



## GIS Standard for Environmental Restoration

### Why Do We Need a GIS Data Standard?

The collection, storage, management, and analysis of geospatial data are critical components of environmental restoration activities. Geospatial data can be stored in a number of ways (i.e., paper, microfilm, and/or electronically) which may not be readily accessible and usable, or easily shared with, or reported to others. Geographic Information System (GIS) technology can provide cost-effective and efficient tools to apply and manage such data. However, careful planning and the use of consistent data storage and GIS system implementation standards are necessary to achieve the full potential offered by GIS technology.

**Spatial Data Standard (SDSFIE).** The SDSFIE (developed at the The CADD/GIS Technology Center, Army Engineer Research & Development Center, Vicksburg, Mississippi (<http://tsc.wes.army.mil>)) provides both a graphic (e.g., symbols, colors, line styles) and non-graphic standard (database format and organization) for GIS implementations. The SDSFIE is designed for use with commercially available "off-the-shelf" GIS (e.g., ESRI ARC/INFO & ArcView; Intergraph MGE & GeoMedia; AutoDesk AutoCAD Map; and

Bentley GeoGraphics) and relational database software (e.g., Oracle & Microsoft Access). The standard has been developed based on input from various technical experts; review and analysis of existing working DoD and state GIS's; review and analysis of various existing database management systems used throughout DoD and the federal government; and content contributions from federal, state, local, and private sector sources. For additional information go to the "Products" area of <http://tsc.wes.army.mil>.

The SDSFIE data model consists of the following five basic levels of hierarchy: Entity Sets, Entity Classes, Entity Types (includes Entities), Attribute Tables, and Domain Tables:

(1) *Entity Sets* (or Themes) are broad groupings of features and related data. The SDSFIE structure currently includes twenty-five Entity Sets. Most of the features pertaining to environmental restoration activities are found in the "Environmental Hazards" Entity Set.

(2) *Entity Classes* are logical groupings of features and data within an Entity Set for data management purposes.

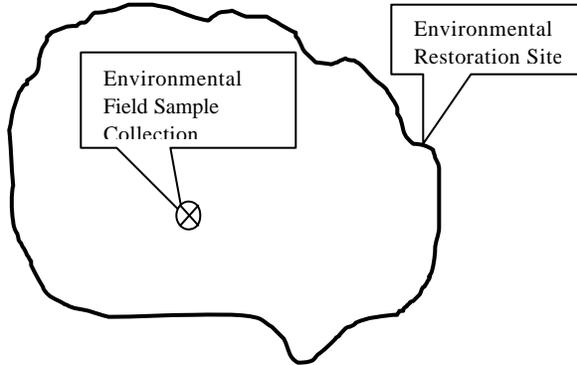
(3) *Entity Types* are real-world features or objects which can be depicted graphically on a map or drawing. Each entity type has an associated attribute table. GIS features can be depicted by one of three different object types: (a) Boundary (Polygon) (a line string, or group of arcs) which forms the perimeter of an area. an example would be the boundary of a lake); (b) Point (a single point representing the geographical location of a feature, (e.g., a well), points are typically represented on a map by a symbol); or (c) String/Chain (a line or group of arcs).

(4) An *Attribute Table* is a relational database table containing information (attributes, fields, or columns), either directly or indirectly related, to an Entity Type. Each attribute table is assigned

both a long (common) name (up to 50 characters in length) and a short (8 character) name. Each attribute is also assigned both a long (common) name (up to 50 characters in length) and a short (10 character) name.

(5) *Domain Tables* are database tables containing lists of codes (i.e., permissible or valid values) for populating specific fields in the Attribute Tables; e.g., units of measure, material types, etc.

*Join relationships* is the term commonly used for the built-in electronic capability by which relational databases link multiple records of a common attribute or item and provide access to the records through the use of queries. Join relationships are established in the SDSFIE/FMSFIE through the use of “Primary Key” attribute fields in a “parent” attribute table and “Foreign Key” attribute fields in related “child” attribute tables.



### Typical GIS Features for Environmental Sampling and Site

**Environmental Restoration Projects.** One application of GIS on environmental restoration projects is keeping track of the extensive amount of sampling data and making it available in a format which can be used for analysis, reporting, and decision making. Two GIS features (Entity Types) typical to environmental restoration projects include Environmental Restoration Sites

and Environmental Field Sample Collection Locations.

*Environmental Restoration Site* – The definition provided in the SDSFIE for an environmental restoration site is “a geographic area where an active environmental study or project is underway to remediate pollutants located in the soil, sediment, surface water, or groundwater.” In the SDSFIE, the following standard designations (called discriminators) are provided for labeling an environmental restoration site: (1) DoD Installation Restoration Program Site (IRP), (2) Formerly Used Defense Site (FUDS), (3) Superfund Site, (4) Brownfield Site, (5) Base Relocation and Closure (BRAC) Site, or Environmental Restoration Site (ER) (for sites that do not fall within the previous designations). An environmental restoration site may be depicted as a point feature (with a symbol) for small scale GIS applications (e.g., the scale of a USGS quadrangle map), or as a boundary/polygon feature for large scale GIS applications.

Basic information about each specific environmental restoration site is recorded in the database table entitled: “Environmental Restoration Site” (long name) and “ehsitirp” (short name). Additional information related to Environmental Restoration Sites can be recorded in other relational database tables.

*Environmental Field Sample Collection Location* - The definition provided in the SDSFIE for an Environmental Field Sample Collection Location is “the physical location at which one or more environmental field samples are collected.” In the SDSFIE, the following standard designations (called discriminators) are provided for labeling an environmental field sample collection location: (1) Soil (point location where a soil sample was collected), (2) Groundwater (point location where a groundwater sample was collected), (3) Surface Water (point location where a surface water sample was collected), (4) Sediment (point location where a sediment sample was

collected), (5) Waste (point location where a sample of a waste material was collected), (6) Air (point location where an air sample was collected), and (7) Biological (point location where a biological sample (e.g., plant) was collected). An environmental field sample collection location will always be depicted as a point feature (with a symbol).

Basic information about each specific environmental field sample collection location would be recorded in the database table entitled: “Field Sample Location” (long name), “ehchaspt” (short name), e.g., date established, reference elevation, coordinates, etc.).

An environmental field sample location can also be another feature in the GIS, e.g., a borehole (gesubbhl), monitoring well (imwelwel), exhaust stack (ehairasp), wastewater treatment plant outfall (ehswtdis), and underground fuel storage tank (ehtnkust).

Many environmental samples can be collected at each environmental field sample location. This data is considered to be temporal (time specific), because the samples can be collected on different dates over a relatively long period of time (several months or years). A few of the basic relational database tables for recording the detailed environmental sampling data collected at environmental field sample locations are as follows:

(1) *Environmental Field Sample Occurrence* (ehfmsam) – Used to record specific information about the collection of one or more samples at a location (e.g., date & time collected, who collected sample, depth, temperature, sample type, etc.). Provides the capability to manage sample collection data and perform analysis and reporting concerning the types and concentrations of contaminants present at each location.

(2) *Environmental Field Sample Analytical Test Procedure* (ehfntes) – Samples that are collected are delivered to an analytical laboratory

for processing. Information about the analytical test preparation and procedures are recorded in this table.

(3) *Environmental Field Sample Analytical Result* (ehfmres) - Used to record a summary of the chemical results (for each analyte, parval, or contaminant) of the laboratory analysis of each field collected sample.

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