field

- ESRI promotes Field App for data collection, but it is just as useful for reference data in the field
- Generally talking about offline field work
- Basemaps
  - Vector tile basemaps .vtpk
  - Tiled basemaps LiDAR, aerials, other rasters .tpk

  - Advantage of having State-wide basemaps on your devices

  - DNR-SPC-TPK-Imagery-Files (actually half of these files came from EGLE!)
    - https://stateofmichigan.sharepoint.com/sites/DNR-SPC-TPK-Imagery-Files



- Mobile Map Packages (MMPK) (just for reference not for data collection, not editable) .mmpk

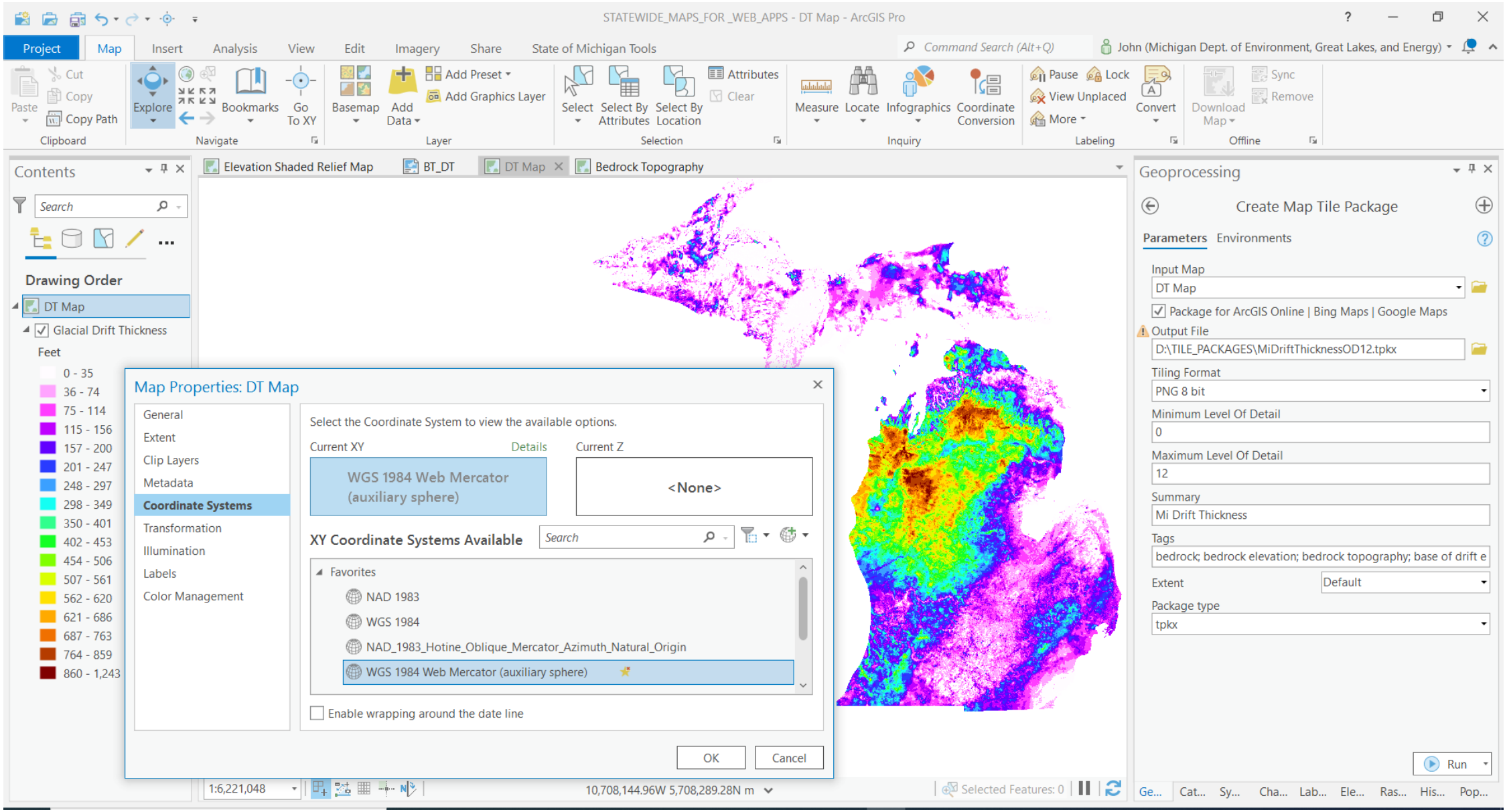
- Sideloading Basemaps and Mobile Map Packages
  - Basemaps are often very large and the only practical way to load is Side load to device, if using IOS devices use iTunes to drag & drop

- Examples
  - Statewide basemaps
  - Alpena sinkhole HVSR passive seismic work
  - Gladwin well survey
  - Statewide geological and USGS well inventory

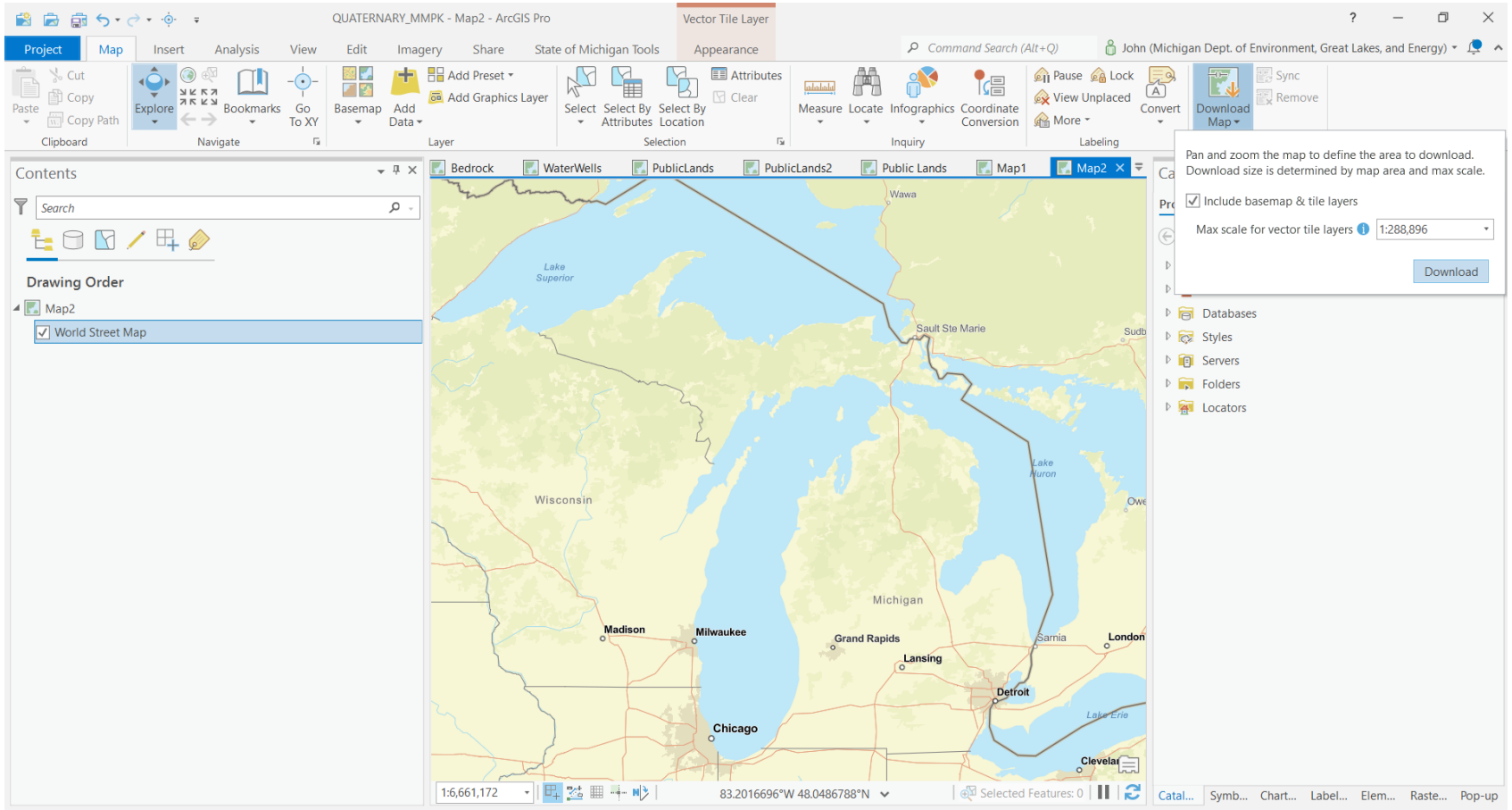
Bringing Data Into The Field Tips

- Set scale dependency on detailed layers
- Use WGS 1984 Web Mercator (auxiliary sphere)
- Can easily switch from data evaluation to data collection and back
- Helpful having tablet for reference and a smartphone for data collection
- Why multiple mobile map packages and base maps
  - To be lean and mean to allow to easy smaller quicker updates…

Create Map Tile Package

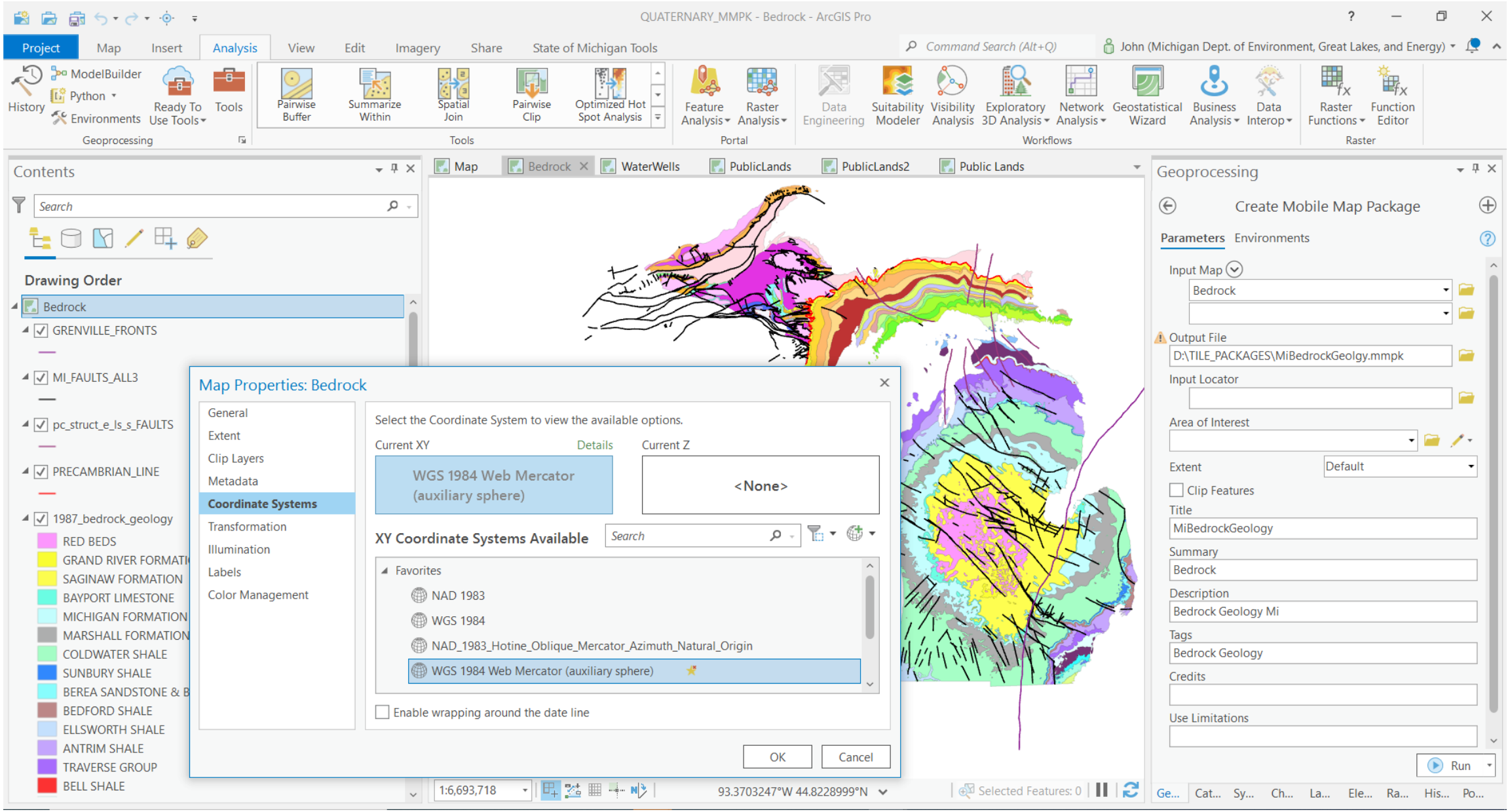


Use ESRI or Other Basemaps to Create Own Vector Tile Basemaps



- Also Tile Package Kreator ESRI unofficial tool

Create Mobile Map Package



This PC › (D:) DATA › TILE_PACKAGES

Name	Date modified	Type	Size
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MiRegionalWaterTable.mmpk	2/28/2023 12:58 PM	MMPK File	37,465 KB
MiRegionalWaterTableLOD12.tpkx	2/26/2023 12:07 PM	ArcGIS Map Tile Package	8,472 KB
MiRegioalWaterTable.mmpk	2/25/2023 7:06 AM	MMPK File	22,804 KB
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MiDriftThicknessOD12.tpkx	12/4/2022 6:25 AM	ArcGIS Map Tile Package	8,801 KB
MiBedrockTopographyLOD12.tpkx	12/4/2022 6:20 AM	ArcGIS Map Tile Package	7,306 KB
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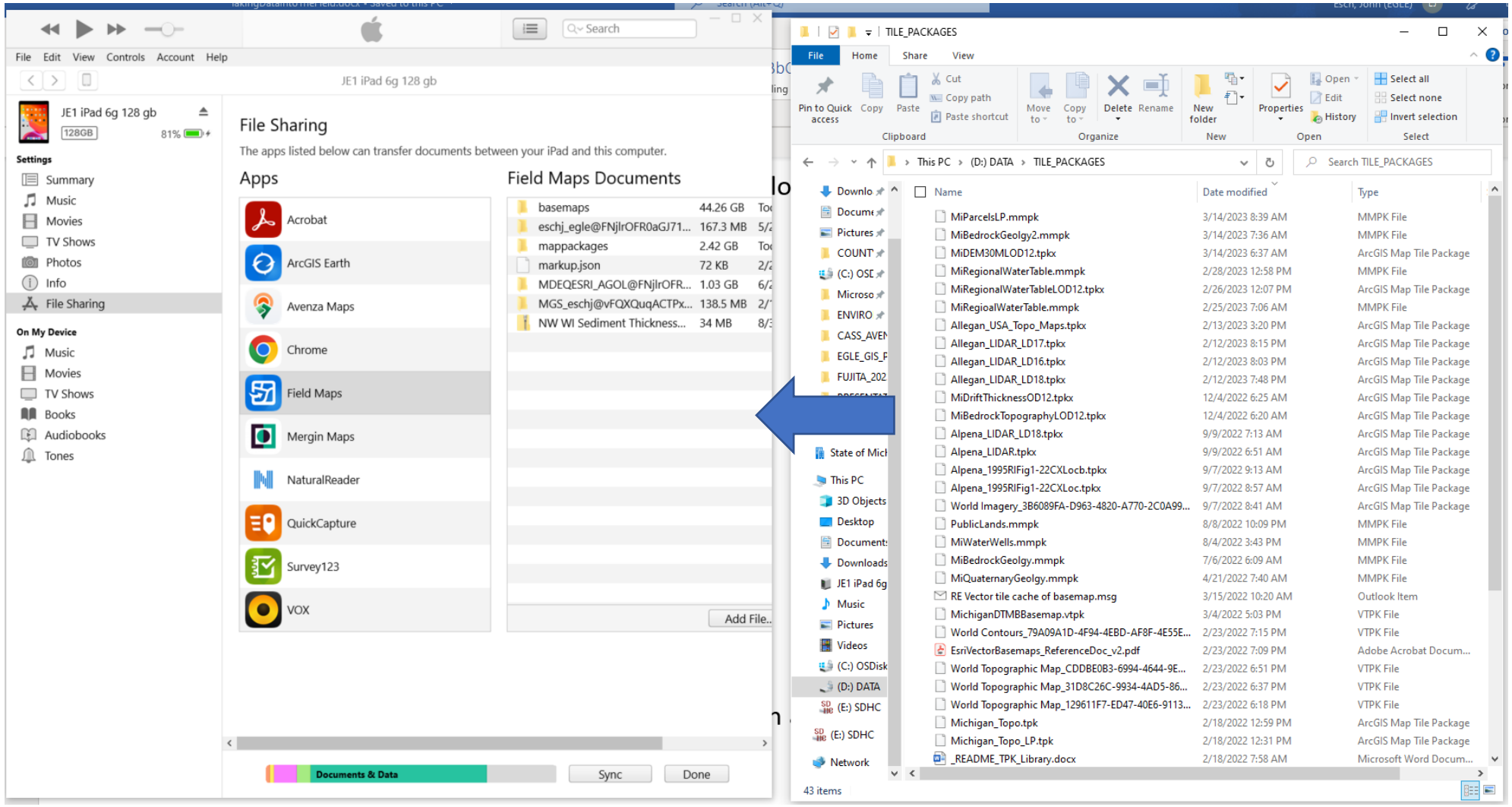
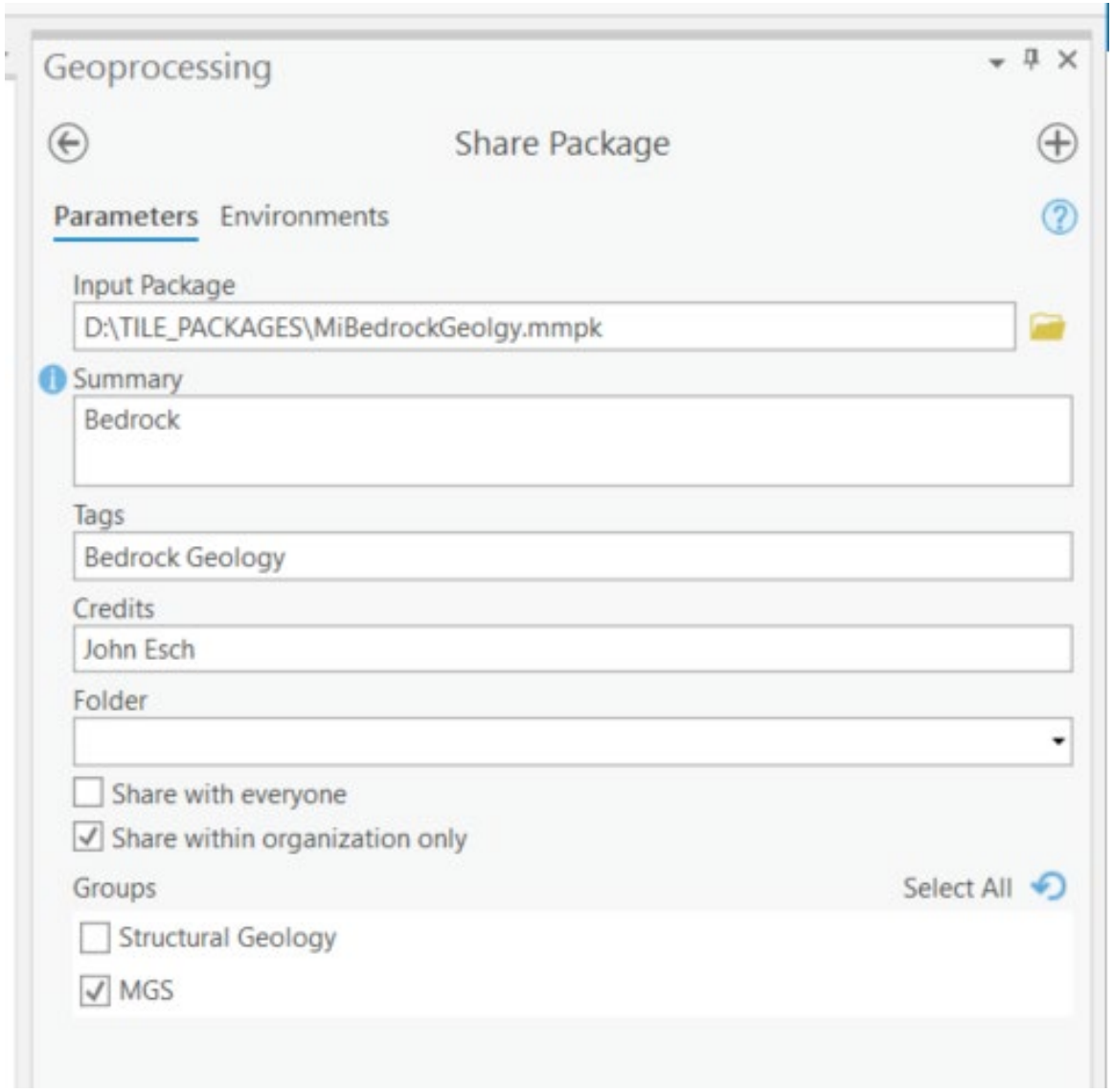
DNR_Leaf On Natural Color TPK	7/28/2022 7:13 AM	File folder	
TILE_PACKAGES	4/20/2022 10:39 PM	File folder	

Side-Loading Large Basemap to IOS Devices Using iTunes



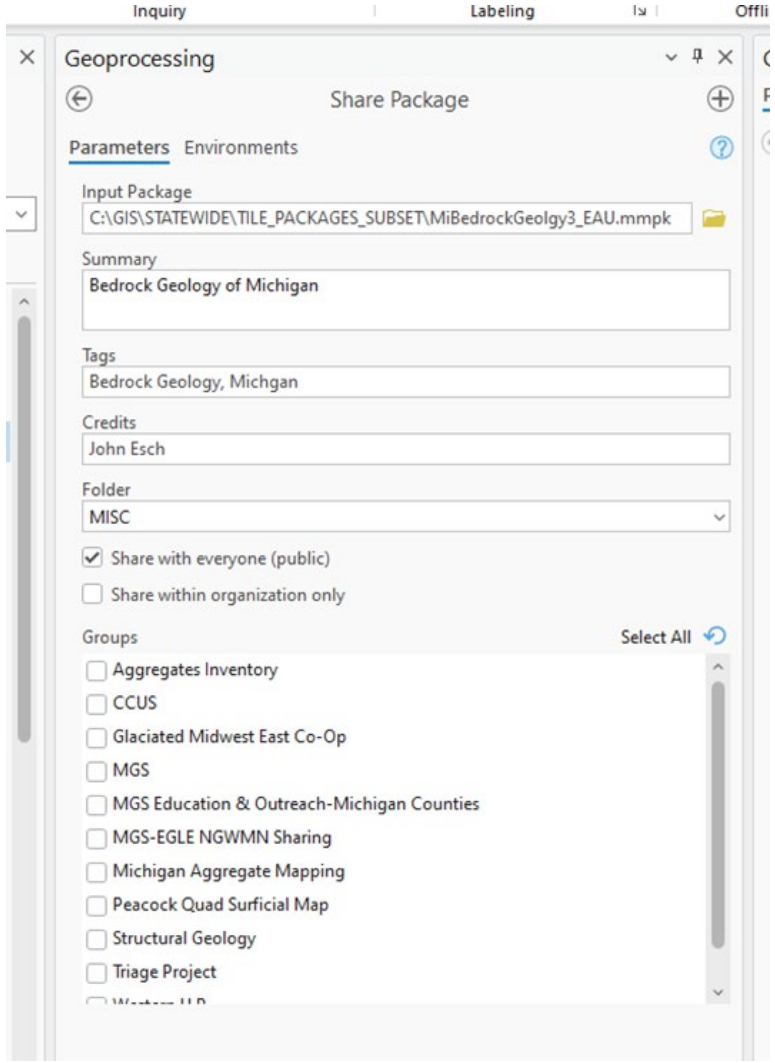
Just drag and drop

ArcGIS Pro Share Package tool



Any MMPK or TPKX or VPTK shared with public can be used in Field Maps without a named user account******

ArcGIS Pro - Share Package tool



Share mobile map packages (MMPKs) with anyone
To share MMPKs with mobile workers without requiring them to sign in to Field Maps, you must use the **ArcGIS Publisher extension**. If you don't use the ArcGIS Publisher extension to share MMPKs, mobile workers must sign in to an ArcGIS organizational account to access them.

Opportunity for public outreach and citizen science

Anyone with a device can access mobile map packages, tile layers or vector tile package basemaps you create

Basemaps and Mobile Map Packages for Reference

Mobile Map Packages

- Bedrock Geology
- Quaternary (Glacial) Geology
- Oil & Gas
- Water Wells
- Groundwater
- Public Lands
- Soils

Tile Package Basemaps

- Michigan DEM
- Glacial Drift Thickness
- Bedrock Topography
- Regional Water Table
- State Highway Road Map
- Bouguer Gravity
- Total Magnetic Field
- County Mosaics of LiDAR Hillshade, Slope or Shaded Relief
- County Mosaics Aerial Imagery
- USGS Topos

Vector Tile Basemaps

- Michigan DTMB
- World Street Map (ESRI)
- Hydrology
- Wetlands
- CountyTwpSec

Others

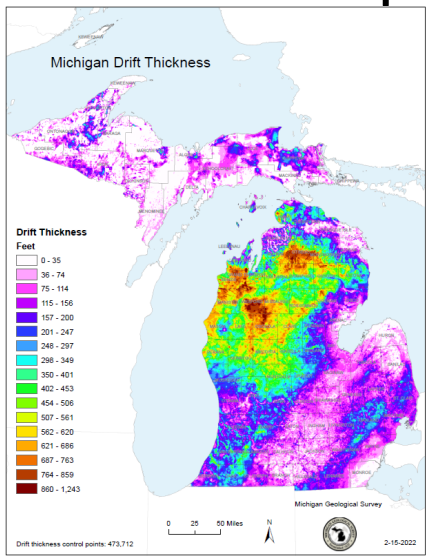
- Soils
- Hydrology
- Pits/quarries/mines
- Structural Geology
- Michigan Pc Geology
- Aggregates Inventory

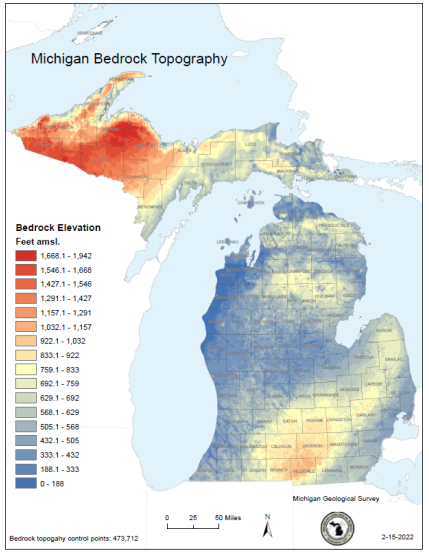
Value of Statewide Basemaps

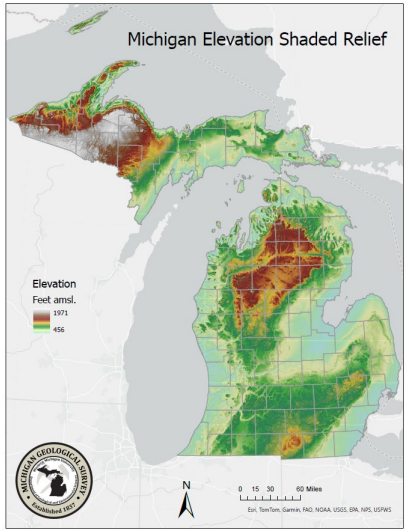
- If working with a given state, all your Field Map projects will have underlying basemaps available
- Lessens the need to include basemaps with your MMPKs
- This allows your MMPK or your editable Field Map projects to be lean an mean
- This also allows faster sideloading or downloading of your MMPK or basemaps

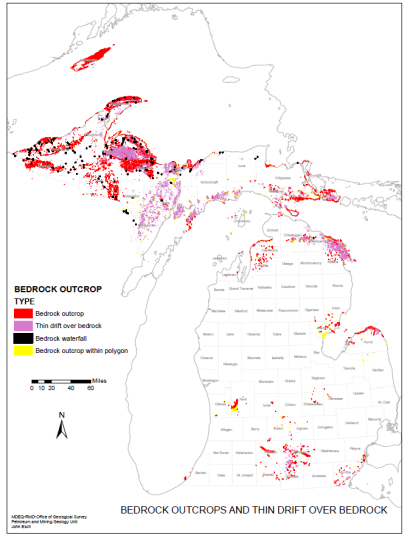
Why Multiple MMPK and Basemaps

- Allows for smaller MMPKs and easier to update them
- Too many layers in a single MMPKs make it more difficult to turn layers on/off
- Focused MMPKs (bedrock, glacial, groundwater, soils, hard rock, hydrology…)
- Statewide geological basemaps allow comparison across different MMPKs and layers (DEMs, bedrock elevation surface, glacial drift thickness, regional water table, SSURGO soils parent material raster, formation tops structural surfaces…)







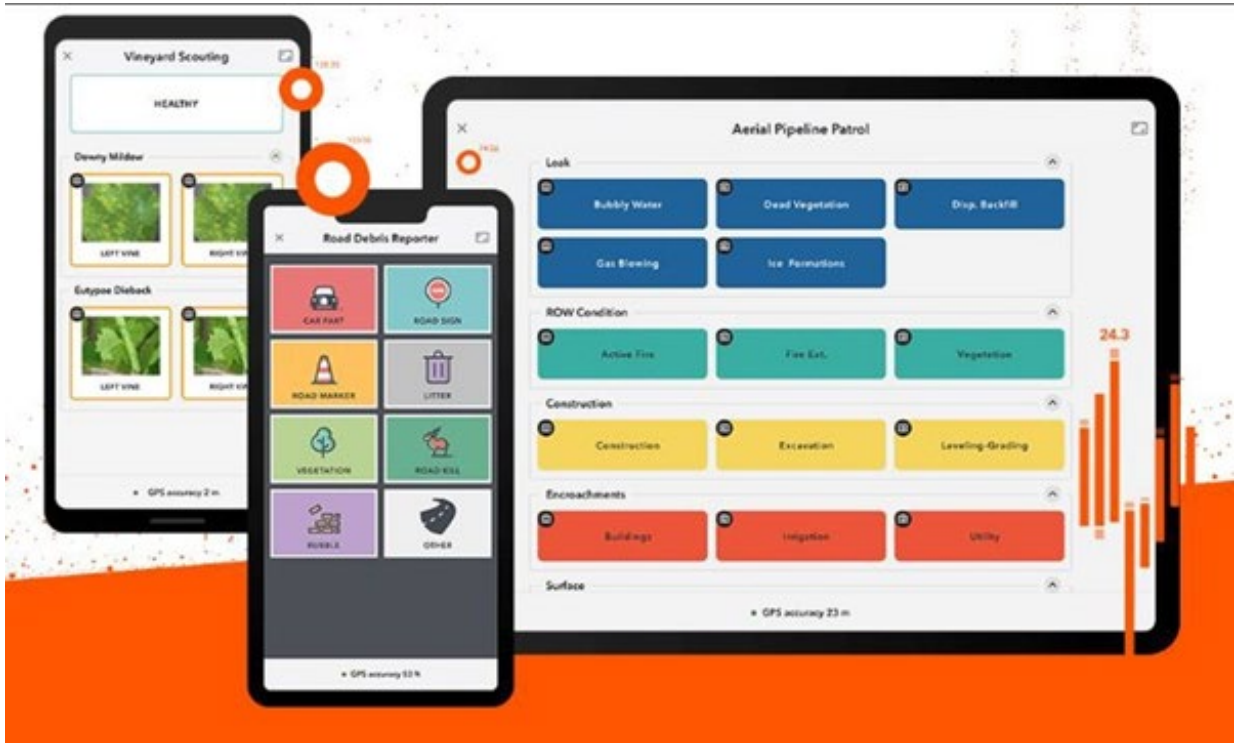


Other Options:

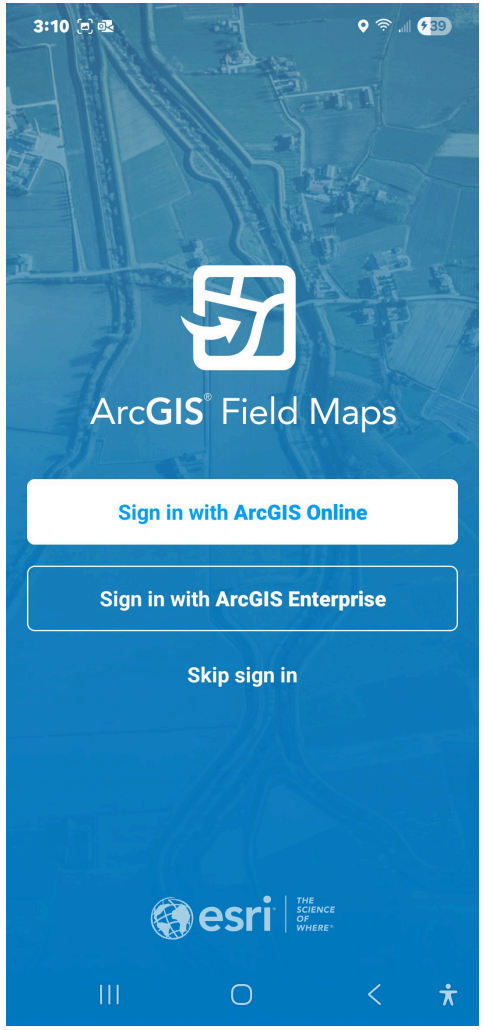
- Google Maps - Offline
- Avenza Maps
- QFIELD – field data collection tool for QGIS

Demos

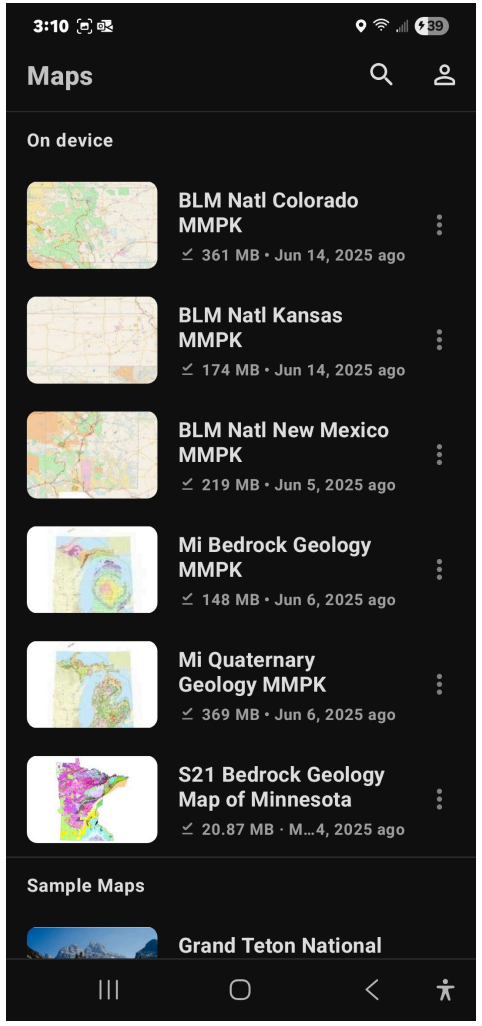

ArcGIS Field Maps
Sign in with ArcGIS Online
Sign in with ArcGIS Enterprise
Continue without Signing in
esri


Vineyard Scouting
HEALTHY
Downy Mildew
Eutypa Dieback
Road Debris Reporter
Aerial Pipeline Patrol
Leak
Bubbly Water
Dead Vegetation
Gas Blowing
ROW Condition
Construction
Encroachments
Surface
24.3

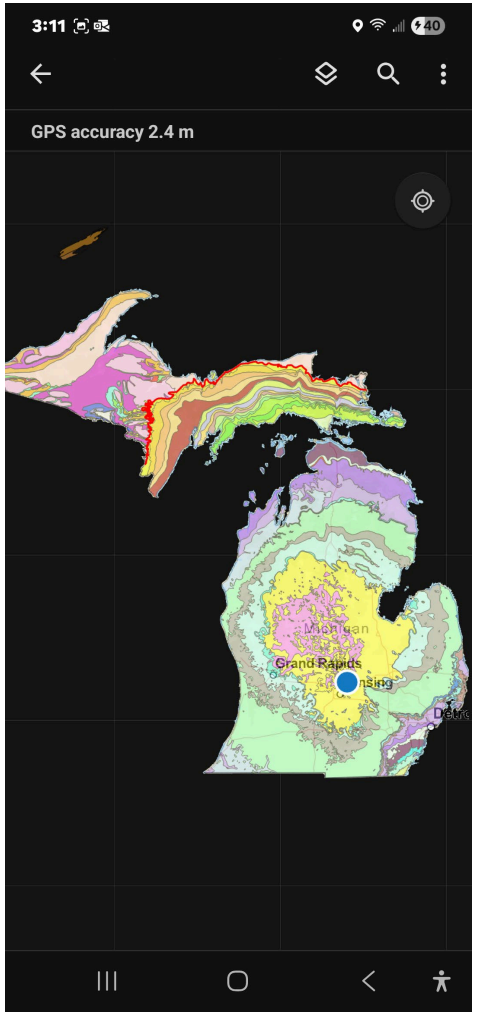
ArcGIS Field Maps Demo



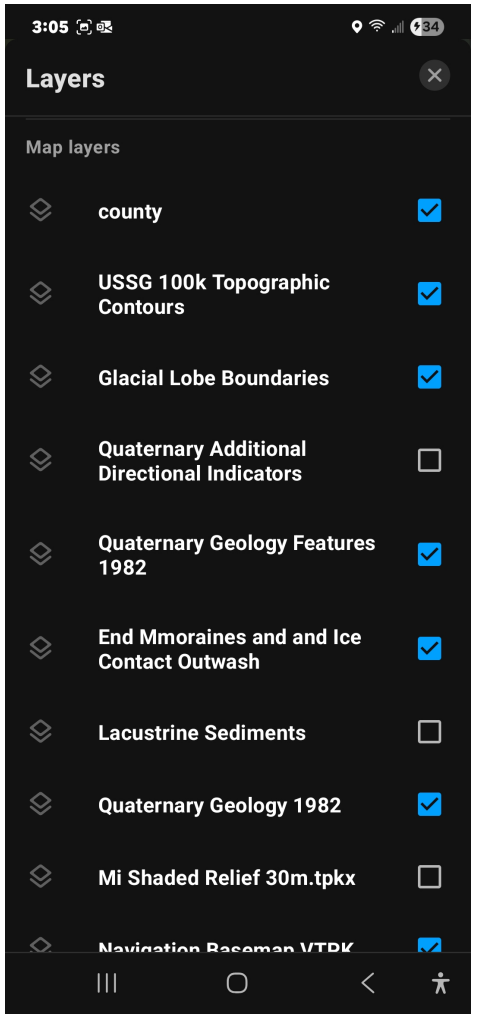
Field Maps opening Sign in dialog, if you would like to access one of the publicly available MMPKs, click **Skip sign in**



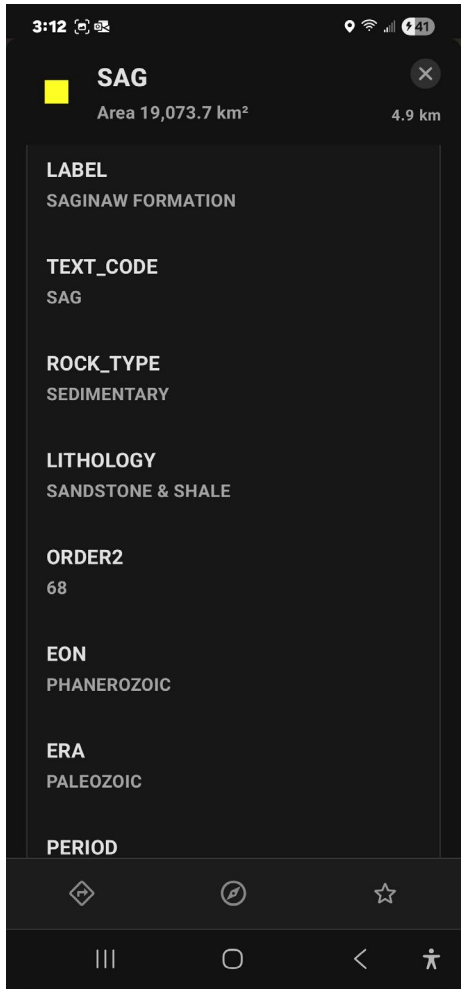
Maps tab showing the MMPKs you have on your device or one that at publicly available through ArcGIS Online



Example of the Michigan Bedrock Geology MMPK

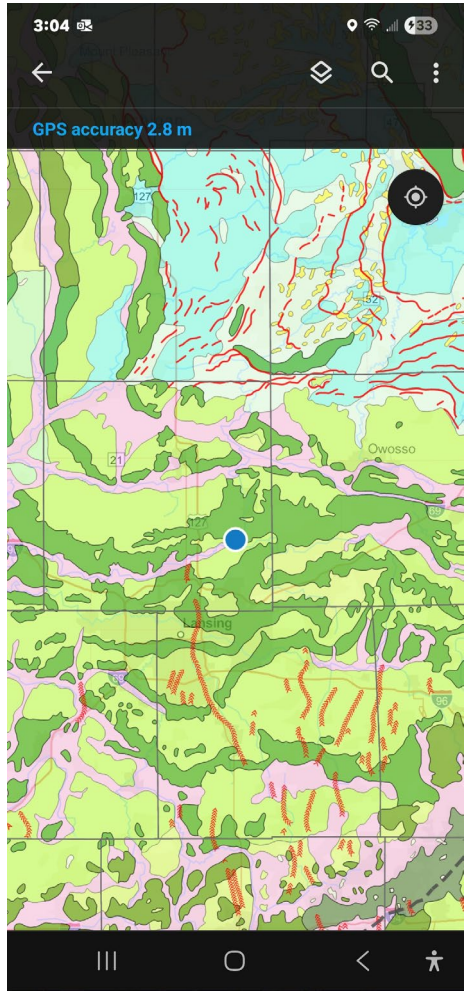


Layers and Basemaps (within the MMPK) can be toggled on/off

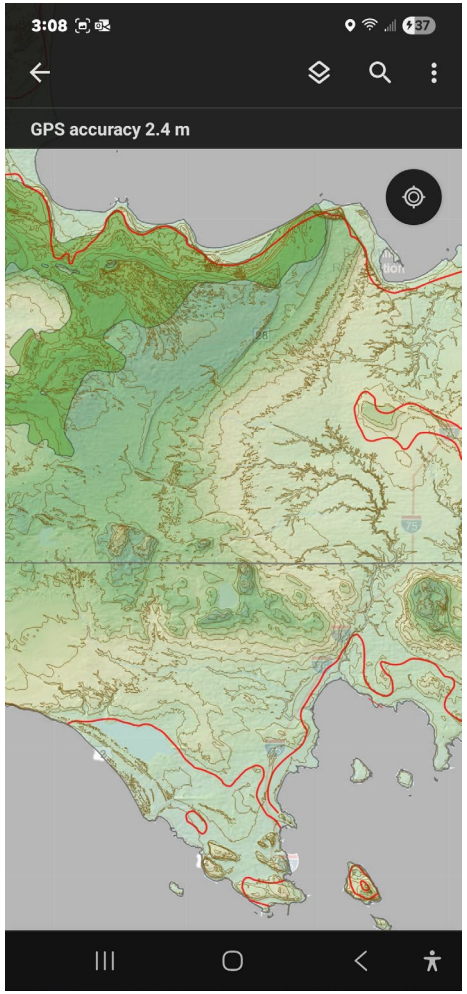


Click of a feature view attributes

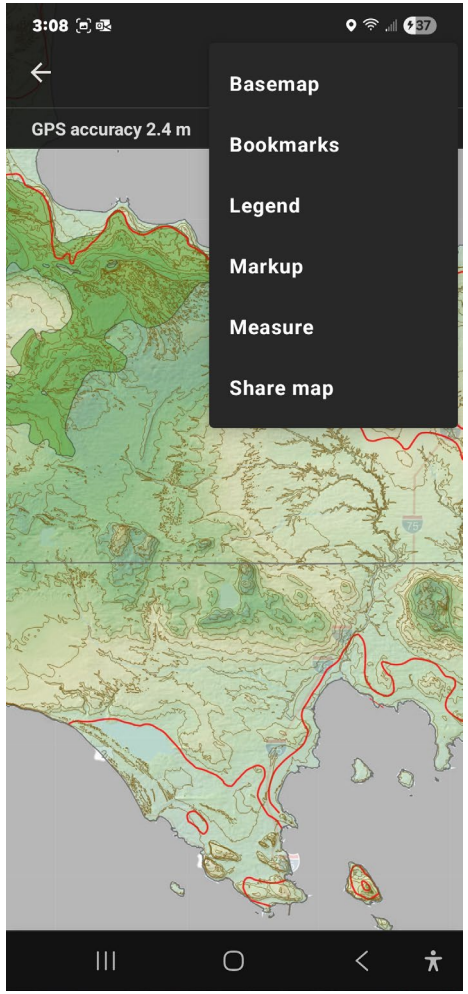
ArcGIS Field Maps Demo



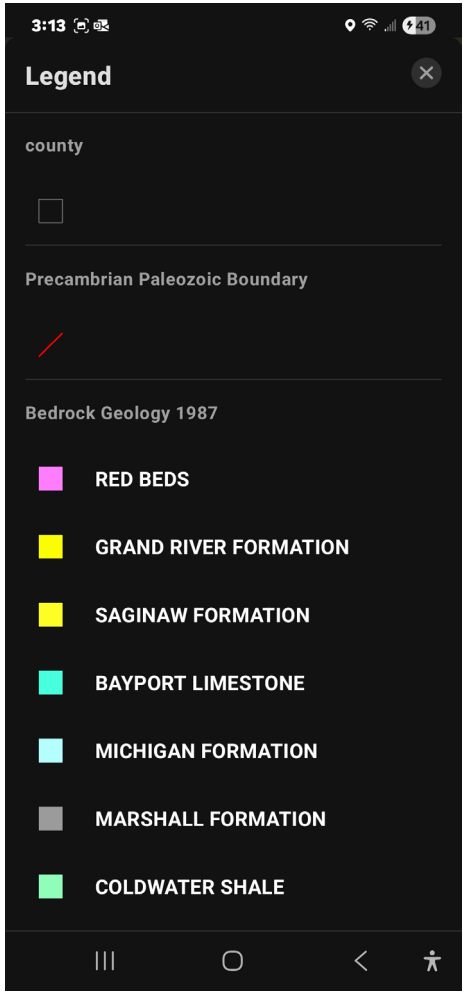
Mi Quaternary Geology zoomed into central L.P.



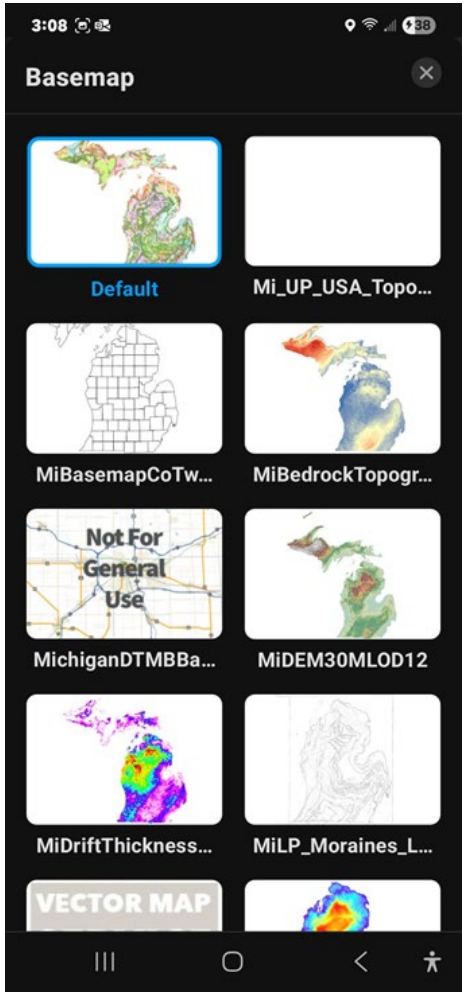
Mi Quaternary Geology zoomed into western U.P. with Quaternary Geology turned off, but end moraines glacial shorelines, 100k contours and shaded relief turned on



Click the 3 dots in upper right to open up a dropdown for added functionality

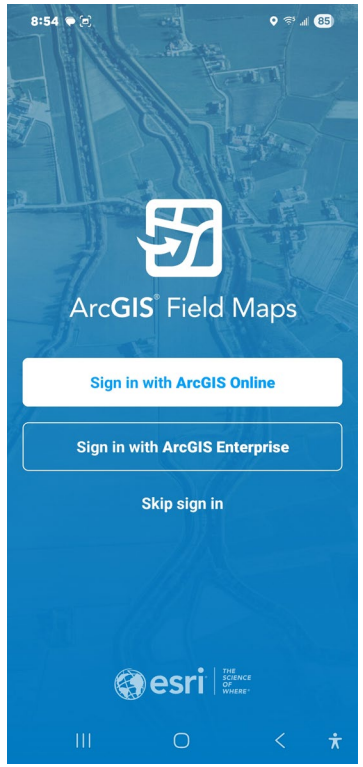


Can view the Legend for any of the layers that you have turned on



Can change basemaps if you have other basemaps downloaded or sideloaded

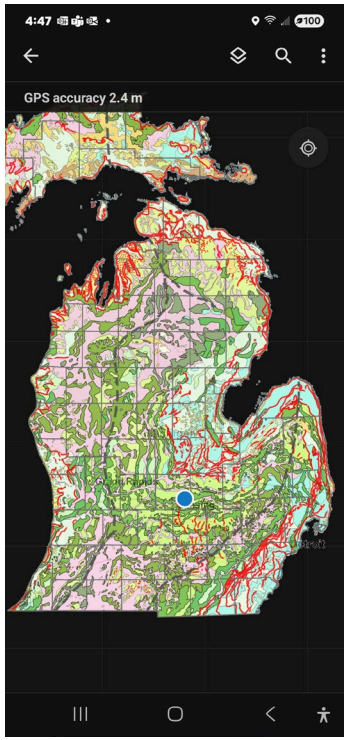
If you'd like to try examples of a free MMPK that don't require an ESRI AGOL named user account (i.e. public)



If you'd like to try Mobile Map Packages follow these steps:

- Download the ArcGIS Field Maps app from the Google Play Store for Android or Apple App Store for iOS
- Open the app and grant the location permissions it requests. If you do not approve location permissions, your GPS functions will not work
- Tap 'SKIP sign in' at the bottom (you do not need an account to use these)
- Tap the search bar/button at the top/top right
- Search for **Mi Quaternary Geology MMPK** or **Mi Bedrock Geology MMPK**
- Once you find the MMPK, tap on the download icon on the right. A blue circle will show the download process
- Once downloaded, tap on it to open,
- Explore the data within!

You can turn layers on/off, click on a layer to see some of the attributes. It will track on the app you as you drive or walk using the GPS on your device. Try exploring the data, pan, zoom on/out and create markups.



Mi Quaternary Geology MMPK
Mi Bedrock Geology MMPK

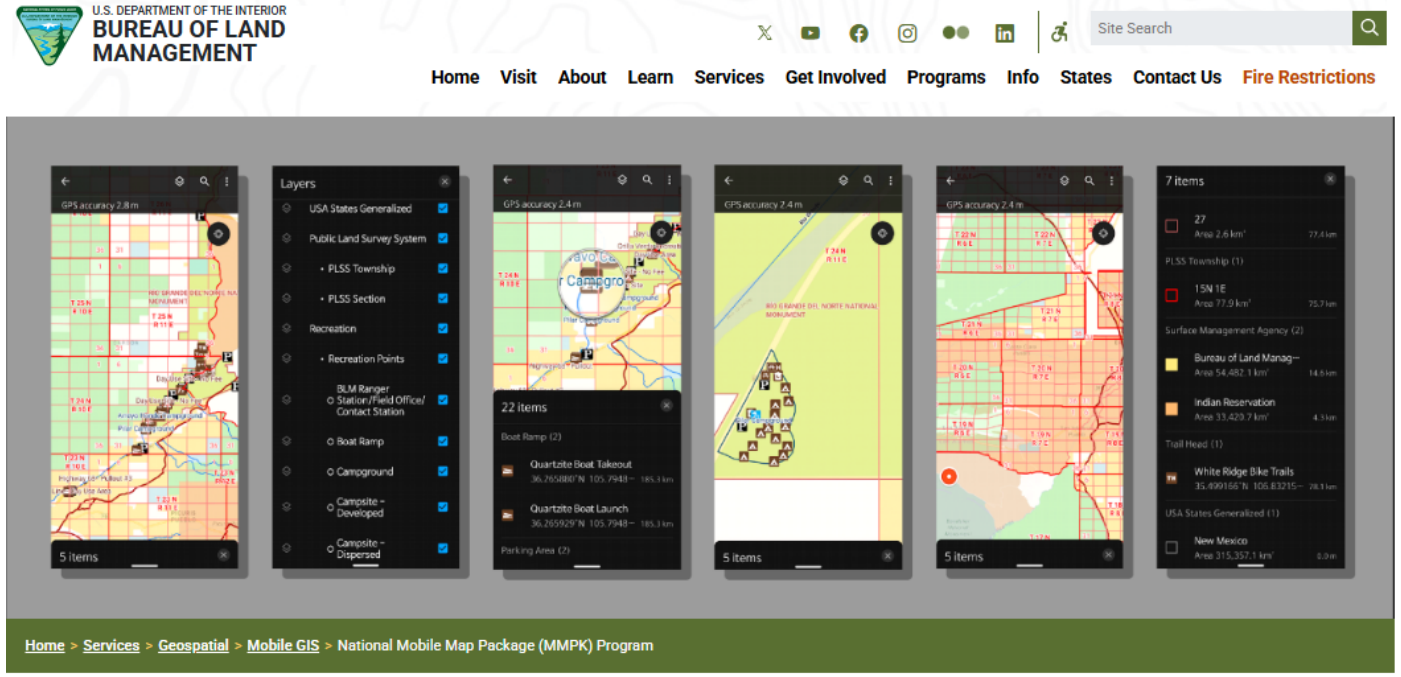
If you already have an ESRI ArcGIS Online named user account, you can just login and use it just same as described above.

For the Mi Quaternary Geology MMPK, I will often turn off the Quaternary Geology 1982 layer and leave on the End Moraine and Ice Contact Outwash, 100k contours, and Mi Shaded Relief 30m layers. This gives a nice broad overview of the glacial landscape.

I usually download or sideload the same data on a tablet so as I am driving I can see the geology change along my route. Having the same data on my phone is nice for field work or just walking a trail.

For the more detailed larger MMPKS, large separate statewide VTPK basemaps and county aerial and LiDAR TPKS, it usually more efficient to side-load them onto our devices.

BLM Free National Mobile Map Package (MMPK) Program



Free National Mobile Map Package (MMPK) Program

The Enterprise Geospatial Services Team believes you should have access to the data your taxes pay to create in a modern format, usable offline, for free. The BLM National Recreation MMPK program is an evolution of the BLM New Mexico Hunting/Recreation Map system, which provided offline data for New Mexico in an award-winning program for nine years.

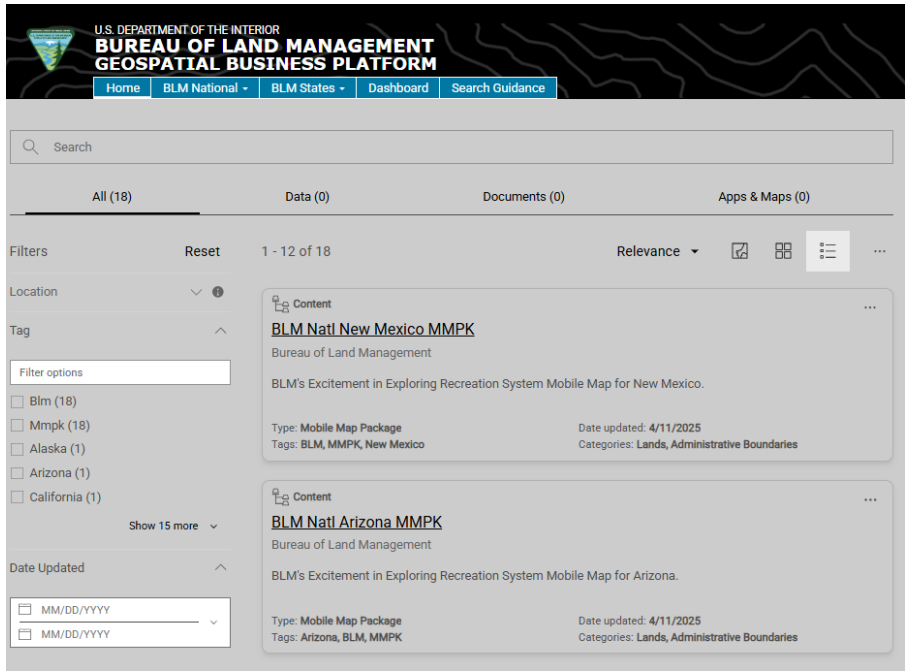
Anyone can download statewide MMPK files from Field Maps WITHOUT an account. These files work with no data connection and show your location on top of various BLM data with a recreation focus. Currently the western 18 BLM states are being individually produced, with plans to increase to all 50 states (and possibly territories) soon. These map files will be updated quarterly in a semi-automated process.

Mobile GIS

- National Mobile Map Package (MMPK) Program
- Old Spanish National Historic Trail Mobile Map
- S1 Mobile Mapper Application for Android

How to find BLM MMPKs on App

Within Field Maps Search for **BLM MMPK**

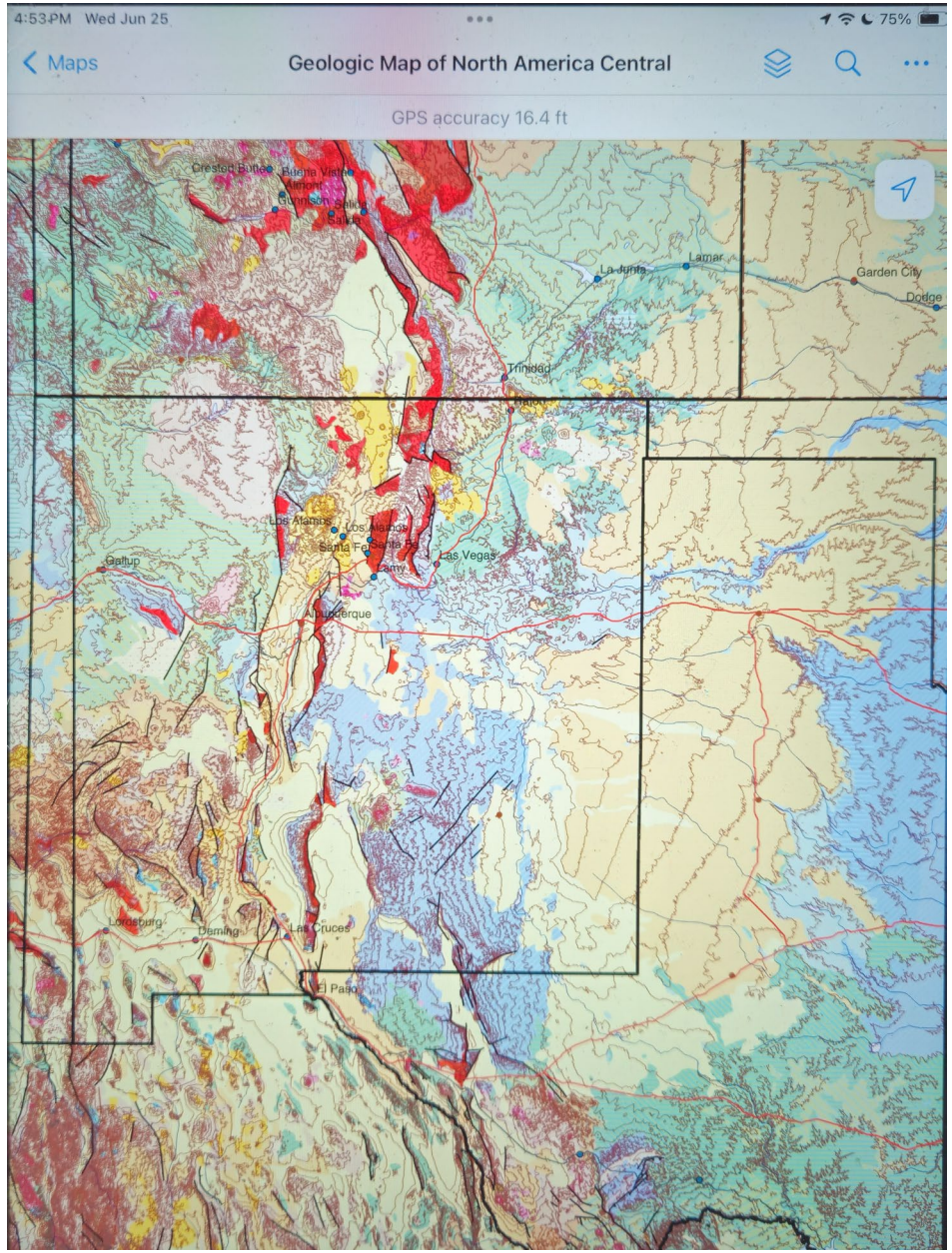


https://www.blm.gov/services/geospatial/mobile-GIS/national-mobile-map-package-program

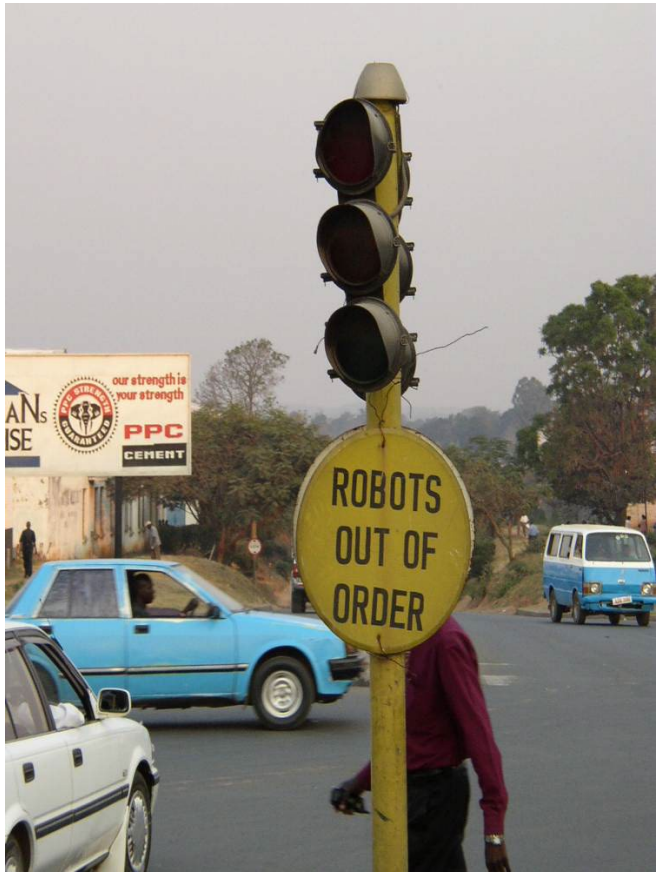
Geologic Map of North America MMPK & Basemaps

Geologic Map of North America MMPK & Basemaps are available upon request, These are quite large files so will likely require side-loading to your device.

An ArcGIS Online named user account is required as the MMPK is not shared publicly.



Question/Contact?



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