BEST PRACTICES AND METADATA GUIDELINES FOR TRANSMITTAL OF GIS DATA BETWEEN AGENCY AND SHPO DATA SYSTEMS

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Introduction

The use of global positioning systems (GPS) as a field tool and geographic information systems (GIS) as an office and management tool will continue to expand in cultural resources management. Indeed, GIS itself will become more of a field tool in the next few years, with data available on handheld computers and in GPS data collection units. As more field observations are generated in digital formats, there is a natural desire to avoid re-digitizing data. Re-digitization takes effort and can also degrade spatial and attribute accuracy.

This best practices memorandum proposes formats in which spatial information in GIS data file formats should be conveyed to BLM information systems from other parities and from BLM to SHPO information systems. Although use of GPS is an important reason for this proposed standard, the standard itself does not require that GPS be used to create spatial information. Because GPS use is increasing and brings to the fore issues of digital data transmission, GPS and mapping in general are addressed briefly in this introduction.

GPS is revolutionizing how maps get made. Even low-cost receivers can calculate geographic coordinates more precisely than one can determine them from a 1:24,000 USGS topographic map. GPS information can usually be converted into a GIS file format compatible with BLM and SHPO spatial databases. Cultural resource information systems (managed by BLM or by SHPOs) can benefit greatly from streamlined transmittal of *appropriate* digital data.

GPS field recordings, even those made with sophisticated data collectors, cannot usually be imported into GIS data systems without some manipulation. The difficulty is not file formats, but in the nature of GPS data itself. GPS is a mapping tool, like a theodolite, an electronic distance meter, or a stadia rod. These tools require skillful manipulation of their results to create a coherent site map. So does a GPS. GPS does make collecting the information needed to make effective maps much easier.

Managers of cultural resource information systems (in SHPOs or in agency offices) have little interest in receiving all of the GPS files from a fieldwork episode, just as they had no interest in receiving the instrument books from people mapping with alidades and plane tables. Cartographic representation was and is an interpretive activity. Managers of cultural resource information systems need to receive cartographic representations of cultural resources phenomena in a format appropriate for error checking and rapid inclusion in their information systems.

The standards proposed here are a template that can be used in almost every western U.S. state to convey records to a SHPO or agency GIS. The source of the records could be an agency field office, a contractor, or an avocational group. The standards discussed here pertain to conveying data as GIS data files. In general, we expect that organizations capable of creating GIS records are using GPS as a mapping tool. But, there is no necessary equivalence here: one could be using just GIS to create records. The standards proposed here are indifferent as to the source of spatial information. Instead the standards focus on reasonable description of the informaton's accuracy.

A brief note on terminology is necessary. Throughout this document "phenomenon" and "entity" are used in very specific meanings. A *phenomenon* is the real world "thing" that is mapped or recorded. An *entity* is the representation of a phenomenon in an information system. Usually, *entity* refers to a GIS entity (a graphic representation in a known coordinate space), but it could also be a row of data in a table.

Cartography and GPS

Most agency offices currently map site locations and boundaries to a 1:24,000 map base in the lower 48 states and 1:63,560 map base in Alaska. While there are formal standards for every formal map series published by the U.S. Geological Survey, the general notion in agency map files is that the cultural resources depicted are "pretty good" representations of site location and boundaries. This is inherent in the map scale. For example, a 0.5mm pencil line on a 1:24,000 map is 12m wide. A site represented as a visible 2mm dot would be 48m in diameter and cover an area of about half an acre (actually 1,806 square meters or 19,516 square feet).

GPS brings much higher accuracy to the recording process. Even uncorrected GPS from "sports model" GPS receivers will plot accurately at 1:24,000 scale. At larger scales (e.g., 1:6,000), inconsistencies will start becoming evident in uncorrected data.

Fieldwork gathers GPS and other spatial information in whatever way is most effective. Sites may be mapped using a variety of tools at the same time. The resulting raw spatial information In turn, the field mapping information is cleaned and made more regular to produce site "sketch" maps at scales of 1:100 to as small as 1:24,000 and site "location" maps at scales of 1:24,000 for inclusion in the site record packet.

For paper cartographic purposes, the draftsman can synthesize multiple sources of spatial information into a coherent single map. In digital cartography one is always tempted to retain the original digital data to the fullest possible extent, yielding a map that is complex and possibly difficult to interpret. For example, a site boundary could be created from GPS lines, GPS points, interpolations between points and lines, topographic lines from a USGS map, and a fenceline traced from a digital aerial photography. If one asked, "what is the spatial accuracy of the boundary?" there would be no simple answer.

An Introduction to Metadata

The standards proposed in this document are use-oriented. That is, they aim toward the use of individual pieces of information rather than documentation of its genesis. The user or evaluator of spatial information that follows these standards should be able to answer the question posed above about the spatial accuracy of a boundary, because the standard creates *metadata* (literally, data about some item or body of data) for each spatial entity.

Data are primary pieces of information about the phenomenon itself. For example, a site identifier is a primary piece of information about a site. Metadata are simply additional pieces of information that allow the user of data to better understand the primary information (i.e., data) that they are using. For example, knowing that the site data (primary attributes) were entered from field notes rather than a formal site record might lead you to consider it less reliable for some purposes. Metadata are particularly useful when it comes to spatial information. For instance, estimating the likely accuracy (or inaccuracy) of a resource's spatial location is very useful when using a map that shows where the resource is (or is said to be).

However, one must recognize that the distinction is artificial in some important ways. For example, is knowing the date a site record was filled out data or is it metadata? It is fairly obviously the former, but isn't it also the latter because terms, field methods, and standards for recording change over time?

There are many approaches to metadata. One is to describe the full heritage of each data item. Another approach is to describe entire sets of data. The latter approach is used in current Federal Geographic Data Committee standards for geospatial metadata. This data set standard is still part of this proposed standard.

A second approach is to describe individual entities within a data set. This approach, which is also called feature-level metadata, is appropriate when data are heterogeneous in source, origin, and variable in data quality. Because each entity in a cultural resources information system may have come from different fieldwork episodes, mapping techniques, and digitization methods, this standard focuses on the characteristics of individual GIS entities, the proposed standard incorporates entity-specific metadata as well as data set metadata.

An earlier draft of this document requested for each spatial entity the types of GPS receivers, positional dilution of precision (PDOP) values, numbers of filtered positions, and other information about how each spatial entity was created. This revision of the earlier documentation moves description of field and office coordinate determination methods to a single metadata file for conveyed spatial data sets. Instead, it requests for each entity four attributes to facilitate use of the spatial data for most purposes.

Best Practices and Implementation

This standards document grew out of a working collaboration between several different organizations. While it establishes standards, it can also be best used as a starting point for anyone who needs to build a cultural resources GIS data file that will ultimately be transmitted to a BLM or a SHPO cultural resources information system. One can certainly add on to the information categories presented here. Like any standard, deviating from it or changing values in it will make it weaker.

The data and metadata described here are not dependent on a particular software but can be implemented easily in many different software environments. Currently, the BLM and many SHPOs use ArcGIS release 9.x This software includes a catalog function that assists the user in creating metadata about entire datasets (not entity-level metadata). We strongly encourage the use of the ArcGIS metadata tool for documenting data sets – it is rapid, complete (exceeding the recommendations for data set level metadata), and easily shared. A great boon is the ability of the ArcCatalog tool to gather the spatial extents, counts of spatial entities, and projection information automatically. ArcGIS is only one of many GIS tools. ArcView 3.x has its own set of add-in extensions for metadata, as does AutoCAD Map, and GeoMedia.

Entity-level data and metadata are not created by any of the tools described above, because they are specific columns in GIS attribute tables. These data and metadata columns, or fields, can be created in almost any GIS software as part of an entity-associated table. Models for these can be found in ESRI's personal geodatabase format, as Microsoft Access tables, and as ESRI shapefiles at ________________________ [my intent is that Dan can post examples at the DUG site].

Various file formats are appropriate for transmitting data to agency offices. The most useful are non-topological (so that GIS entities can overlap each other) and easily read by various software tools. The ESRI shapefile format is perhaps the most universal format currently used for GIS datas. When properly documented, it can be very effective as a transmittal format. ESRI has another file format called the personal geodatabase (as of ArcGIS 9.x) which stores spatial data and attributes in a single file (a JET database – the same format used by Microsoft Access). Shapefiles have the advantage of universality, personal geodatabases have the advantage of encapsulation. To date, the shapefile format has been stable for more than 5 years. Personal geodatabase formats have been changing over the past two years. For these reasons, the shapefile format is **recommended** (but not mandatory) for transmitting spatial data with attributes at the present time.

Datum and Coordinate System

Coordinate systems describe the x, y, and z dimensions of spatial data. Except for spherical coordinates systems (such as latitude and longitude), all coordinate systems in some way fit the curving surface of the earth to rectilinear, planar , axes. Every coordinate system is based upon a datum point, which in turn is linked to a particular models of the earth's shape. The North American Datum of 1927 (NAD27) is based on a simple elliptical model of the earth first formulated in 1866. Almost all published, paper, maps in the United States are based on NAD27,. A more complex model of the earth resulted in the creation of the North American Datum of 1983 (NAD83). A large body of digital mapping data has been collected in NAD83, and GPS units use this datum (or technically its global equivalent) by default to report coordinates. The BLM and most federal agencies are using NAD83 as the digital map datum, though NAD2004 will soon be available. BLM's standard is currently NAD83, and a best practice is that this be the preferred datum in transmitted data sets.

Coordinate systems, except for latitude-longitude (called "geographic" in some software systems), tend to be locally useful, almost by definition. Most GIS programs allow for reprojection or direct use of geographic data as if it was in a planar coordinate system. Thus, the most universal format is geographic coordinates. However, it is now easy to transform data between coordinate systems, especially within the same datum model, so one could use any locally appropriate systems.

The most important point about datum and coordinate systems is that they be well-documented for each dataset transmitted from one party to another. Many BLM administrative units have their own standards (usually at a state level). For BLM uses, then local standards should prevail as being the most convenient. However, if no standard is in place or a more universal body of information is needed (e.g., straddling local standard boundaries), then the following values are **recommended**:

- Datum: North American Datum of 1983 (NAD83)
- Coordinate System: Latitude-longitude (geographic) decimal degrees
    - Many offices may prefer Universal Transverse Mercator (UTM) in an appropriate zone
- Datum Conversions(if needed): use HARN if available, NADCON if not

Data Set Level Metadata

Data set metadata is a mandatory accompaniment to all GIS data transmittals. Data set metadata describe the entire content of a particular collection of data. Usually, the collection, or set, is a single map data file. Data set Examples are an ESRI-format shapefile (which is actually three or more distinct files), , Once again, the most important standard is that datum and coordinate system must be documented in data set level metadata. In general one is always well-served by following the FGDC standard, the Content Standard for Digital Geospatial Metadata (CSDGM), which is in release 2.0 as of this writing.

The FGDC standard can appear onerous to the casual data submitter. Whether one uses this standard or not, there are some items that should accompany every data submission. These are shown in the following table. Metadata documents must be sent in plain text formats. Optionally, one might also include the same information in formats created by metadata tools.

Topic	***Description***
Data creator	Company, agency, or other organization who created the data in the dataset.
Date created	Date on which the dataset was created, finalized for conveyance
Associated activity, resource identifiers	A list of identifying numbers associated with this dataset. Typically, this might be an organization project number, an agency investigation number, and a SHPO activity or project number. The purpose is to lead the user to appropriate paper records.
Methods, data processing description	Methods and data processing techniques used to create the data. A brief description will suffice This topic can include the field procedures, equipment, and protocols used for collecting spatial data. For GPS data collection, this could include receiver make and model, PDOP cutoff, etc. Post-field processing, aggregation, digitization, and smoothing may be described in this section. Datum conversions performed upon the data set should be specified.
Responsible party and point of contact in creating organization	The name(s) and contact information of a person in the data-creating organization who is familiar with the data and responsible for its quality.
Coordinate system, units, and datum of data	This topic must cover the coordinate system and datum in which the data are conveyed (not necessarily the coordinate system in which the data was created – this might be covered in the "Methods" section of the metadata document, including conversion from the source coordinate system to the conveyed coordinate system). Different agency offices may have specific requirements for data that will be accepted.

Entity Data and Metadata

The following sections describe mandatory columns that shall be present in each GIS attribute table and must be populated with attribute values for each row in the table. We have not included a full description of entity labels in the mandatory columns, since these are variable from one state to the next. For each column attribute, except entity labels, a table of allowed values and what they denote follows the attribute description. For ease of reference, each column is presented on its own page.

Entity Identifier(s)
Column name(s): variable, by state-level convention
Column format(s): variable, by state-level convention
Description: This attribute is actually data about the phenomenon, consisting of one or more identification values. State-level conventions and standards should be used here. For instance, many states use the Smithsonian trinomial numbering system for archaeological sites that have been formally recorded and thus would require this number to be present if known. The Smithsonian number could be in three columns (state identifier which may be numeric or character, county identifier which is typically 2 characters wide except in California, and resource number) or just a single column as in "26WA1234". Similarly, almost every entity has both a field or temporary or local identifier (a temporary site identifier, an agency-specific project number) and a formal identifier (an assigned AHR number in Alaska, an LA number in New Mexico, a Smithsonian trinomial, a California p-number, a master survey report number, etc.). Appropriate identifiers, formats, and allowed values should be identified at the **state** level and are mandatory if applicable.
Attribute Values: State-specific.

Horizontal Positional Accuracy
Column name: HposAcc
Column format: character, 6 wide
Description: This attribute describes the *horizontal* positional accuracy of the GIS entity. Accuracy can be conceptualized as the likelihood that a stated coordinate is the true coordinate of a position. Hence, accuracy is the converse of positional error. The values for this attribute are probable positional error circles – the root mean square (RMS) error of a position.

For a single position, the root mean square error is a clear measure of accuracy probability. Many GPS units and post-processing software return RMS errors for averaged position fixes. However, there are many cases in which RMS error is more difficult to determine. RMS error is an estimate derived from repeated measures; single position fixes must default to having an RMS error at least as large as the usual RMS error for the source of the position fixes.

A practical guideline for determining the value of this attribute is the source of the coordinates ("location") used to create the GIS entity. So, a map coordinate measured from a USGS 1:24,000 quadrangle has an RMS error greater than the paper map itself.

The entity-level attribute is important because combining data with different horizontal positional accuracy can yield unexpected results. For example, a highly accurate GPS-determined position may plot on the "wrong" side of a USGS digital map image registered in coordinate space. This is not due to an error in either position, just the positional error in the map is greater than the error in the GPS position. Adjusting the GPS-position to match the map would degrade the horizontal positional accuracy of the GPS reading (and the HposAcc value should be changed accordingly).
Attribute values: Attribute values are the roughly 90% probability that a stated coordinate lies within a certain distance of the true coordinate.

Value	Example methods used to determine coordinate(s)
<1m	Averaged, differentially corrected high-end resource grade GPS; Survey-grade GPS; Experienced operator using 10" or more precise total station or theodolite and EDM traversing from a known coordinate monument less than 5000m distant
<10m	Single position of high-end resource grade GPS; multi-position averaging of sports-grade GPS without differential correction
<20m	Typical sportsman grade GPS – single position fix; USGS 1:24,000 map (National Map Accuracy Standard is approximately 13m)
<100m	USGS 1:36,000 to USGS 1:125,000 map
UnkLow	Unknown – low confidence in horizontal positional accuracy; likely error is not known, location is only an estimate quite likely to be erroneous
UnkHi	Unknown – high confidence in horizontal positional accuracy; likely error is not known, but coordinates are likely to be correct on a 1:24,000 scale map
UnkUnk	Likely error is not known and no estimate of reliability of horizontal position is possible

Horizontal Positional Source
Column name: HposSrc
Column format: character, 10 wide
Description: This attribute describes the source of the coordinates used to place the GIS entity into coordinate space. The attribute values describe only the most common sources and are not intended to be comprehensive. Horizontal positional source is useful as a means to segregate GIS entities derived from different sources, especially in data derived from plots on paper maps.
Attribute values: Attribute value is determined by the *source* of the horizontal coordinates. A GIS entity may have multiple sources, in which case one should state the predominant source. Multiple source entities that have no dominant source should receive an attribute value of "other".

Value	Example methods used to determine coordinate(s)
GPS	A GPS unit, of any grade, was used
SurvInst	A total station or a survey instrument (transit, alidade, theodolite, electronic distance meter, stadia rod, or chain/tape), was used
USGS map, scale, e.g., USGS24000 USGS62500 USGS100000	Horizontal position coordinates were derived from USGS map at given scale. Note that if one transfers a GPS position to a map, then digitizes from the map, the accuracy is still that of the map, not the GPS.
Aliquot	Derived from an aliquot (cadastral) location. This depends upon the size of the aliquot part relative to the entity coordinate. At best, since an aliquot must be mapped to be converted to coordinates, the horizontal positional accuracy is that of the associated map.
Asserted	Horizontal position is an assertion with no other source information (e.g., a site record). In this case, horizontal positional accuracy will probably be unknown.
Other	Some other source, known but not among choices above.
Unknown	Source is not known.

Boundary Precision
Column name: BndPrec
Column Format: character, 6 wide
Description: Boundary Precision is the "fuzziness" or uncertainty of a reported boundary. It applies only to polygonal (having the geometric property of area) GIS entities. "Fuzziness" can be thought of as how sharply a bounding line should be drawn. An inaccurate boundary would be represented as a wide gray line, a very accurate boundary as a thin, darker, line. Current GIS display technology does not do a particularly good job of displaying the uncertainties in data, containing no display utilities by which one can indicate uncertainty or fuzziness easily. Note that the concept of boundary precision does not, generally, apply to whether a boundary is real, imagined, or how it was estimated. Rather, Boundary Precision is the reliability one places upon the boundary as a set of coordinates. Some other means is necessary to determine whether one should trust the method by which the boundary was defined on the ground.

Boundary precision can be a complicated estimation if one considers all of the potential error sources and uncertainties that compose a bounding line. For example, if one creates a boundary by joining together high accuracy GPS positions, what is the "fuzziness" of the lines between the points? This will depend upon how closely the position fixes fit the intended boundary. Too few points, or points in the wrong place, and a boundary can be quite inaccurate.

Many GIS polygons are composed of heterogeneous boundary sources, each of which could have its own spatial inaccuracy. In the standard presented here, each GIS polygon is given a single value for boundary precision. A more complex standard would involve associating appropriate accuracy attributes with *each* part of a polygon boundary. Although perhaps desirable, individual boundary segment attributes would be complicated to create and manage. For this reason, they are not incorporated into this standard. A single estimation is requested in this standard.

In general, the predominant technique used to gather or create coordinates of the ***observed*** boundary of an entity determines the boundary precision. Estimated parts of boundaries are not to be included in the estimated accuracy. Because of its inherent complexity, boundary precision will always be a judgment of the cartographer creating the GIS entity. The precision of the boundary

Attribute values: Attribute values are the estimated, appropriate values for a "gray" line to represent the boundary of a phenomenon, were a GIS to draw the boundary as a zone of probability. The values are intended to be best judgement, realizing that one will probably be combining different error widths in most cases.

Value	Example methods used to determine boundary
<1m	Averaged, differentially corrected high-end resource grade GPS; Survey-grade GPS; Experienced operator using 10" or more precise total station or theodolite and EDM traversing from a known coordinate monument less than 5000m distant
<10m	Single position of high-end resource grade GPS; multi-position averaging of sports-grade GPS without differential correction
<20m	Typical sportsman grade GPS – single position fix; USGS 1:24,000 map (National Map Accuracy Standard is approximately 13m)
<100m	USGS 1:36,000 to USGS 1:125,000 map
UnkLow	Unknown – low confidence in horizontal positional accuracy; likely error is not known, location is only an estimate quite likely to be erroneous
UnkHi	Unknown – high confidence in horizontal positional accuracy; likely error is not known, but coordinates are likely to be correct on a 1:24,000 scale map
UnkUnk	Likely error is not known and no estimate of the accuracy of horizontal position is possible

Boundary Observation Completeness
Column name: BndComp
Column format: character, 8 wide
Description: The Boundary Observation Completeness Attribute describes whether the boundary in the shown in the data represents the entirety of the boundary of the entity being mapped or only part of the entity boundary. The attribute is particularly useful in situations where only part of a phenomenon (e.g., a resource, an investigation) is mapped in the field. The attribute flags the observational completeness of the phenomenon boundary representation, not the logical completeness of the boundary. A boundary is logically complete simply by closure (for a polygonal entity); observational completeness means that the logical boundary matches the actual boundary.

Note that in the case of a linear or point phenomenon, an observed boundary may take the form of a line (perhaps the centerline of the phenomenon) or a point (perhaps the central point in the phenomenon).

A cultural resources example may clarify the concept of observational completeness. Consider an archaeological site recorded within a highway right of way. The crew recording the site is not allowed to leave the right of way, although the site runs outside of the right of way. So, the crew maps the boundary of the site as they observe it right up to the edge of the right of way. In the GIS, the polygonal shape representing this archaeological site is "squared off" at the right of way edge – the GIS entity is logically complete. In other words, there is a boundary represented in the GIS, but the entire boundary was not observed, so it does not represent the boundary of the entire phenomenon.

In practical terms, someone using the spatial data is given a means to determine whether the data are complete for a given phenomenon or whether the boundary shown is closed merely by convention. This determination is often very important for "linear" entities, such as roads, trails, or ditches. Segments of these phenomena may be recorded in their entirety (see below under the Segment attribute), even though the entire road, or ditch, or pipeline is not completely observed. Yet, each segment recording is a complete observation. No part of the reported segment boundary is an inference.
Attribute values: Attribute values for Boundary Observation Completeness signal to the user whether a boundary was completely observed or not.

Value	Boundary observation completeness
Complete	Entire phenomenal boundary was observed (mapped) completely. Note that this could mean the centerline of a phenomenon, or a centerpoint. By convention, a distinctly identified segment of a phenomenon can have a value of "Complete" if it has been mapped entirely.
Partial	Only part of the phenomenon was mapped.
None	The phenomenon boundary was not observed or mapped at all. Boundaries created by buffering using a convention (e.g., "sites less than 30m in extent shall be mapped as point and buffered to be a polygon 30m in diameter") would have a value of "None" for Boundary Observation Completeness.
Unknown	The observational completeness of the phenomenon spatial data is not known.

Segment Status
Column name: Segment
Column format: character, 1 wide
Description: The segment variable describes whether the spatial entity represents a definable segment, lobe, or part of an entity, rather than the entire entity. It is necessary because some phenomena are so extensive spatially, forbidding of access for mapping and observation, or otherwise unobservable. A spatial data user may be presented with a spatial entity of high positional and boundary accuracy, complete boundedness, and yet be shown only part of the entire phenomenon. This attribute flags such a condition for the spatial data user. If true (the entity is a segment), then there is more of the same phenomenon, perhaps present in data as different spatial entities. If false, then the entity represents the entire phenomenon.

The State of Hawaii is an excellent example of the use of Segment. In a GIS, the state is represented as several distinct polygons. Each is a part (a segment) of the state but is not the entire state. Thus, Segment = TRUE for each island.

Linear phenomena are particularly amenable to segmentation in spatial datasets. Simple examples abound: the portion of a highway that lies within a particular county. A railroad construction shoo-fly.

A lobe of an entity is also a segment. Above, the example of an archaeological site in a highway right of way was given (see Boundary Observational Completeness). The portion of the site within the right of way is a lobe, or segment, of the entire site. So, not only was the boundary incompletely observed, but the spatial data represents a segment of the entire phenomonon.

There is no necessary relationship between Boundary Observation Completeness and Segment. A boundary may be complete, but the entity is only a segment (e.g., a single Hawaiian island). A boundary may be incomplete and the entity is only a segment (the highway right of way site example). A boundary may be complete and the entity is not a segment (the entity represents the entire phenomon). A boundary may be incomplete and the entity is not a segment (for example, a partly observed archaeological site bound).
Attribute values: Attribute values for Segment are straightforward.

Value	Segment
T-TRUE	The entity is a segment of the entire phenomenon.
F-FALSE	The entity is the entire phenomenon.
U-UNKNOWN	The relationship of the entity to the phenomonon is unknown.

Maximum Entity Width (applies only to point and linear entities)
Column name: EntWidM
Column format: integer
Description: In many cases, phenomena are recorded in GIS as points and lines, even though they are two-dimensional (i.e., they have area). The Maximum Entity Width column gives a single metric value representing the width of the entity. If one were to create a spatial boundary around the entity, then one would use half the Maximum Entity Width as a buffer distance.

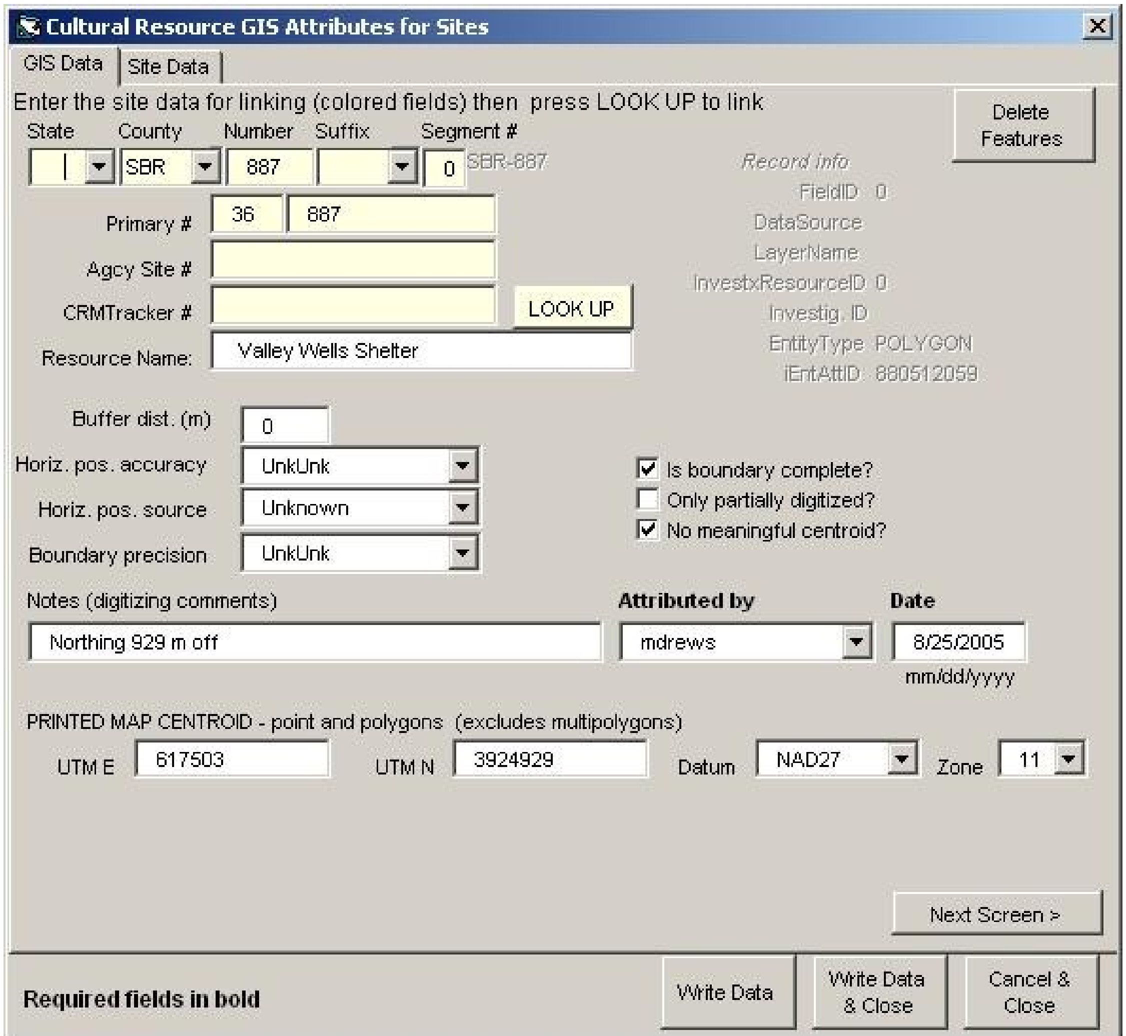
When a phenomenon is presented in GIS as a polygon, it will not have an entity width (the value should be zero).

Attributes: The values in this column are the actual width or diameter of the phenomenon's spatial extent.

Value	***Description***
0	Entity should not be buffered to create a polygon (e.g., it already is a polygon)
1 to any value	Width or diameter of resulting polygon if entity is buffered to create phenomonon of appropriate size. Buffer distance in most GIS software would typically be half of this value.

Example Interface for Metadata Entry and Editing

The figure below displays the entry screen for the current version of the BLM California Arch Edit tool. This GIS toolbar runs in ArcView 9.x. When a cultural resource feature is selected with the tool, the screen below is presented (for resources – a similar screen is used for investigation entities).



The screen displays many of the features discussed above. In the upper left of the screen, *identifiers* are entered. In the middle of the screen, the *buffer distance* is requested, as are *horizontal positional accuracy, horizontal position source,* and *boundary precision.* In the middle of the screen, *boundary completeness* and *segment status* (phrased as partial digitization) are gathered as check box entries. The rest of the screen shows some other useful values that are not discussed as part of this standard. In practice, the use enters relatively little information because most values are defaults.

The BLM California application uses a personal geodatabase as its data storage. The geodatabase contains all of the lookup values for the metadata and the data itself. This enforces standardization of terms, even if someone edits the attributes without using the form shown above.