

## Abandoned Mine Lands using iPads with GIS in the field

Many people realize the advantages of having a device as portable as the iPad and appreciate the power that it wields. Obviously it has potential. But is it rugged enough for use in the field? What options exist for GIS? Use the ESRI cloud, or not? The ND Abandoned Mine Lands (AML) division has addressed these questions and based on the needs of the division, has issued their staff iPads for use in the field.



Figure 1: Thomas Vigessa is using the iPad in the field. [Click photo for larger view.]

### The iPad as a Ruggedized Device

There are several heavy duty cases available for the iPad. AML is using the Otterbox case which completely seals the iPad (except for the speaker) and protects the device from environmental elements. It offers a high level of protection from drops or other impact. The stand is sturdy and doubles as a cover that snaps over the screen for additional protection.

Viewing the screen outdoors is improved by setting the screen brightness high and choosing a darker background for the home screen. Increasing screen brightness does impact the battery life, but aside from that, battery life is excellent. It should also be noted that polarized sunglasses cannot be used if turning the iPad in portrait position as the screen will appear to go dark.

Outside temperature may be an issue as the device can overheat and shut down when it reaches 95 degrees. Common sense makes this less of an issue, for instance holding the iPad in the shade of one's own body, not leaving it in a hot vehicle, etc. The operating temperature range of an iPad is between 32

to 95 degrees. Storage temperature should not go outside of the range -4 to 113 degrees or the device may become damaged. AML has not used the iPad yet in winter conditions. The iPad is based on a touch screen and usage will be hindered if the user is wearing gloves. Stylus pens or touch screen gloves may need to be used.

A true ruggedized device has high GPS accuracy which goes to the centimeter level. GPS accuracy on the iPad does not match that of a true ruggedized device. But it is not too bad either. Depending on location and what is around you, the accuracy varies. In open areas without interference it appeared to be right on. Next to buildings accuracy was off by 10-15 feet, or more.



Figure 2: Rear view of Otterbox case. [Click photo for larger view.]



Figure 3: Front view of Otterbox case. [Click photo for larger view.]

### GIS on the iPad

AML has been considering two options for GIS on the iPad. One option is to use the ESRI app and put our data on the cloud through ArcGIS Online. The app is free through the App Store but the cloud requires a paid subscription. The other option is the GIS Pro app by Garafa. This is not a free app. It has a price tag of \$299.99 on the app store. If subscribing to the cloud is not a viable option (security concerns or cost issues), then this app is a nice alternative.

GIS Pro by Garafa is the GIS option that AML is currently using. It provides open source access to base maps (topographic, street, satellite). These base maps can be cached and the app is completely offline capable. AML data is stored locally on the device through a simple import process. Imports can include ESRI shapefiles and KML/KMZ files. Moving data on and off the device can be done wirelessly by email or, for larger datasets, by connecting to a computer with iTunes.

As an IT person, I was interested to see the usefulness of iPads in the field and how the tools are being applied. So I accompanied AML staff on a recent outing to a drilling and grouting project near Beulah, ND.

Holes were drilled along the road and within the ditch the previous year and their locations recorded with GPS. The cased drill holes with voids were now being filled with grout in an attempt to stabilize this area, which is extensively undermined. The drill holes had been capped off, buried just below the surface and markers placed beside them with pink top stake chasers.



Figure 4: Pink top stake chaser is faded, but marks the location of a drill hole location. [Click photo for larger view.]



Figure 5: Bill Dodd exposes the cased drill hole. [Click photo for larger view.]

AML works to stay ahead of the contractor by finding and exposing the cased drill hole locations. Some of these markers have faded and some are missing. So the cased drill hole locations were not obvious. The iPad was being used to view the map of these locations, and get within proximity.



Figure 6: Bruce Johnson and Thomas Vigessa use GIS on the iPad to assist in locating cased drill hole locations where markers are missing. [Click photo for larger view.]

As drill hole voids are being filled with grout, progress is tracked on the iPad. The GPS symbol indicates which hole is about to be worked on. Data collection is done as the work progresses within the attribute list for each feature.

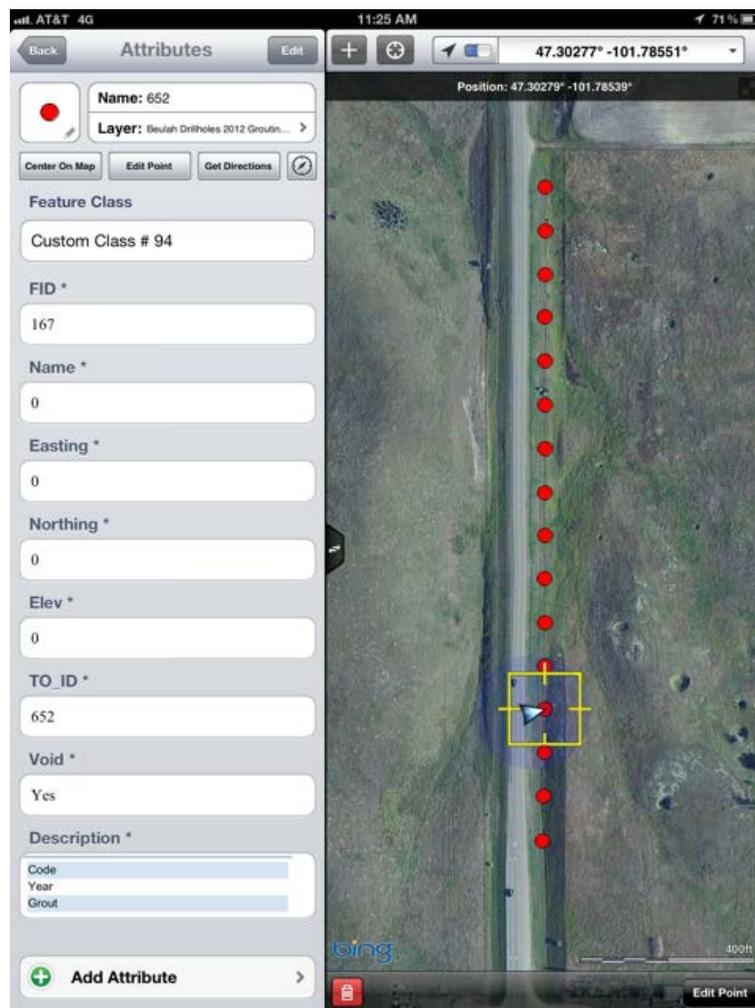


Figure 7: Screen shot of GIS Pro on the iPad displays the locations and attributes for cased sink hole locations. [Click photo for larger view.]

The AML construction inspector assigned to oversee this work has started an additional project on the iPad. There are numerous sink holes in the area, so he has been inventorying these by recording location points on GIS Pro. He is also including attribute data, such as photos and notes, which will help AML assess the danger levels of these sink holes.



Figure 8: A sink hole near the grout and drilling project. [\[Click photo for larger view.\]](#)

A realtor in the area requested to meet with AML regarding property where a potential buyer is concerned about undermining. The landowner had a map, but it was an outdated copy. The iPad was useful in this instance as well since it had the most recent underground workings of the Knife River mine loaded. We were able to zoom in and pan the area at will. The base map was changed easily with a couple taps. The discussion was far more detailed than it would have been with only a paper map.

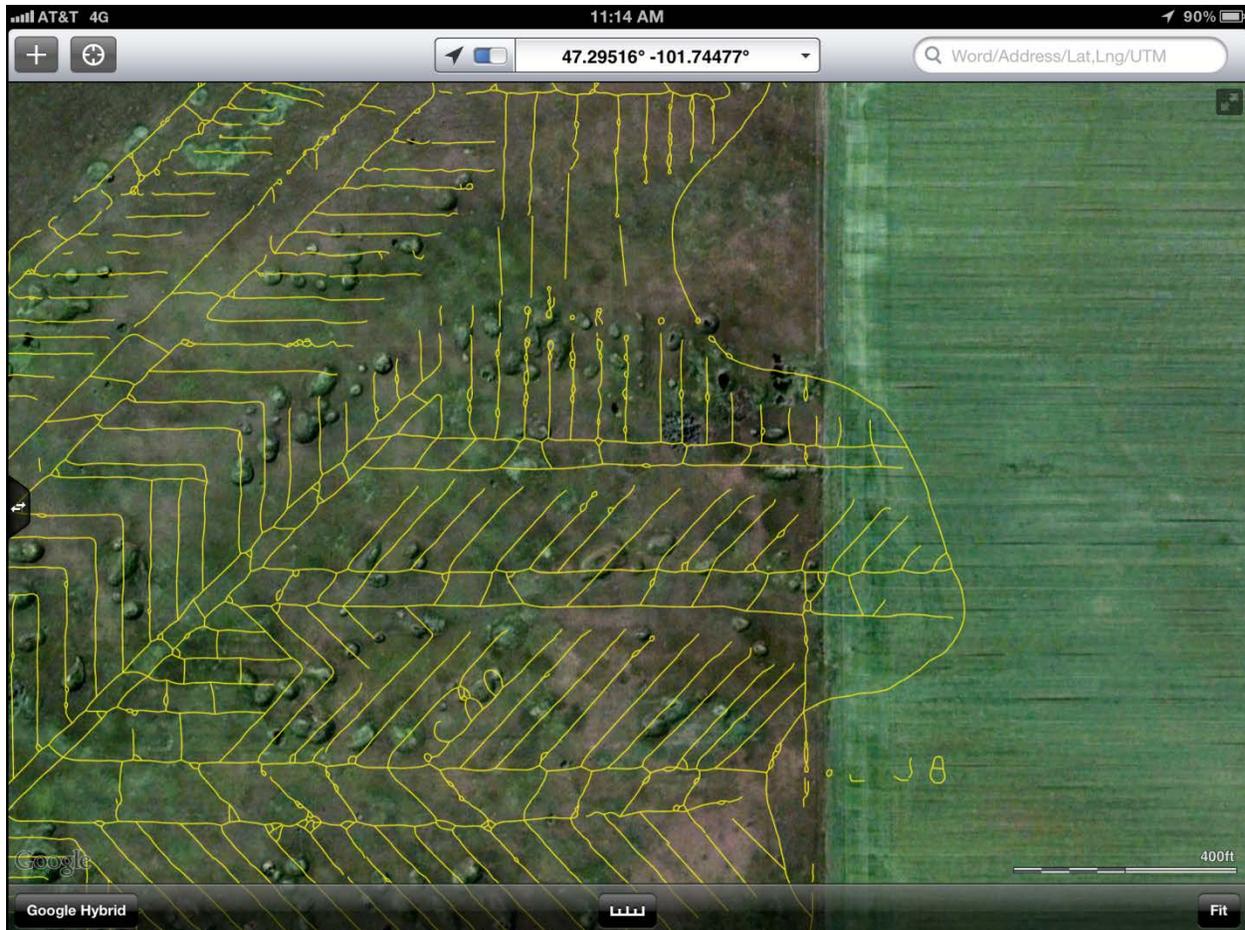


Figure 9: Screen shot of GIS Pro on the iPad showing the 1953 map of the Knife River mine. [Click photo for larger view.]

The realtor asked if she could get this on her own iPad. We have accommodated by sending her the KML/KMZ of the mine along with some suggestions of free apps she could use on her iPad. The free apps aren't nearly as fast for loading and panning but are adequate for general viewing purposes.

### Summary

The iPad offers a great deal for use in the field. It does not offer the highest levels of GPS accuracy, but works well for many AML needs. We have ordered the Otterbox Latch accessory to enable hands-free with the iPad and have recently assigned an iPad to a staff member of the Reclamation Division for trial use in inspecting active surface mines. The close of the construction season will provide valuable feedback from our AML construction inspector as to the successes and any failings of the iPad with the GIS Pro app installed.

## The ESRI ArcGIS app for the iPad

The AML iPads also have the ArcGIS app from ESRI loaded on them. Some AML test data does exist on ArcGIS Online (ESRI's cloud) from the Beta timeframe. ArcGIS does offer easy access to a collaboration of maps available through ArcGIS Online. A number of North Dakota state agencies have subscriptions of some sort with data out there. Finding maps and adding them to favorites is a bonus here as there are many maps available to the public.

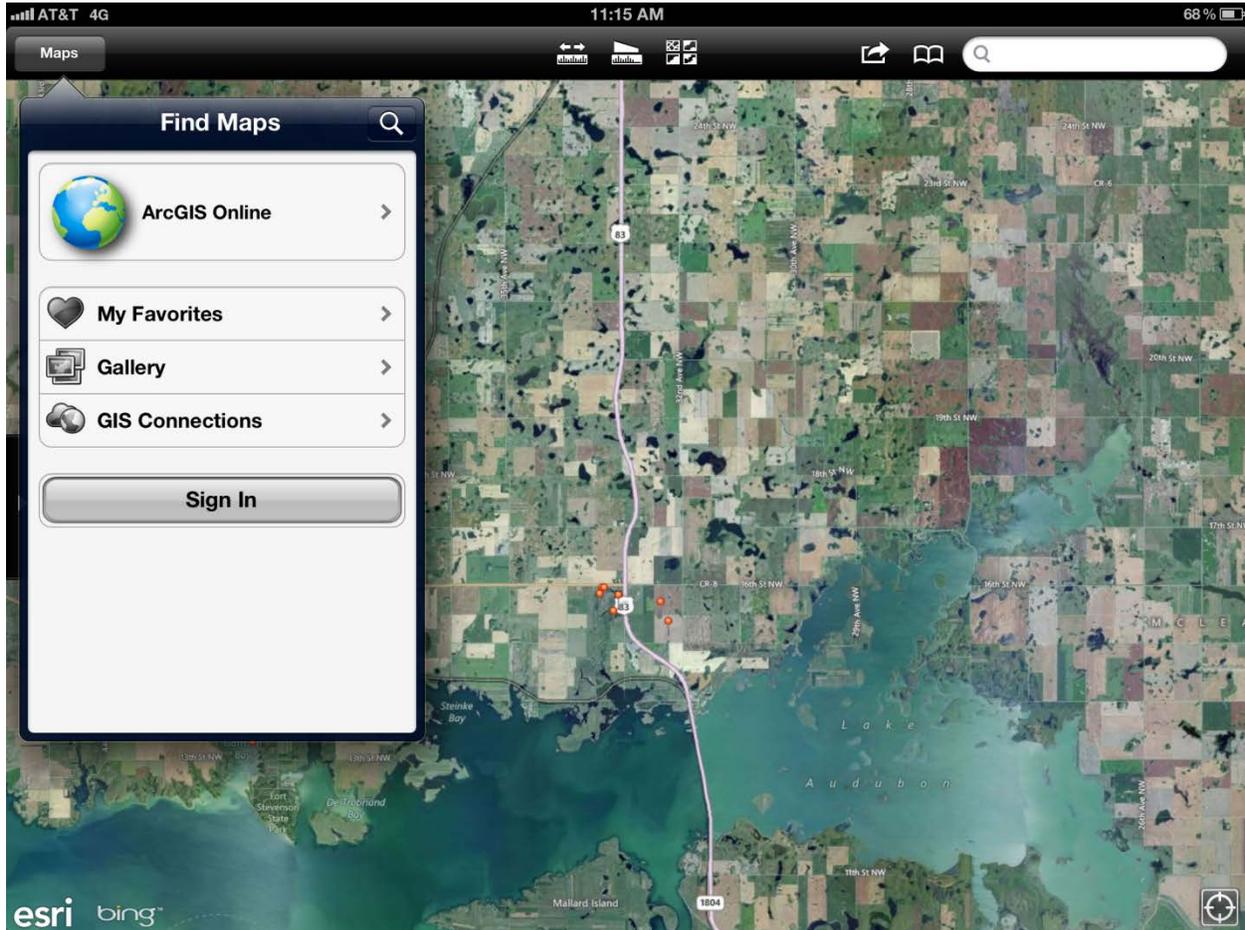


Figure 10: Screen shot of the ESRI ArcGIS app on the iPad. [Click photo for larger view.]

Expect the ESRI's ArcGIS app for iPad to improve greatly over the next year. According to the ESRI User Conference proceedings, the fall rollout will offer offline functionality. The winter rollout (March 2013) will offer full editing capability. A 30-day free trial subscription to ArcGIS Online is available (includes access for 5 users).

The paid subscription cost for ArcGIS Online is \$2,500/year (5 users), \$10,000/year (50 users) and \$17,500/year (100 users). The method here is to place your data on the cloud, then access it with the iPad ArcGIS app. Permissions can be set on the data so ability to access is strictly controlled. ESRI emphasized at the User Conference that the security of the data is taken very seriously.