



Exploration & Production

GENERAL SPECIFICATION

GEOINFORMATION

GS EP GIN 303

**Cartography and geo-referenced Data Management
for Geosciences**

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1. Scope

Cartography and cartographic representation aim at various types of data, software and representation.

The purpose of this general specification is to outline the mandatory elements in creating and managing Geographical information data for the purpose of generating maps dedicated to the needs of the Geosciences.

This general specification applies to all maps produced within Geosciences teams at headquarters and affiliates, using standard cartographic or geographic information system (GIS) software.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
ISO 19115 :2003	Geographic Information -- Metadata
ISO/TS 19139 :2007	Geographic Information – Metadata--XML schema implementation

Professional Documents

Reference	Title
Not applicable	

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	



Total General Specifications

Reference	Title
Not applicable	

3. Resume

1: Traceability

Data must be reusable and updatable. Data shall therefore be structured, thus classifying all information objects according to type, each following unique rules (also called specialty criteria).

To insure traceability, one must record through specialized catalogue such as ArcCatalog or Project Wise, or else through an Excel File:

- Each file contributing to the map (including geographic scale & geodesic description)
- For each of these files: all elements necessary for reconstructing them: i.e. the color palette, the original ASCII file, the SQL query, etc.

2: Formats

Formats generated shall be one of the following:

- **ASCII** for punctual data (wells, grids). The most constrained ASCII formats: ZMAP ASCII, Grid Surfer, UKOOA files (P190, SPS ...) are preferred. Free ASCII formats files shall include description of their format.
- For image formats **geotiff**, **tiff**, **jpeg** associated with **tfw** or **jgw** geo-referenced file and with compressed **ecw** or **mrsid** files for geo-referencing parameters.

3: DBMS

The recommended DataBase Management System (DBMS) for cartographic data is **DBMS ArcSDE**.

4: Standards

Geodesy: All maps and associated files shall be referenced to an official TOTAL or EPSG geodesy.

Colors: For geological or litho logical representation, one shall comply with the internal standards, that is a unique color code available from headquarters EXPLO/IGEO/ARI in charge of this specification.

Wells representation: In representing well status and fluid types, one shall use the definitions of the "Chambre Syndicale de la Recherche et de la Production du Pétrole et du Gaz Naturel".

5: Printing Formats

cgm, **postscript** and **pdf** are the recommended printing formats. In order to retrieve the data for further processing, several outputs will be required.



4. Forewords

Cartography is a precious mean for analysis and communication in geography.

It requires the association of several techniques to generate maps for the representation of space, territories and landscapes, but also to display a representation of objects, events, or any associated phenomenon in their relation in space, with their specific characteristics

A map shall be making sense, good looking, and easy to read.

A map shall be updatable and reusable.

In the domain of Cartography, depending on the complexity of the data to be searched, processed or simply displayed, it is necessary to use the specific techniques of Computed Aided Design (CAD) or Geographical Information System (GIS).

The tools utilized must allow importing a wide variety of data and formats, for both vector and imaging types.

Managing each map is essential in tracing its components for validity as well as further updating.

Reusing the data can only result from data structuring, thus classifying all information objects according to type, each following unique rules.

All files and maps shall be associated to a geodetic reference.

5. Cartographic Environments

When generating maps, operational constraints may lead to using different cartographic environments:

5.1 The CAO type maps

These maps are generated using Computer Assisted Design software in conjunction with Geospatial extension (ex: Autocad+ Map 2D GIS, Microstation Bentley Map). These applications are extremely powerful for graphical representation and creation/conception but have poor GIS functionalities.

5.2 The GIS type maps

These maps are generated using Geographical Information System software, such as ArcView, ArcGis, MapInfo, Cadcorp, ... These applications associate the standard graphical edition tools with topological logic and meta data analysis and management, thus allowing a more dynamic representation of the information.

5.3 Mandatory Title Blocks contents

The above two types of maps must be generated within a strict compliance to the geodesy and projection representation.

All maps produced shall include a Title block full with all the document essential information for traceability purposes.



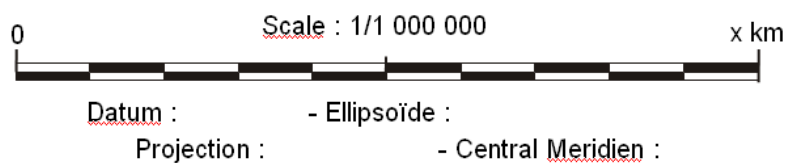
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6. Data

6.1 Representation

Representation is always one of two main types: **Vector** or **Image**.

6.2 Formats

Formats are used for creating maps, for exchanging maps across platforms, or to produce final paper copies.

Each of these functions has its own group of software and associated formats:

Designing		Exchanging		Printing	
Format	Software	Format	Software	Format	Software
Dgn	Microstation	Dxf	Autocad	CGM	POSC pour Image et Vecteur
Dwg	Format AutoCad	Mif_Mid	MapInfo	PS	Postscript
Shapefile	ArcView series(ESRI)	OpenGis	OpenGis	Pdf	Adobe
Tab	MapInfo	TIFF/JPEG	Format Image	ECW / MSid	Large compression Image formats

Note: the printing formats are not usually recognized as official. However, the printing file can be exchanged between printers, and as such widely used.

7. Bringing together all graphical files and building a DBMS

Here again, you may be faces with many options. For the purpose of integration in an ArcGIS environment, choose DBMS **ArcSDE (ESRI)** whenever possible.

7.1 Which DBMS format?

For a long time, the DBMS could not always host graphical format files, because these were too large compared to the servers capacity.

Today's panel of structure categories accept graphical files (vector or image) into a DBMS.

Applications listed above are not equivalent in their capacity to accept and properly read external formats.

The recommended and most spread format is **ArcSDE (ESRI)**, although other options include: **Oracle Spatial 9** and **PoscGIS (OpenGIS)**.

8. Standards

8.1 Graphical objects metadata: present status

Today, there is no existing standard for the management of graphical objects metadata.

Regarding Geographical MetaData structure, please refer to [ISO /TS19139: 2007](#).



8.2 Well status and fluid content representation

Objective: The graphical standard aims at representing the well status and its fluids type.

Conversion of symbols from GADAMA (Geosciences Affiliates Data Management) to ARCGIS is presented in Appendix 1.

Regarding CAD environment, the FrameMap tool embedded in the Bentley Microstation environment provides all symbolic representations.

In the GIS domain, these representations may be found by the « Chambre Syndicale de la Recherche et de la Production du pétrole et du Gaz naturel ».

All local or regional representations must be provided to HQ for optimal share within the Company.

8.3 Color Standards

Some geographical standards do exist, on regional or national extend. A single color code is acceptable per affiliate and per company.

As for geological color codes, these pseudo standards must be shared with headquarters as well as any necessary updates, in order to be taken into account and shared in the entire group.

8.4 Limitations in the compliance to color standards

When a piece of information is to be represented, it would be ideal to be able to display it in the same way and instantly on all maps. And yet, this symbolic representation and the way it is perceived on the map will be widely influenced by external factors to the point that our goal cannot always be reached.

For example, using the normalized colors of the geologic ages can lead to an unreadable map or to the fading of the strong point the map is aiming at making.

Therefore, standards should only be used when they do not affect the meaning of the map.

Some geological standards may only be valid in a portion of the area covered by the map: for example, litho-stratigraphic representations may be limited in geographical extent.

9. Exchange formats with interpretation workstations

9.1 Introduction

Within the Geosciences domain, the main data providers are the Geosciences interpretation workstations such as Sismage, Gocad, Skua, Landmark, Petrel.

The map can be designed directly in the mapping software embedded in these packages. The data can also be input in separate mapping software (Zmap, CPS3, etc.) for various purposes:

- Graphical editing
- Aggregation with data from other origin
- Standalone storage
- Cross Workstation data sharing



There are many ways to transfer data from interpretation workstations for retrieval, import or exchange. The exchange format and procedure vary with data, software as well as with the storing format and computer architecture.

While no standard prevails, here are some popular options:

9.2 GIS type files

The trend is to export data in GIS formats, where minimal loss of information is encountered. Information regarding geo-referencing and metadata is then recovered.

One shall make sure that the following data is properly transferred:

1. Data colors

Indeed, color codes vary with systems, and having to redefine each color could be a lengthy job (this is not always obvious and you may end up with the right map while still having to regenerate the original colors)

2. All graphical elements

GIS software usually deal with a more limited number of graphical objects than CAD software do.

Some exports do not simplify the complex elements, initiating thus further errors in the import process downstream. Other exports even dismiss such data without warning.

Integrity check (proper transfer of the colors and thorough transfer of the graphical elements) is thus mandatory!

Note:

Landmark software Open Explorer allows direct retrieval of most data from a GIS project.

9.3 CAD type files: *dwg*, *dxf* and *dgn* formats

- The two CAD formats most frequently used in the oil industry are: ***dgn*** (MicroStation) and ***dwg*** (AutoCAD)
- Software such as ZMap or CPS3 can generate export files in ***dgn*** or ***dxf*** format.

Exporting such formats must however be validated through complete checking of:

- Target geodesy –which may be different from the original data set
- Structure of the data exported:
 - When exporting data to interpretation workstation as well as to any other software, and when these data are well structured in the original CAD file, one shall avoid global export and maintain instead the original data structure for further processing.

9.4 ASCII format, including Grids

ASCII is the most popular and easy to use format.

ASCII is well suited for punctual data such as wells, grids. The ASCII format is well fitted for information attached to individual points.

It is not well suited however for linear or polygonal representation. In such a situation, one most often then describes the discrimination column which will define the way to go from one segment or polygon to the next.

No all cartographic programs accept such file types. However, in most cases adds-on have been written in that way.

9.4.1 Which ASCII format?

Some software accept open ASCII format, then descriptions of that format must be entered with data input.

Other software will expect the ASCII format to follow specific rules such as separation rules, specific naming of the columns, etc. Some ASCII formats are even more specific, being defined through standards which ought to be more stable. Can be mentioned in that last category: ZMap Ascii, Grid Surfer, UKOOA files (P190, SPS, ...)

These formats, if accepted by the complete chain of graphical tools used, should be preferred whenever possible.

Whenever possible, choose the most constrained ASCII formats: ZMAP ASCII, Grid Surfer, UKOOA files (P190, SPS ...)

9.4.2 Geodetic Information?

With the exception of UKOOA files, the ASCII files do not by default include geodetic information.

It is mandatory that a description of the geodetics of the data be always attached to all ASCII file.

9.5 Printing purposes Export formats (*cgm*, *ps*, *pdf*)

The previous warning regarding the structuring of data is even truer for the printing purposes export formats, as printing oriented files loose geo-referencing information.

The data within is described in inches just as it will be on paper. Besides, the data files loose the data layers organization.

One will therefore have to first undertake a geo-referencing work of the retrieved data.

***cgm*, *ps* and *pdf* formats are to be avoided as export OR EXCHANGE formats.**

A workaround possibility to retrieve the data is to:

- Make several outputs:
- for each type of data, dedicate a separate output to a separate type of object: well, faults, isochrones colors, isovalue lines, etc.,
- then associate to each of these files a geo-referencing element (grid, graticule, ..)

9.6 Interoperability formats

Such formats allow data exchange across workstations.

The most famous are OpenSpirit, which includes an ArcGis module, and RESQML 1.1, also geo-referenced.

9.7 Direct reading of Oracle databases / ArcSDE

Workstations frequently store their mapping information in Oracle databases with an extra SDE layer. It is then very easy for mapping software to fetch directly all necessary elements in this oracle DB.

Two dedicated formats will allow exchange between geo-databases:

- GML (Open GIS)
- ESRI XML (an extension of GML by ESRI)

9.8 Image formats

Recommended image formats are:

- **geotiff**: geo-referenced tagged image file format
- **tiff** or **jpeg**s: associated with their **tfw** or **jgw** word-file (or geo-referencing parameters)
- Compressed files: **ecw** or **mrsid** (MisterSid)

The **tiff** format with **lzw** compression is to be avoided.

10. Quality controlling Maps: traceability

The mapping process can lead to complex documents made of many layers from various origins.

Tracing the origin of each component is therefore essential for the reliability of the document its maintenance and updating.

Here are a few ways of keeping track of the origin and process leading to the final document:

10.1 Excel sheet

One will record for each map:

1. each file contributing to the map
2. for each of these files: all elements necessary for reconstructing it: i.e. the color palette, the origin of the ASCII file, the geodesy, SQL query, etc.

10.2 Specialized catalogue

ArcCatalog aims at being a specialized catalogue for ArcGis type data. It allows storing the same kind of information, either as Metadata or directly within the files themselves.

So far, however, this system does not allow listing thoroughly of all files making up the project.

We thus would qualify it as an attribute manager, storing the metadata of a file, in the same way a Word or Excel file does in the Properties of a document.

10.3 Documents managers

Many systems for managing documents are available around. Some are dedicated to CAO type (MicroStation, AutoCAD) mapping software. Originally designed along with specific mapping software, they can now manage as well other formats or software. One example of this is management system Project Wise.



These management systems allow for:

- retaining the structure of each composing file,
- keeping track of metadata associated to each information element,
- managing version control,
- exporting maps without losing their internal data structure.

Please note that the Bentley ProjectWise Geospatial tool includes a geospatial module allowing to spatially manage all the documents stored in the database, as well as an ArcGIS compatible plug-in.



Bibliography

ISO 19119	Geographic Information Services
EPSG Guidance note 6	Map content – Recommended Practice Coordinate Reference System
EPSG Guidance Note 5.1.2	Definition – Recommended practice
POSC Epicenter DataModel	Petrotechnical Open Software Corporation Specifications for information modeling, information management and data and application integration over the life cycle of E&P assets. Includes Schlumberger FINDER and Seabed, OpenSpirit and Landmark data models
ESRI Glossary	http://support.esri.com/index.cfm?fa=knowledgebase.gisDictionary.gateway
GIS Glossary	http://www.gisdevelopment.net/glossary/ http://www.gis.com/resources/library/dictionaries.html



Glossary

CAD maps: short for created using Computer Assisted Design software (see below)

DBMS: « DataBase Management System », most used management system for data bases (Oracle, etc)

jgw : add on file of a **jpg** or **jpeg** image file allowing integration into a GIS ; Also called « ArcView World File for **tif** Image ».

GIS type maps: generated using Geographical Information System software, such as ArcView, ArcGis, MapInfo, Cadcorp,

GIS project: set of maps (layers, associated tables or RDBMS (relational database management systems) tables, charts, reports and layout) displayed in the same geodetic references allowing them to overlay. Each maps or layers may have their own geodetic references.

Metadata: shareable information attached to a specific technical piece of data. Ex: country, lease, contractor, etc. See [ISO 19115: 2003](#) references for details.

mrsid : (pronounced Mister Sid) acronym for Multi-Resolution Seamless Image Database

SDE: spatial data engine .**ArcSDE** is a server software product used to access massively large multi-user geographic databases stored in relational database management systems (RDBMSs).

tfw: ASCII files containing information for geocoding image data so **tiff** images can be used directly by GIS. **tfw** are associated with an ordinary **tif** file as a separate file alongside. They are also named ArcView World File for **tif** Image.

GADAMA : Geosciences Affiliates Data Management

Sismage™ is TOTAL's proprietary software suite of seismic interpretation tools

Appendix 1 Gadama wells symbols for ArcGIS

How to customize ArcGIS in order to use the Gadama well symbols and status?

- o Copy the font file TOTAL_WELLS.TTF in the Windows directory: C:\WINWKS\Fonts
- o Copy the ESRI style file GADAMA_wells.style in the ArcGIS installation directory:
C:\Business\arcgis\Styles

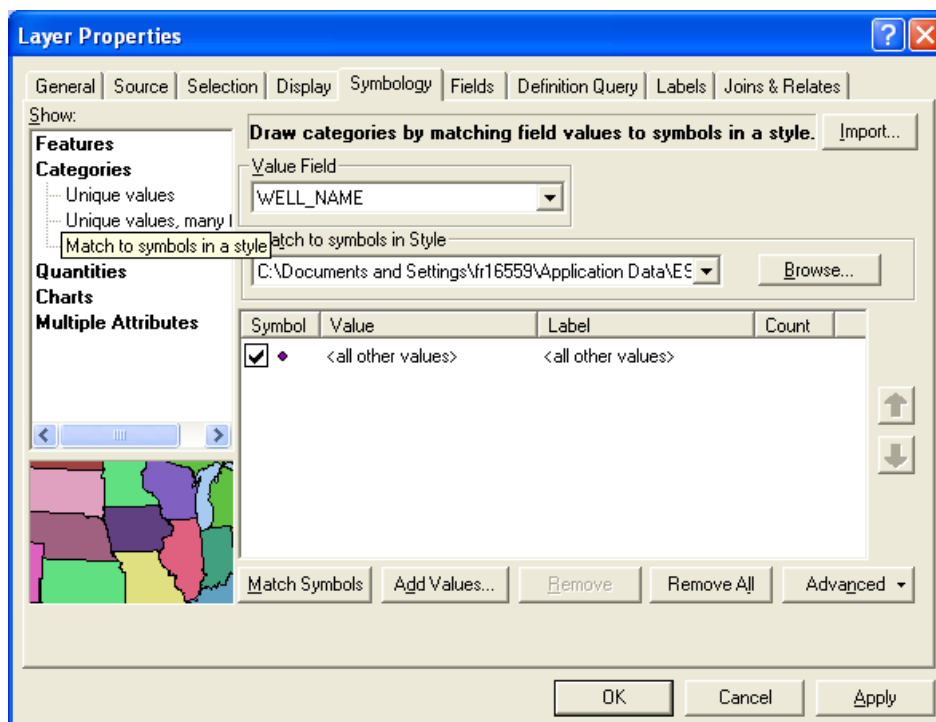
Once the font and the style files have been copied on the PC, next time ArcGIS is opened, the GADAMA_wells style will be available to automatically associate the correct symbol to the wells status. Provided an attribute column of the GIS layer selected, contains the status information.

How to use the new Gadama wells symbols?

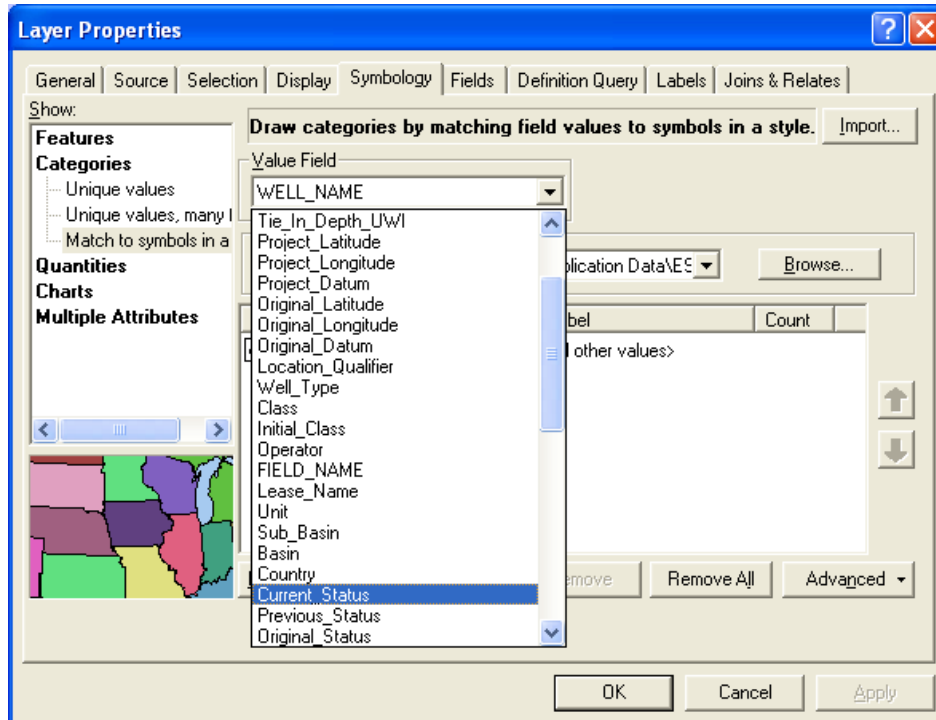
Right-click on the GIS layer > Properties

Select tab "Symbology"

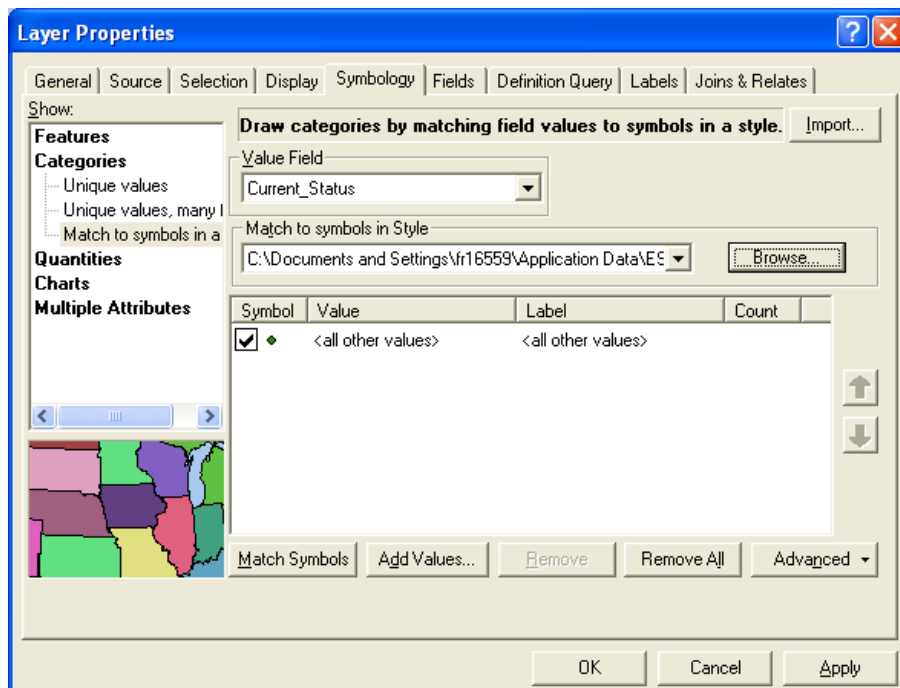
Select "Show > Categories > Match to symbols in a style"



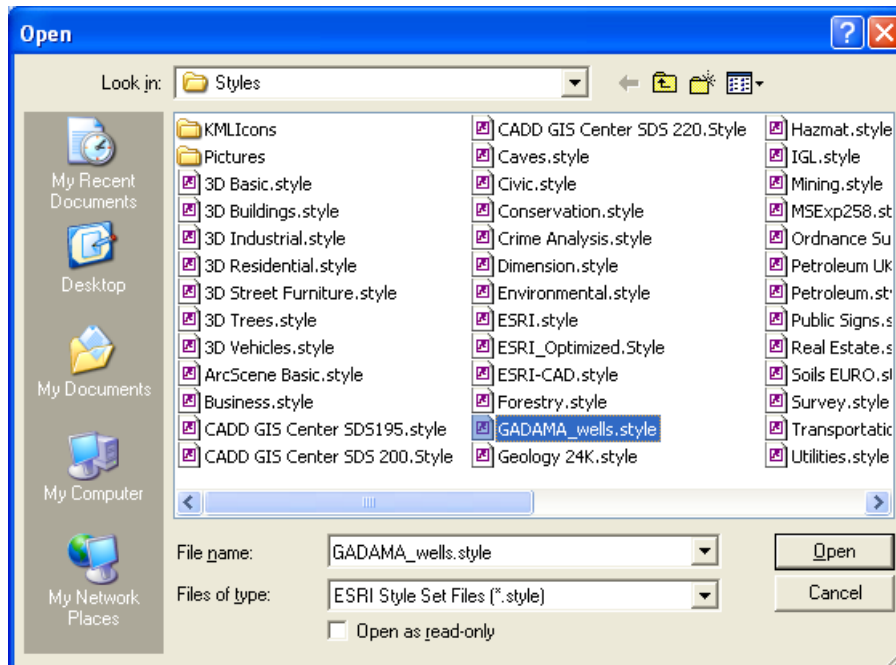
Select "Value Field" containing the current status:



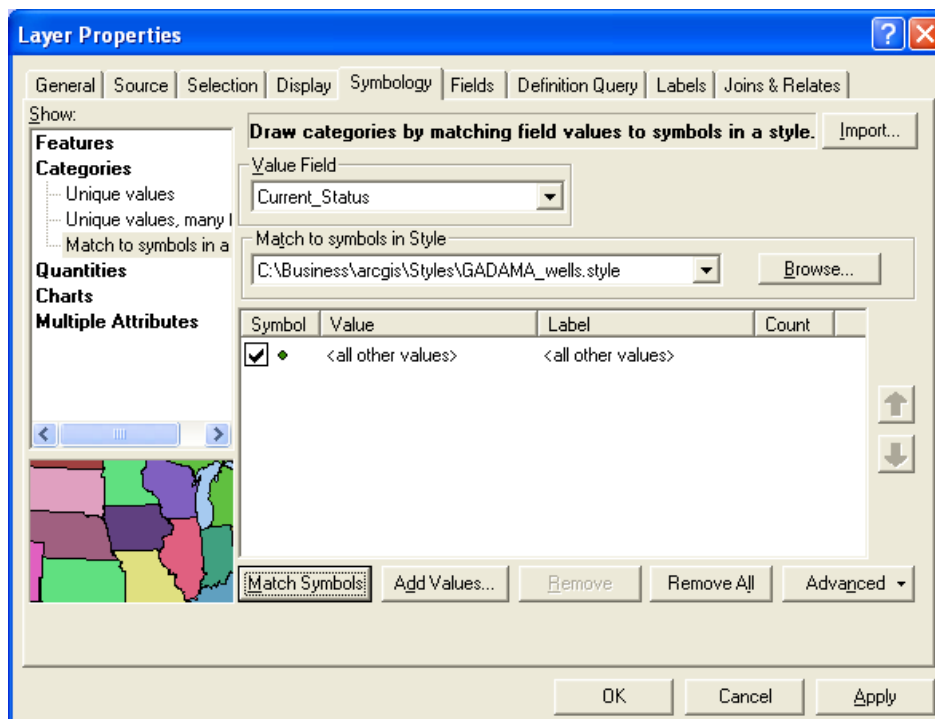
Click button "Browse...":



Select file "GADAMA_wells.style":

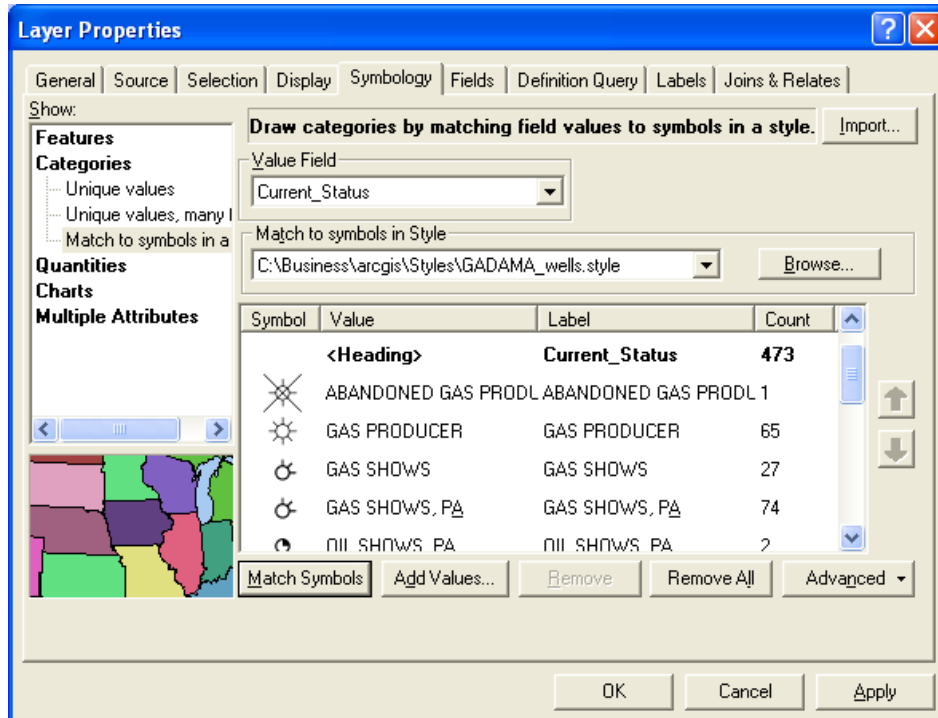


Click button "Open":



Click button “Match Symbols”.

The wells symbols will automatically be sorted according to the status value:



Click button “OK”.

The GIS map and layer symbols are automatically updated according to the GADAMA style:

