

◆Rod Probing

Probably the most common way to search for graves is to probe the soil in the area with a 6-foot-long rod with a blunt end and a T-shaped handle. These rods can be purchased commercially or be made by the user. The soil is probed in various spots looking for the resistance one would expect from a coffin or vault.

Advantages: Inexpensive, easy to use, generally accurate for recent burials in coffins or vaults.

Disadvantages: Invasive, so families may object. Cannot find burials that were not in coffins. Cannot find wooden coffins that have rotted, which is very common among graves from the 1800s and early 1900s. The coffin and remains decay and the coffin void fills in, leaving no resistance or voids to be found by the probe. Very difficult to find small coffins of infants or children. Rocks in the soil often give false readings, and it is very difficult to probe when the ground is hard or frozen.

◆Soil Coring

A more-exact method of probing is soil coring, in which a 3/4-inch or 1-inch diameter hollow tube is inserted into the ground above a suspected grave. The core is pulled out, and the soil examined for evidence of disturbance through comparisons with nearby undisturbed areas. This work should be done by a trained archaeologist or soils scientist, since the differences between a disturbed and undisturbed soil can be very subtle, especially if the soil is homogenous or very complex.

Advantages: better than rod probing, since it can detect burials even if the coffin is severely decayed. Cost is usually less than remote sensing. There are numerous qualified archaeologists in Iowa who can help; Iowa archaeology firms are listed at the end of this document.

Disadvantages: Invasive, so families may object. Requires an archaeologist or soils scientist, so cost is greater than rod probing. Difficult or impossible in rocky soil. Often, soil difference can be so subtle that even a trained archaeologist cannot tell if a grave exists for certain or not, especially if the original soil matrix is very homogenous or if the upper soil layers are disturbed by non-grave activity such as earth moving or burrowing animals. It is very difficult to core when the ground is hard or frozen.

◆Formal Excavation

The most-definitive way of determining if a burial exists in a plot is formal excavation. Formal excavation is different than grave digging; typically a grave digger will not notice if they are digging an occupied grave until it is too late and the coffin or burial is damaged or destroyed. Human remains are occasionally found in back dirt or borrow piles at cemeteries, since the grave digger cannot always tell if they have gone through an existing grave. Formal excavation is different than exhumation, in which a fairly-recent burial from a known grave is removed; many funeral parlors or medical examiners can arrange for exhumation. In contrast, formal excavation is the systematic removal of soil in a controlled fashion to locate suspected graves while causing minimal damage to them. Formal excavation is best performed by a trained archaeologist who has an understanding of soils and excavation methods. While there are many ways to perform formal excavation, a common way is to use a wide, toothless backhoe to slowly strip away the soil in

level layers a few inches at a time. This allows the archaeologist to check for evidence in the soil of a grave shaft (the filled-in grave hole) above the burial. Once evidence of a burial is encountered, archaeologists can map the burial and leave it in place. If a disinterment permit has been obtained from the Department of Public Health (and the State Archaeologist if the interment is over 150 years old), an archaeologist can carefully excavate the remains for reburial elsewhere, after a consultation with the person who obtained the permit. If the remains and effects are removed, they can be studied to help determine the identity of the individual. Formal excavation can also stop well above the grave if there is evidence of a shaft.

Advantages: Almost fool-proof and, if properly done, will provide a definitive answer. Can be performed in any soil type, rocks are not a problem. Excavation can provide information about not just if a burial is located there, but can also provide information needed to determine the identity of the buried person. There are numerous qualified archaeologists in Iowa who can help; Iowa archaeologists are listed at the end of this document.

Disadvantages: Highly invasive, so families may object. Expensive; it requires an archaeologist and machinery, and possibly laboratory time. There is always a chance that a very ephemeral burial will be missed and destroyed by machinery, although this is unlikely.

◆Ground-Penetrating Radar (GPR)

With GPR, a radio or microwave signal is sent into the ground and the reflected signal is recorded. The time it takes for the signal to return reflects the depth of penetration, and the returning signal can be stronger or weaker depending on the type of material it is passing through and reflecting off. This data can be used to make an image of the subsurface. A GPR technician will walk an antenna over an area, recording data. This data is processed in a computer to create a two- or three- dimensional image of the subsurface. Under ideal conditions, the grave shaft and possibly the coffin or vault will be visible, but under normal conditions, only the upper part of the grave shaft is visible.

Advantages: GPR is non-invasive, so families typically do not object. Under ideal conditions, it can provide a highly-detailed image of the subsurface. GPR can often see through surface disturbances. GPR is probably the best form of remote sensing if the clay content of the soil is low. Services are available in Iowa, for a fee, from the Office of the State Archaeologist (319-384-0724). Other regional practitioners can be found at the web page listed at the end of this document, or by contacting one of the archaeologists listed.

Disadvantages: GPR's effectiveness depends on soil conditions; it does not work well in clay-rich, rocky, or saturated soils. GPR can be expensive and may not provide definitive results; some form of ground truthing may be necessary.

◆Resistivity

Resistivity can often be useful in finding graves, it is based on the principle that soils have differing moisture retention properties and therefore will conduct electricity differently. A small electric charge is run between spikes placed in the ground, and the resistance is measured. When a soil is disturbed, as in a burial, different types of soil are brought near the surface which have very slight differences in electrical resistivity. The surveyor will probe at close intervals over a large area collecting data, which is then downloaded into a computer to show areas of disturbed soils. In a cemetery, these often correspond to marked and unmarked graves.

Advantages: The spikes only penetrate a few inches into the soil, so it is relatively non-invasive and families typically do not object. Can give some idea if disturbances are deep or not. Under ideal circumstances, resistivity is quite effective.

Disadvantages: Resistivity is ineffective if the upper level of soil is disturbed over a large area (for example, by previous bulldozing), and it is ineffective under certain conditions, such as when the soil is very wet or very dry. Can be expensive. May be adversely affected by rocky soil.

◆Conductivity

Conductivity is often effective in finding graves. It works by applying a magnetic field to the ground surface. This magnetic pulse causes the soil to generate a secondary magnetic field, which is recorded to make a map. When a soil is disturbed, as in a burial, different types of soil are brought near the surface which have very slight differences in conductivity. The surveyor will walk an instrument over a large area collecting data, which is then downloaded into a computer to show areas of disturbed soils. In a cemetery, these often correspond to marked and unmarked graves.

Advantages: Conductivity is non-invasive, so families typically do not object. Can cover a large area in a fairly short period of time. It can be very effective under the proper conditions. Suitable instruments are often available from local soil scientists, but one must be certain the operator understands how to identify variation associated with graves.

Disadvantages: Conductivity is ineffective if the upper level of soil is disturbed over a large area. It is ineffective in the presence of ferrous metal (iron, steel, etc.), so the survey area has to be very clean and checked with metal detectors; metal markers, vases, etc., must be removed. It can be less effective if the soil is saturated, very dry, or rocky. It is affected by nearby power lines. Currently, there are no practitioners in Iowa; for regional practitioners, see the web page listed at the end of this document. Likewise, qualified archaeologists can also help you find a practitioner, a list of Iowa archaeologists is included at the end of this document.

◆Magnetometry

A sometimes effective way to quickly identify graves is with the use of magnetometers. Magnetometers are devices that measure minute changes in the magnetic properties of soil. When a soil is disturbed, as in a burial, different types of soil are brought near the surface which have very slight differences in magnetism. The surveyor will walk a magnetometer over a large area collecting data, which is then downloaded into a computer to produce maps that show areas of disturbed soils. In a cemetery, these often correspond to marked and unmarked graves.

Advantages: Magnetometry is non-invasive, so families typically do not object. Can cover a large area in a fairly short period of time. Can be very effective under the proper conditions.

Disadvantages: Magnetometry is ineffective if the upper level of soil is disturbed over a large area. Soils need to have significant iron oxide content, or it will not work. Ineffective in the presence of ferrous metal (iron, steel, etc.), so the survey area has to be very clean and checked

with metal detectors; metal markers, fences, vases, etc., must be removed. Because of its limitations, magnetometry is often less effective than conductivity or resistance. Magnetometry can be expensive.

◆Dowsing/ Witching

A common way to search for graves is dowsing, or as it is frequently called in the Midwest, “witching,” or occasionally “divining”. The dowser walks over an area with two copper wires or rods bent in an L shape, holding the short ends in each hand and pointing the long ends forward. Dowsers believe the wires will cross over a grave. This practice is ultimately derived from an old English and German folk belief that willow or hazel sticks have an uncontrollable desire for water and will point to underground reservoirs. In America, the willow was replaced with copper rods and used not only to find water, but also graves. One common folk belief is that the two rods will converge if the grave is of a male, and diverge if it is female.

Supposedly the magnetic properties of disturbed soil or coffin hardware attract the copper rods. However, this is illogical. First, soil and coffin hardware do not attract metal, as simple experimentation will show. Soil is so weakly magnetic that a hyper-sensitive magnetometer is required to measure it reliably. Second, even if soil or coffin hardware were strongly magnetic, they would not attract copper wire, which is unaffected by magnetism—experimentation at home will show that you can’t move a copper wire or penny with a magnet. Third, even if soil or coffin hardware were magnetic, and non-copper rods were used, the rods would *never* cross when exposed to a magnetic field; long metal objects always run *parallel* with strong magnetic fields. Remember the grade-school science project with iron filings on a glass plate over a magnet? The filings line up parallel and curve with the field, they do not cross each other. All credible scientific trials of dowsing have shown that dowsing is no better than random luck or common-sense intuition at finding graves or water (for further information, refer to Robert Todd Carroll’s reviews of scientific tests of dowsing in the [Skeptic’s Dictionary](#) [John Wiley & Sons, 2003], www.skeptdic.com/dowsing).

Advantages: There are no advantages to dowsing.

Disadvantages: Dowsing is no better at finding graves than common-sense intuition. Dowsing could put yourself or your organization at legal and financial risk and could lead to public embarrassment. When you make determinations about the presence or absence of burials in a plot you are making decisions about other people’s property which carries legal and financial liabilities. The court of law does not recognize folklore such as dowsing as valid scientific practice. While other technologies and methods described here are not foolproof, they can at least be explained and justified in court because they are based on scientific or observational principles.

◆Contacts for Burials Issues:

Office of the State Archaeologist Bioarchaeology Program (burials older than 150 years, can also answer general questions):

Lara Noldner– 319-384-0740

Regulated Industries Unit, Iowa Securities Bureau (oversight of active cemeteries):

Dennis Britson, Director– Dennis.Britson@iid.iowa.gov 515-2815705

State Medical Examiners Office:

Dennis Klein, State Medical Examiner - dennis.klein@idph.iowa.gov 515-725-1400

Walker Hodges - walker.hodges@idph.iowa.gov 515-745-0580

Department of Public Health, Office of Vital Statistics:

Melissa Bird, Deputy State Registrar, Bureau of Vital Records - melissa.bird@idph.iowa.gov 515-281-6762

Attorney General's Office:

Eric Dirth, Assistant Attorney General— eric.dirth@ag.iowa.gov 515-281-8153

◆How to Contact Geophysicists (Remote Sensing Practitioners) and Archaeologists:

Remote Sensing. A list of regional practitioners of remote sensing (GPR, magnetometry, resistivity, conductivity) can be found at the North American Database of Archaeological Geophysicists web site, <http://www.cast.uark.edu/nadag/>. Since geophysics is an unregulated profession, be sure to ask for references and examples of final reports. Geophysicists affiliated with archaeological or engineering firms may be better choices, since archaeology and engineering are regulated professions. Many archaeologists, listed below, can subcontract a geophysicist on your behalf.

Archaeologists. A full list of qualified archaeologists working in Iowa, including out-of-state firms, is maintained by the Iowa State Historical Society on their web site: http://www.iowahistory.org/preservation/review_compliance/consultant_list.html

All Archaeology Firms Based in Iowa Listed with REDDWLRRI

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Bear Creek Archaeology (563) 547-4545

Consulting Archaeological Services (515) 494-1695

Cultural Heritage Consultants (712) 239-9085

Impact 7G (515) 473-6256

Iowa State University Archaeology Laboratory (515) 294-7139

The Louis Berger Group (816) 559-3827

Midwest Archaeological Consultants (920) 559-1929, (515) 333-1893

Office of the State Archaeologist, University of Iowa (319) 384-0724

Prairie Archaeological Research Consultants (641) 757-7830

Quality Services (605) 858-0672

Tallgrass Archaeology LLC (319) 354-6722

Wapsi Valley Archaeology (319) 462-4760

Geophysicists:

Quinn Black - Sanford Museum (712) 225-3922

Colin Betts - Luther College (563) 387-1284

Glenn Storey - University of Iowa (319) 335-1866

Decision-Making Flow Chart for Finding Unmarked Burials

This chart presents some of the decision-making criteria archaeologists and geophysicists use in deciding a method for finding graves. Contact an archaeologist or geophysicist for more information.

