DIGITAL MAPPING TECHNIQUES 2021

The following was presented at DMT'21
(June 7 - 10, 2021 - A Virtual Event)

The contents of this document are provisional

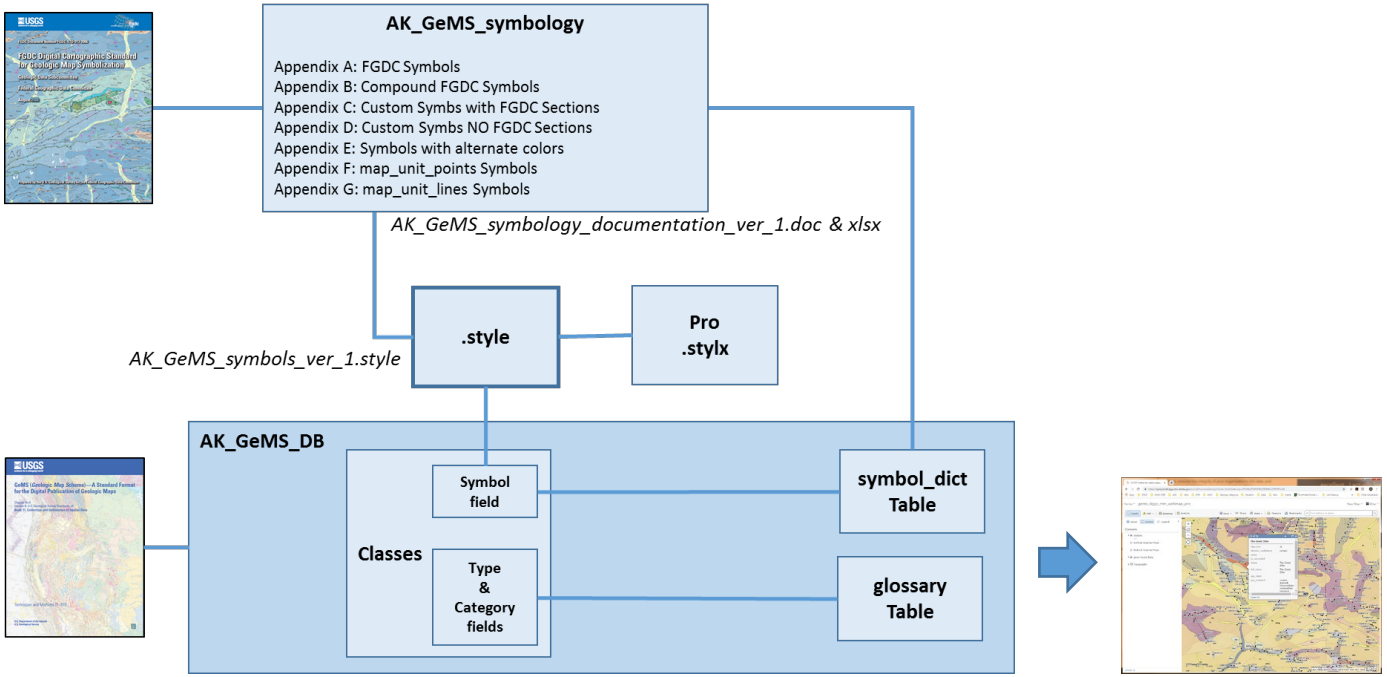
See Presentations and Proceedings
from the DMT Meetings (1997-2021)

http://ngmdb.usgs.gov/info/dmt/

Symbolizing a GeMS Database

DMT 2021

08 Jun 2021



Mike Hendricks, Trish Ekberg, Jen Athey, Amy Macpherson

Alaska Division of Geological & Geophysical Surveys

3354 College Rd, Fairbanks AK 99709

Alaska DGGS has developed and published a GeMS symbology standard and accompanying style file, *AK GeMS symbology: A description of the AK GeMS style file*. This publication describes the organization and content of the current style file used by DGGS for the Alaska GeMS map production system. In this standard, we have identified the primary and optional FGDC symbols for specific feature type values found within our established attribute domains. In addition, we have established procedures for requesting, creating, coding, and documenting custom symbols added to our style. This presentation will describe the development, key aspects, and implementation of this standard for GeMS based geologic map production.

Agenda

- **Introduction**
  - Key Symbology quotes from TM 11-B10 (GeMS)
  - Very brief review AK GeMS Geologic Mapping System
- **AK GeMS Symbology** philosophy & architecture
- **Style File** - AK_GeMS_symbols_ver_1.style
- **Custom Symbols** Procedures and Documentation
- **Future work**

TM 11-B10: GeMS (Geologic Map Schema)
Symbology Quotes

*"**The distinction between map data and their symbolization is important**.* Storing map data in a GIS—as opposed to its symbolization in a drawing program—facilitates machine-assisted analyses of the data, gives greater flexibility for alternate symbolization, and **eases reuse** of the data at different scales." *p.2*

"ArcGIS .style file that contains the area, line, and point symbols used to symbolize the map. **Must include all symbols specified in database.** It is recommended that the .style contain a subset of the symbols in the FGDC cartographic standard…" p11.

Alaska DGGS Geologic Mapping System Components

Organizational Procedures

Tools

AK GeMS Data Dictionary

Alaska DGGS
Field Event Geodatabases

Mapping Process

Alaska DGGS
Single Map AK GeMS Production Geodatabases

Quality Control

Data Reviewer Rules & Python Tools

Style

AK GeMS SYMBOLOGY

In Final Development

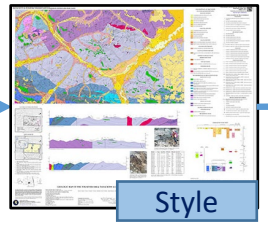
Convert & Load

Alaska DGGS
Multi Map AK GeMS Geodatabase
Style

Geologic Feature Services

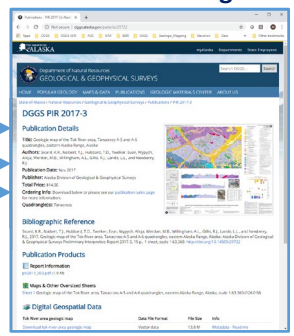
Cartographic Product

Print, pdf, & Rasterize


Style

Geologic Map Image Services

Product Web Page



Export

Alaska DGGS
Single Map AK GeMS Geodatabase
Style
.lyr

Convert

USGS
Single Map GeMS Geodatabase
Style
.lyr

To USGS

GeMS Validation

AK GEMS DATA DICTIONARY: A DESCRIPTION OF THE AK GEMS DATABASE SCHEMA, MP 169

- Report
- Data Dictionary
- Entity-Relationship Diagram
- XML Workspace Document

AK GEMS SYMBOLOGY: A DESCRIPTION OF THE AK GEMS STYLE FILE, MP 167

- Report
- AK_GeMS_symbology_documentation_ver_1.xls (Excel)
- AK_GeMS_symbology_ver_1.style (Style File)

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- Introduction
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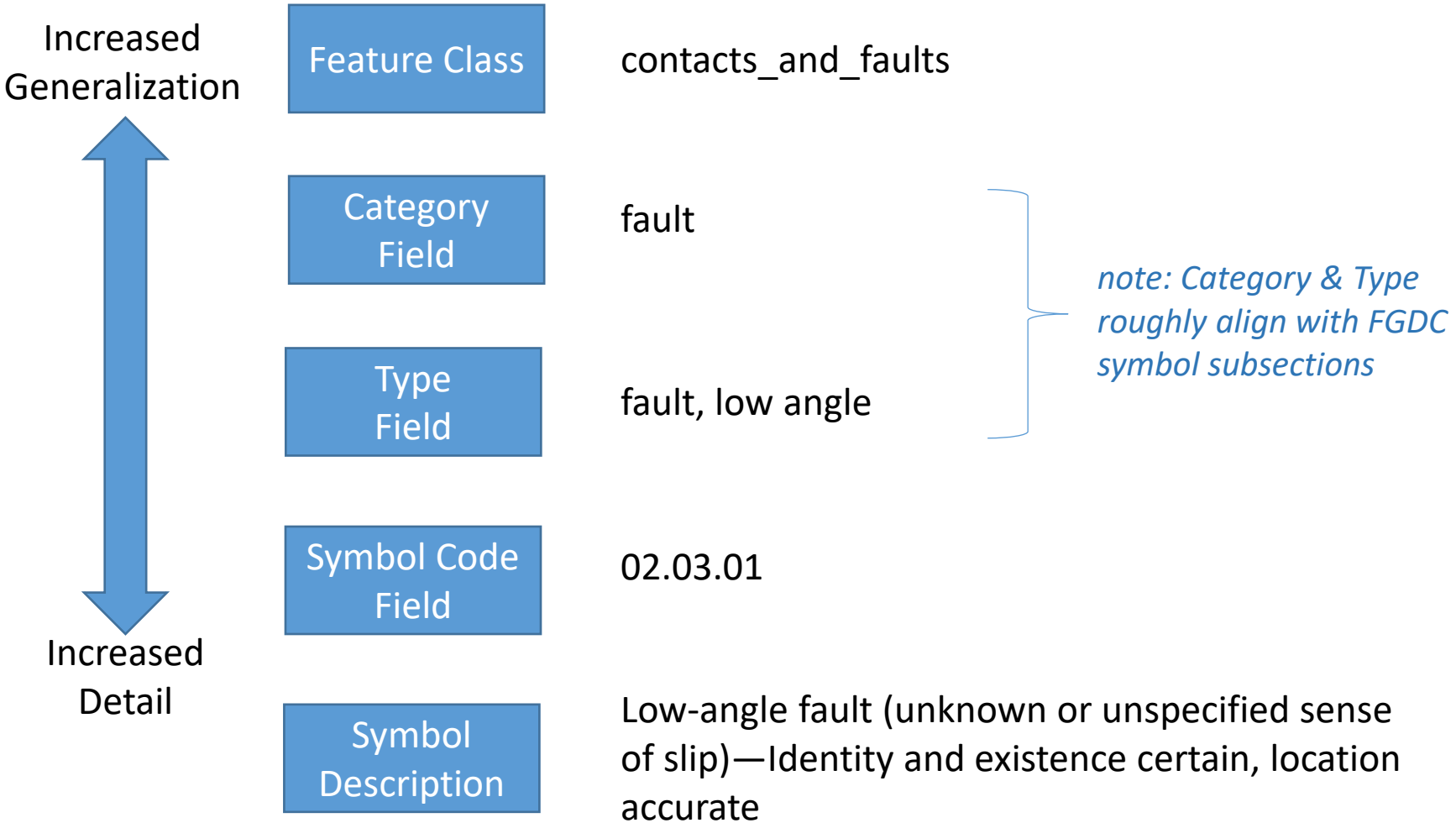
AK GeMS Symbol philosophy

- Symbol code is part of a feature's representation hierarchy
- AK DGGS phased out the use of "ESRI representations"
- We do not use repurposed symbols – We make custom symbols with new symbol code instead
- Formalize the process of requesting, creating, and storing custom symbols
- Always consider symbolization for single map pdf as well as online interactive multi-map representations

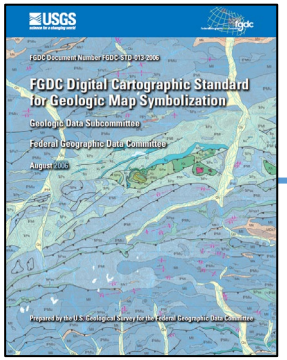
Symbol code is part of a feature's representation hierarchy

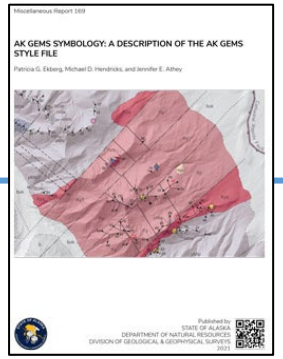


AK GeMS Symbology Architecture

AK GEMS SYMBOLOGY: A DESCRIPTION OF THE AK GEMS STYLE FILE, MP 167

- Report
- AK_GeMS_symbology_documentation_ver_1.xls (Excel)
- AK_GeMS_symbology_ver_1.style (Style File)





AK_GeMS_symbology

Appendix A: FGDC Symbols
Appendix B: Compound FGDC Symbols
Appendix C: Custom Symbs with FGDC Sections
Appendix D: Custom Symbs NO FGDC Sections
Appendix E: Symbols with alternate colors
Appendix F: map_unit_points Symbols
Appendix G: map_unit_lines Symbols

AK_GeMS_symbols_ver_1.style

.style
.stylx

1400 + FGDC
60 + custom
730 map_unit_points

AK GEMS DATA DICTIONARY: A DESCRIPTION OF THE AK GEMS DATABASE SCHEMA, MP 169

AK_GeMS_DB

Classes

Symbol field

Type & Category fields

join

symbol_info Table

Symbol Description

join

glossary Table

370+ records

Key Symbol Related Schema Implementations

- All feature classes have **symbol** field
- All feature classes have binary **draw_policy** field
  - *PlotAtScale field is not included in AK GeMS. We assume a value of 0 (draw at all scales) in GeMS submissions*
- Include **symbol_rotation** field with select FCs: geologic_points, cartographic_points. *May add to more in ver 2.0*
- Include **symbol_alt** field with select FCs: orientation_points, contacts_and_faults. *May add to more in ver 2.0*
  - *Orientation Point symbol for multiple observations at one locality*
  - *Symbolizing fault with custom point decorations.*
- In DMU, **area_fill_pattern_description** field is populated with, and only with, the FGDC pattern code, 101-K, 116-C, etc. and included in style
- Include **style** field in the project_info table to store version of style used for database

DGGS MP 169

AK GeMS symbology: A description of the AK GeMS style file

Authors: Ekberg, P.G., Hendricks, M.D., and Athey, J.E.

Publication Date: Mar 2021

Publisher: Alaska Division of Geological & Geophysical Surveys

Ordering Info: Download below for free or see our publication sales page to order a hard copy.

Quadrangle(s): Alaska General

Related project(s): GeMS Database

Citation ID: 30584

Bibliographic Reference

Ekberg, P.G., Hendricks, M.D., and Athey, J.E., 2021, AK GeMS symbology: A description of the AK GeMS style file: Alaska Division of Geological & Geophysical Surveys Miscellaneous Publication 169, 7 p. https://doi.org/10.14509/30584

Publication Products

Report Information
mp169.pdf (1.58 M)

Supplemental File(s)
mp169_AK_GeMS_symbology.zip (13.86 M)

Keywords

GeMS NCGMP09; Geologic Communications; Geologic Map; Geologic Mapping Standards; STATEMAP Project

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https://dggs.alaska.gov/pubs/id/30584

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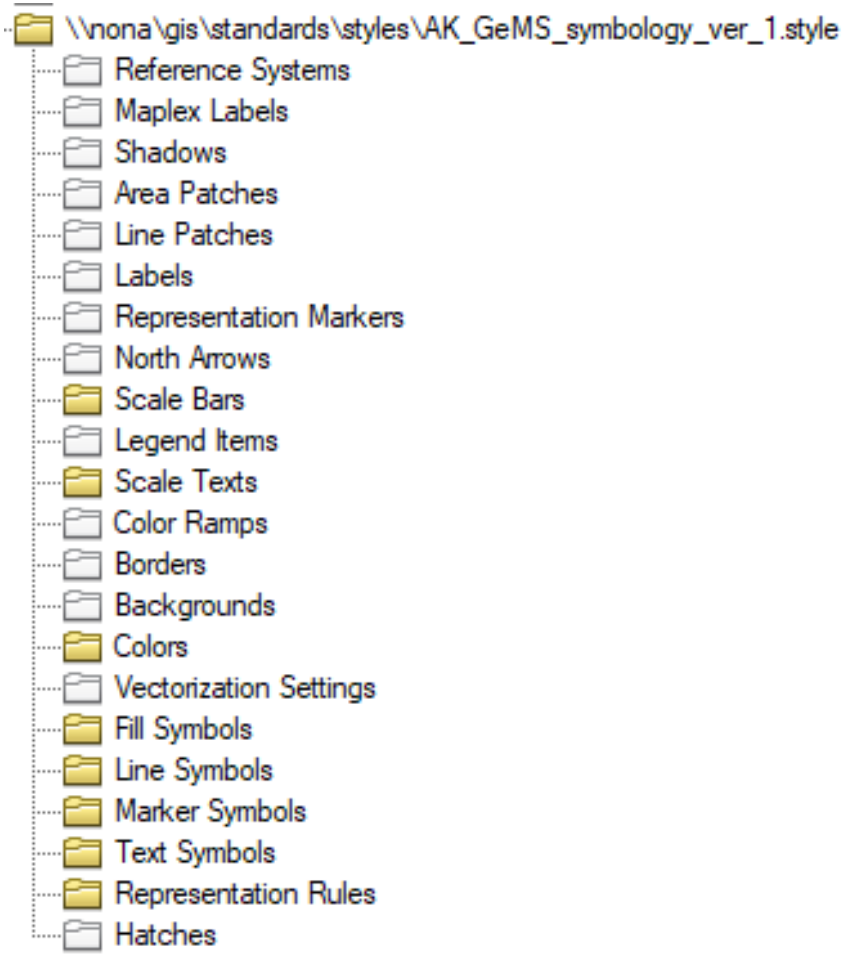
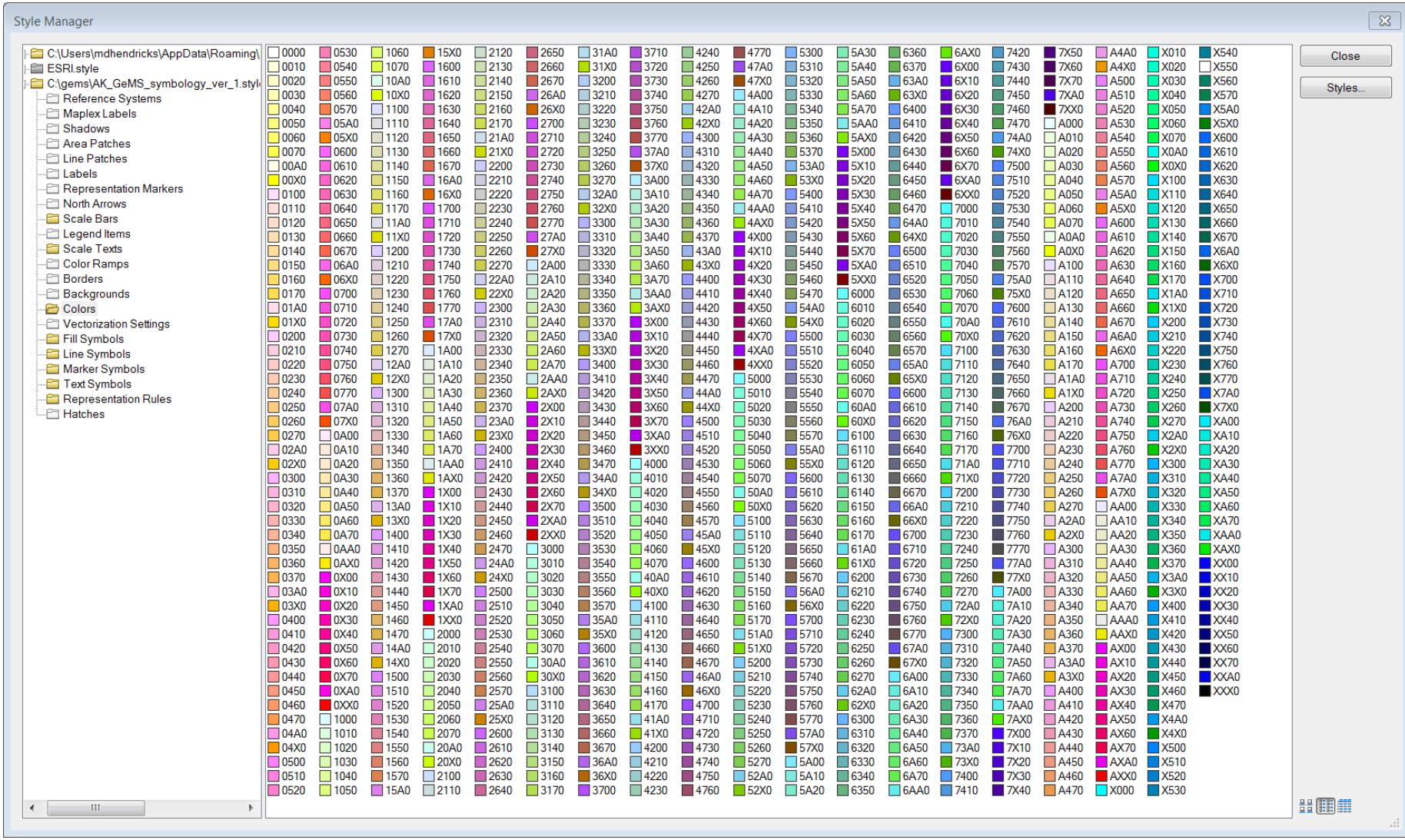
Elements included in: *AK_GeMS_symbols_ver_1.style* 32 Mb

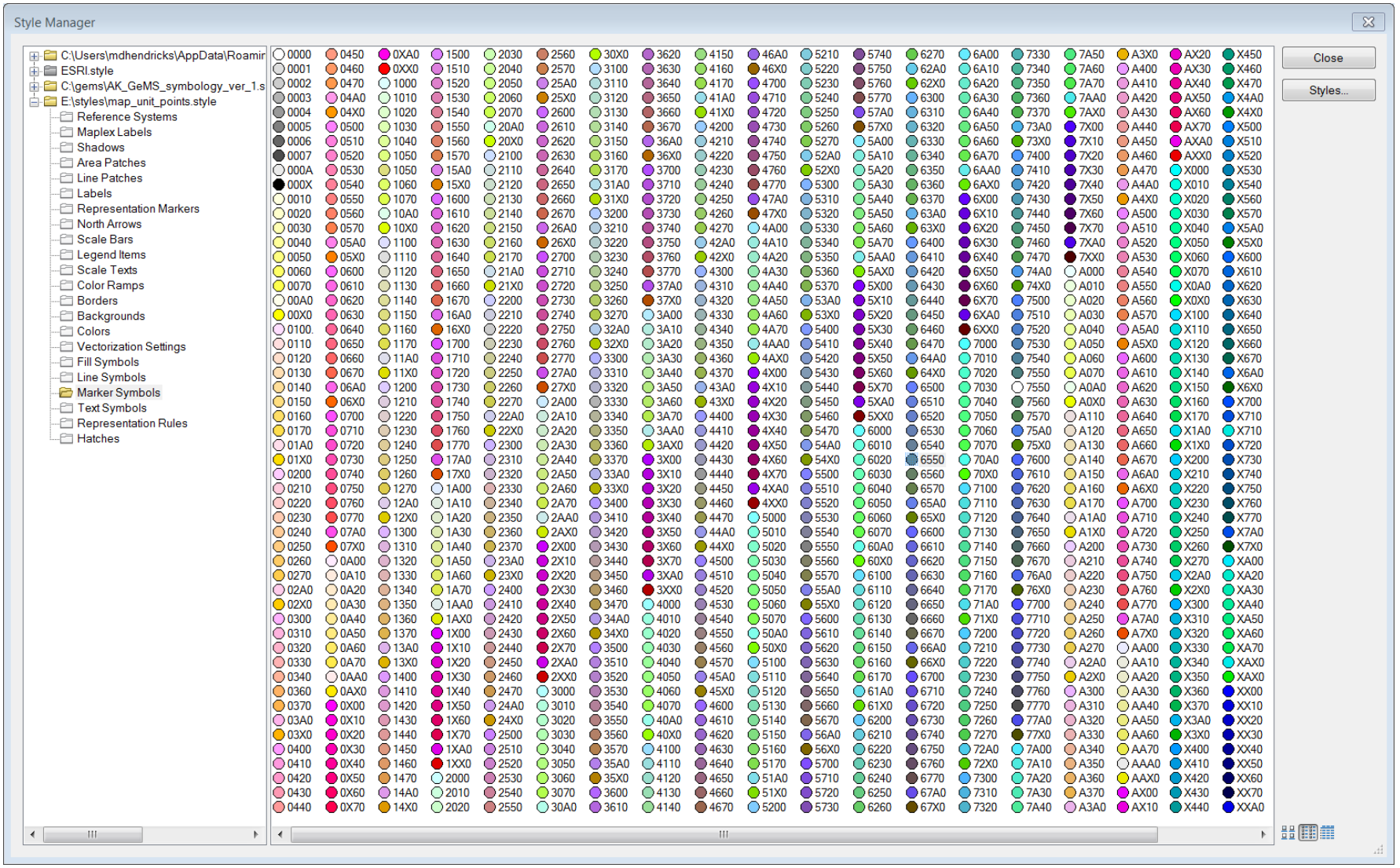


Colors in style

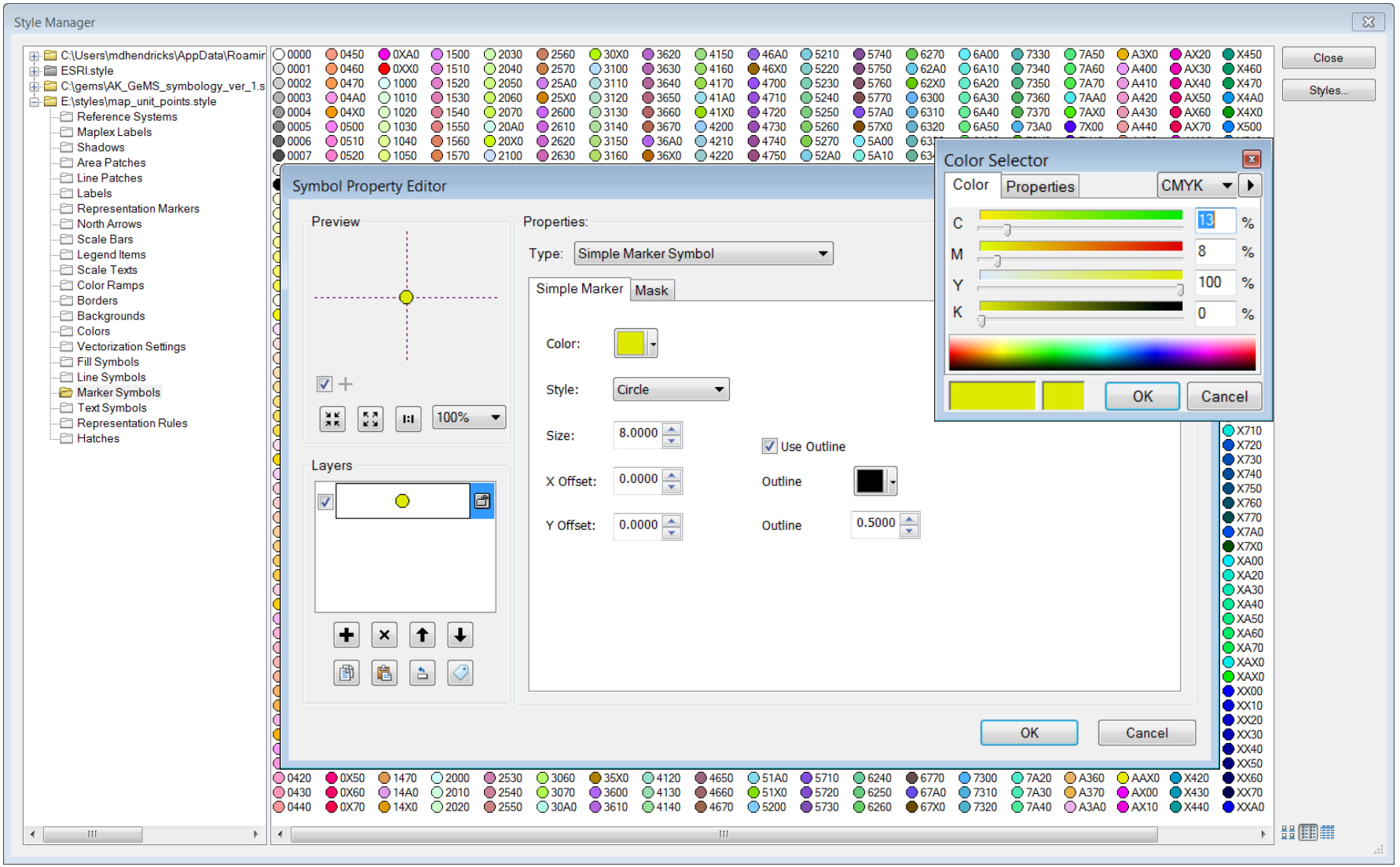
For each code, each digit represents the percent of cyan, magenta, yellow, or black. Color codes use the following abbreviations:
A=8%; 1=13%; 2=20%; 3=30%; 4=40%; 5=50%; 6=60%; 7=70%; X=100%.



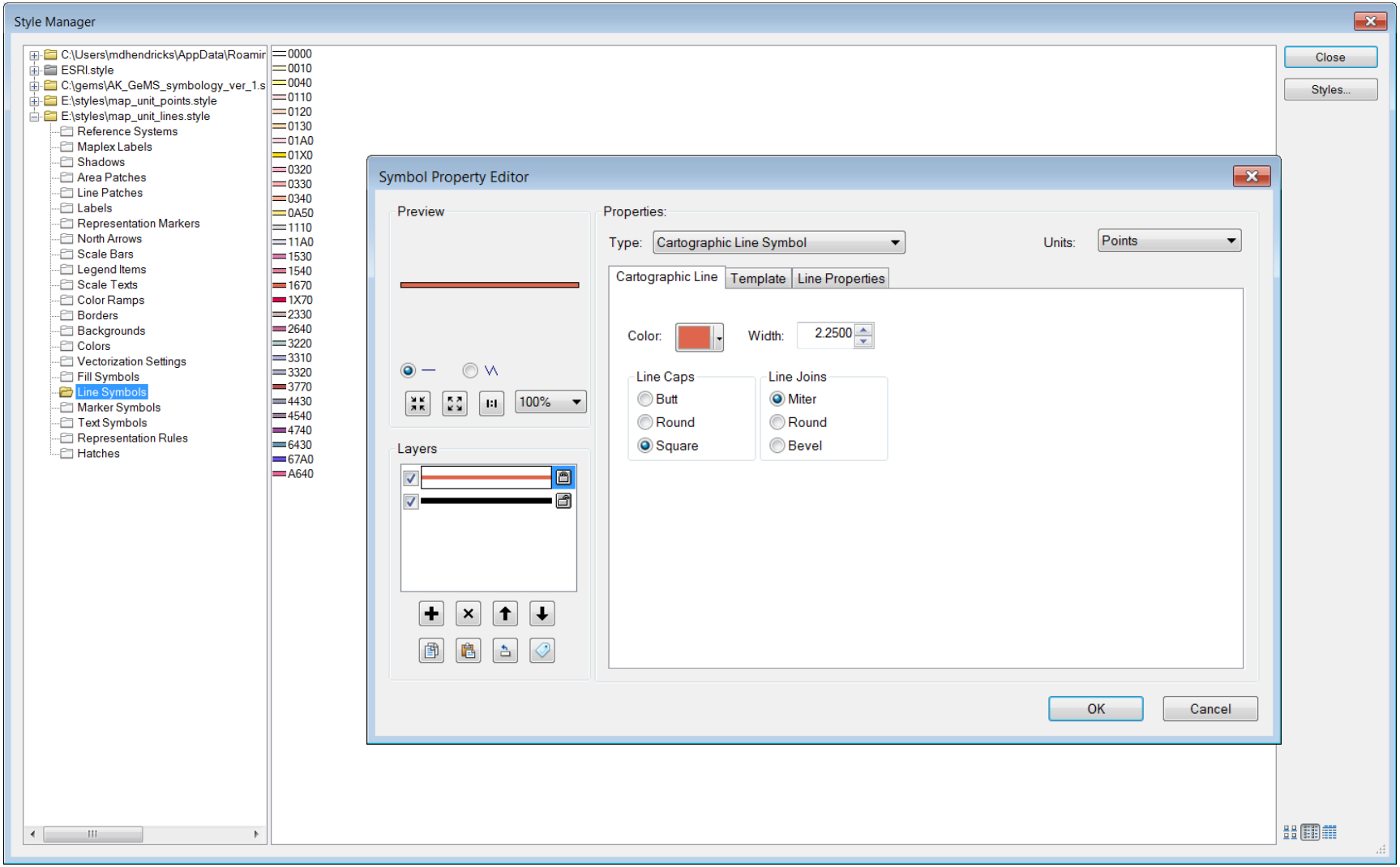
Map_unit_points symbols



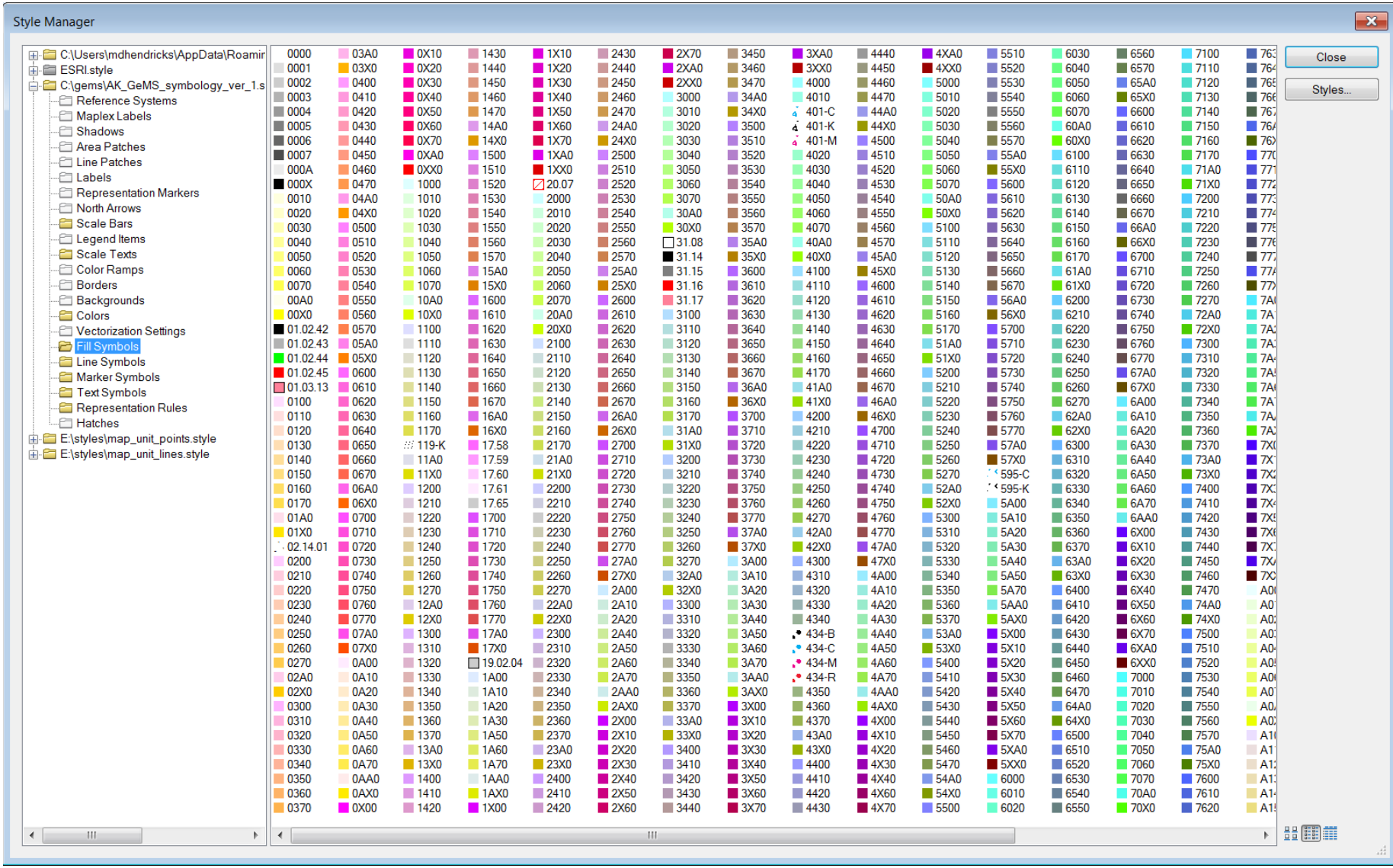
Map_unit_points symbols



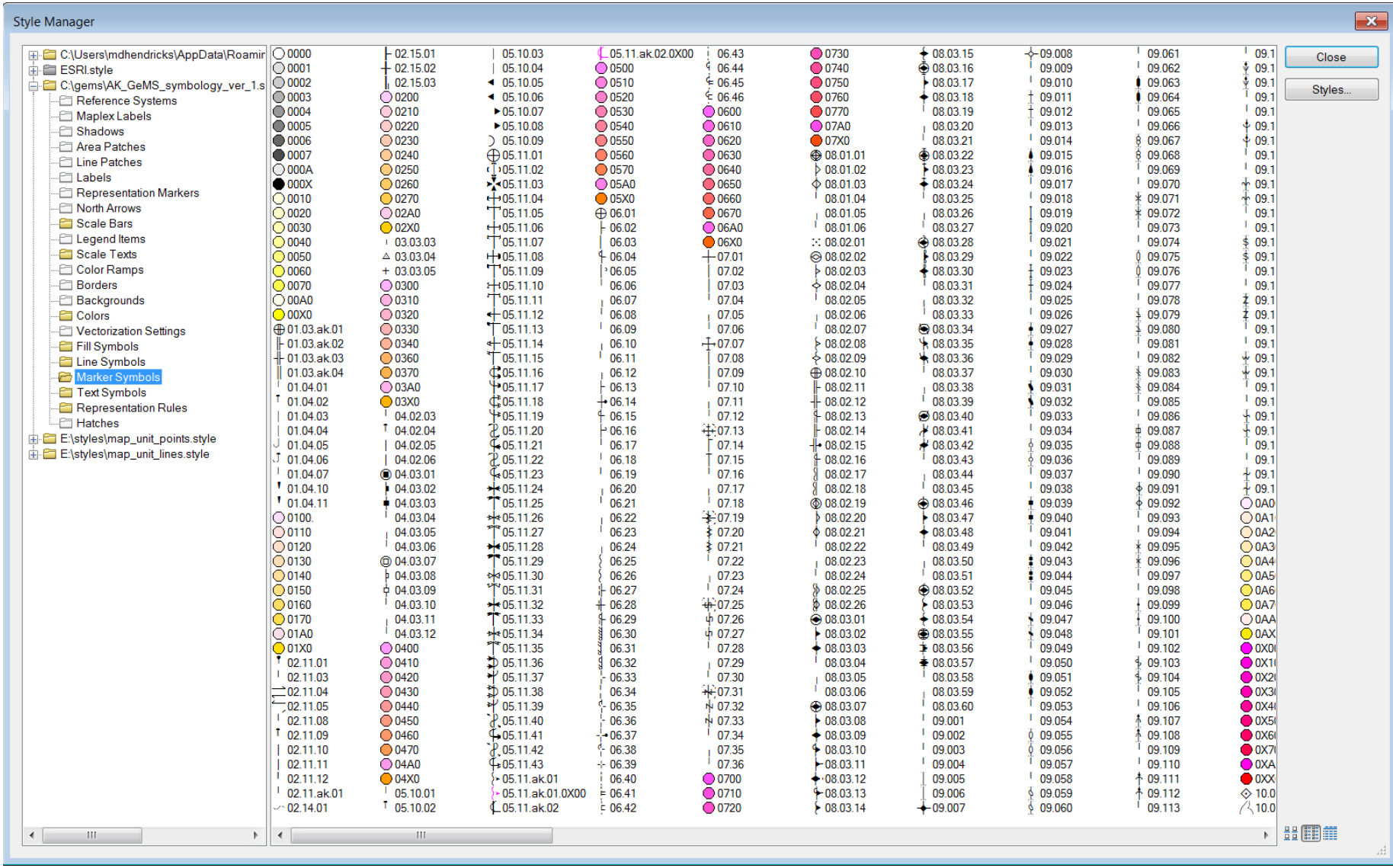
Map_unit_lines symbols



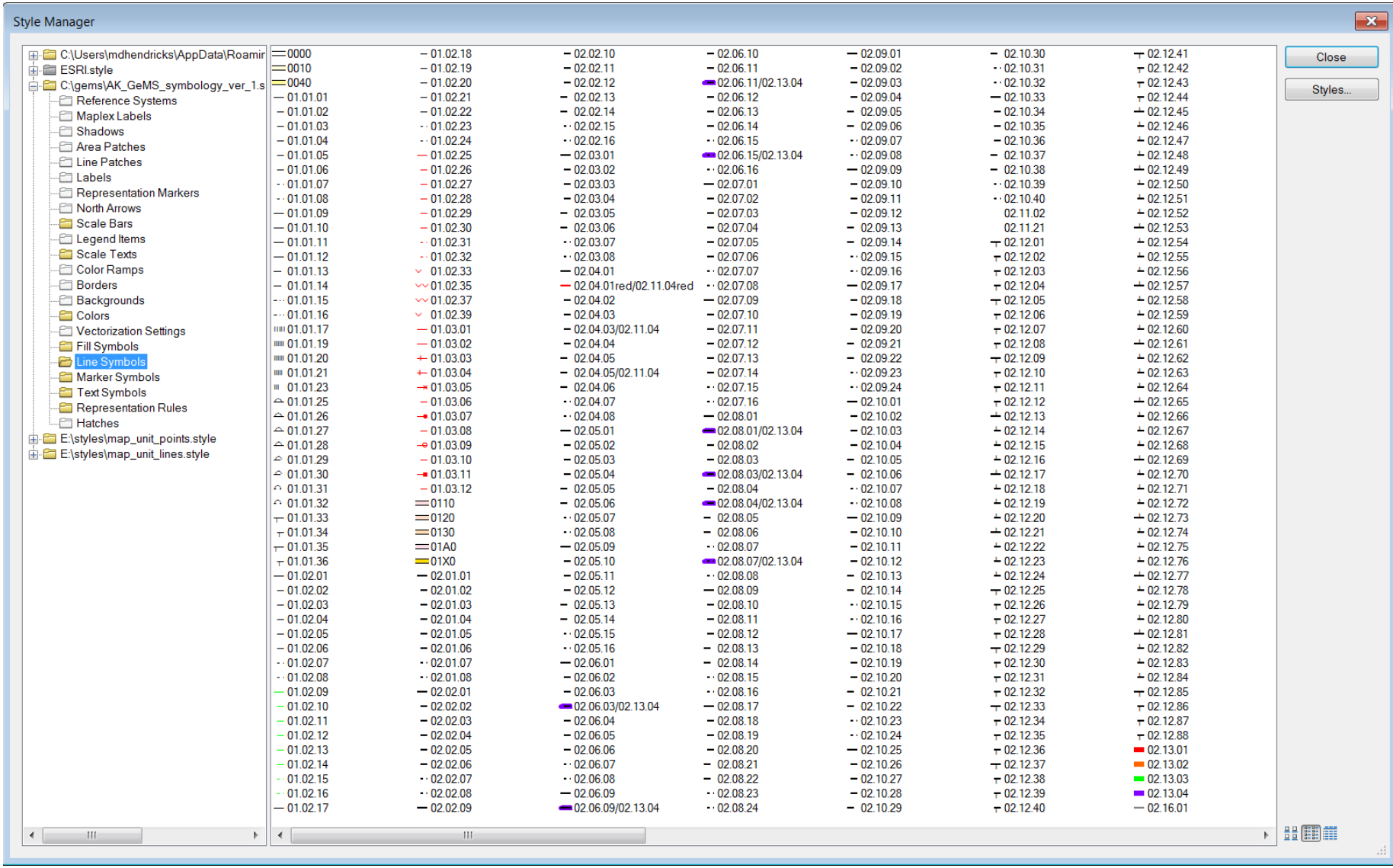
Fill symbols



Marker Symbols



Line Symbols



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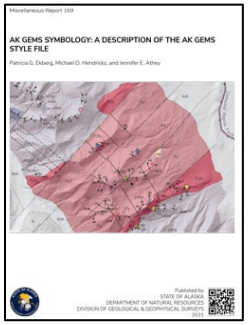
AK DGGS Symbol Categories & Code Conventions



AK GEMS SYMBOLOGY: A DESCRIPTION OF THE AK GEMS STYLE FILE, MP 167

- **FGDC Standard Symbols**—This tab explains all the FGDC Standard Symbols in the style file as they are found in the FGDC manual. Symbols are listed by their FGDC Symbol code, with padded zeros (**example – 01.01.01**)

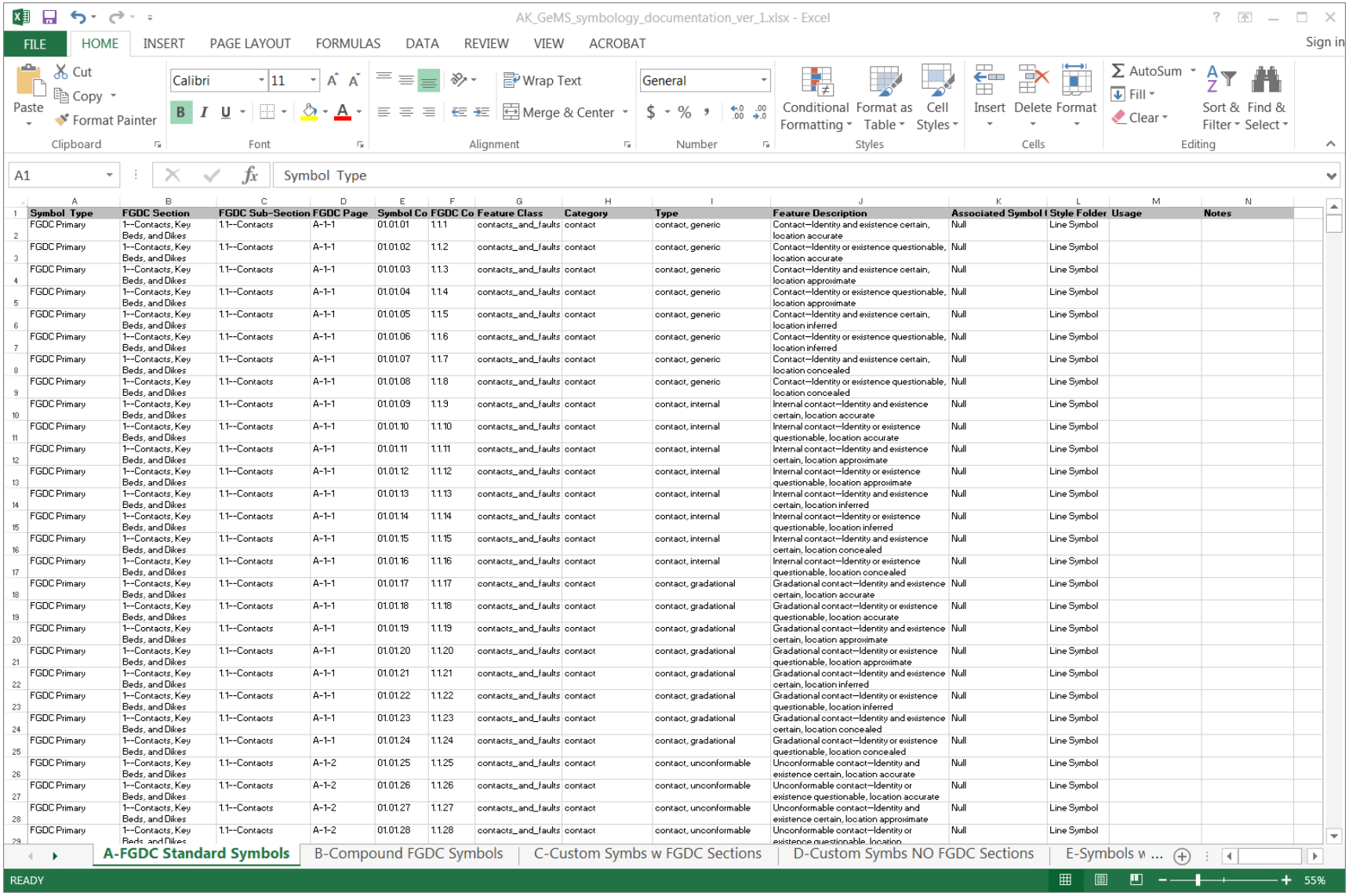
Custom symbols

- **Compound FGDC Symbols**—This tab explains compound symbols which are created from two or more standard FGDC Symbols. Typically these are lines that need to have a repeating decoration along them, or a second symbol level of line color. Symbols are listed by the first FGDC Symbol code / second symbol code (**example – 02.04.03/02.11.04**)
- **Custom Symbols w FGDC Sections**—This tab explains custom symbols that fit into the established FGDC Sections. The symbol codes all start with the FGDC section and subsection into which the feature corresponds, followed by 'ak' and a unique number (**example – 01.03.ak.01**)
- **Custom Symbols NO FGDC Sections**— This tab explains custom symbols that DO NOT fit into the established FGDC Sections. The symbol codes all start with 'ak', followed by a group number (starting at 101 and assigned based on Category), followed by a unique number (**example – ak.101.01**)
- **Symbols with alternate colors**—This tab explains FGDC and AK GeMS custom symbols that need to be shown in alternate colors. In the FGDC manual, the notes on usage for many symbols indicate that a symbol "may be shown in other colors". The default color, as shown in the FGDC manual, is the default color for the symbol in the style file.
  - When an alternate color is needed, a custom symbol is created that uses the standard symbol code and the CMYK color code of the alternate color.
  - For example, FGDC standard symbol 18.56 is a volcanic vent that has a default red color. When needed to be shown in black, the feature is symbolized with code **18.56.XXX0**.
  - To keep with the FGCD color convention of always keeping the K=0, the code **XXX0** is used to represent black.
- **map_unit_point Symbols**—This tab explains the convention for symbolizing map unit points. Symbols code is the FGDC color code that corresponds to the color of each map unit
- **map_unit_line Symbols**— This tab explains the convention for symbolizing map unit. Symbols code is the FGDC color code that corresponds to the color of each map unit

AK DGGS “Symbol Types”

symbol _type	definition
FGDC Primary	The primary and expected FGDC symbol used to draw a feature type stored in an AK GeMS database.
FGDC Secondary	A substitute FGSC symbol used to draw a feature type stored in an AK GeMS database. These symbols should not be used without coordination with the AK GeMS admin staff. See the assoc_symbol_code field for this secondary symbol's primary symbol.
FGDC Decoration	A FGSC symbol used to enhance, or decorate a symbol. For example, a plunge direction.
FGDC Decoration Secondary	A substitute FGDC symbol used to enhance or decorate a symbol. For example, a plunge direction. These symbols should not be used without coordination with the AK GeMS admin staff. See the assoc_symbol_code field for this secondary symbol's primary symbol.
FGDC Alternate	An alternate FGDC symbol used to draw a feature with special characteristics stored in an AK GeMS database. A typical example of an alternate symbols is an orientation point with multiple observations at one locality. See the assoc_symbol_code field for this symbol's primary symbol.
FGDC Not Used by AK GeMS	The FGDC symbol is not currently used by DGGS
FGDC Not Available in Style	The FGDC symbol is not available in the current style file.
AK GeMS Custom Primary	Custom symbol made by DGGS staff for features that do not have a standard FGDC symbol or in cases where a FGCD symbol needs to be repurposed.
AK GeMS Custom Secondary	Custom substitute symbol made by DGGS staff for features that do not have a standard FGDC symbol or in cases where a FGCD symbol needs to be repurposed.

AK_GeMS_symbology_documentation_ver_1.doc & xlsx



AK_GeMS_symbology_documentation_ver_1.xlsx - Excel

FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW ACROBAT Sign in

Cut Copy Format Painter Paste Clipboard | Calibri 11 Font | Wrap Text Merge & Center Alignment | General Number | Conditional Formatting Format as Table Cell Styles Styles | Insert Delete Format Cells | AutoSum Fill Clear Sort & Filter Find & Select Editing

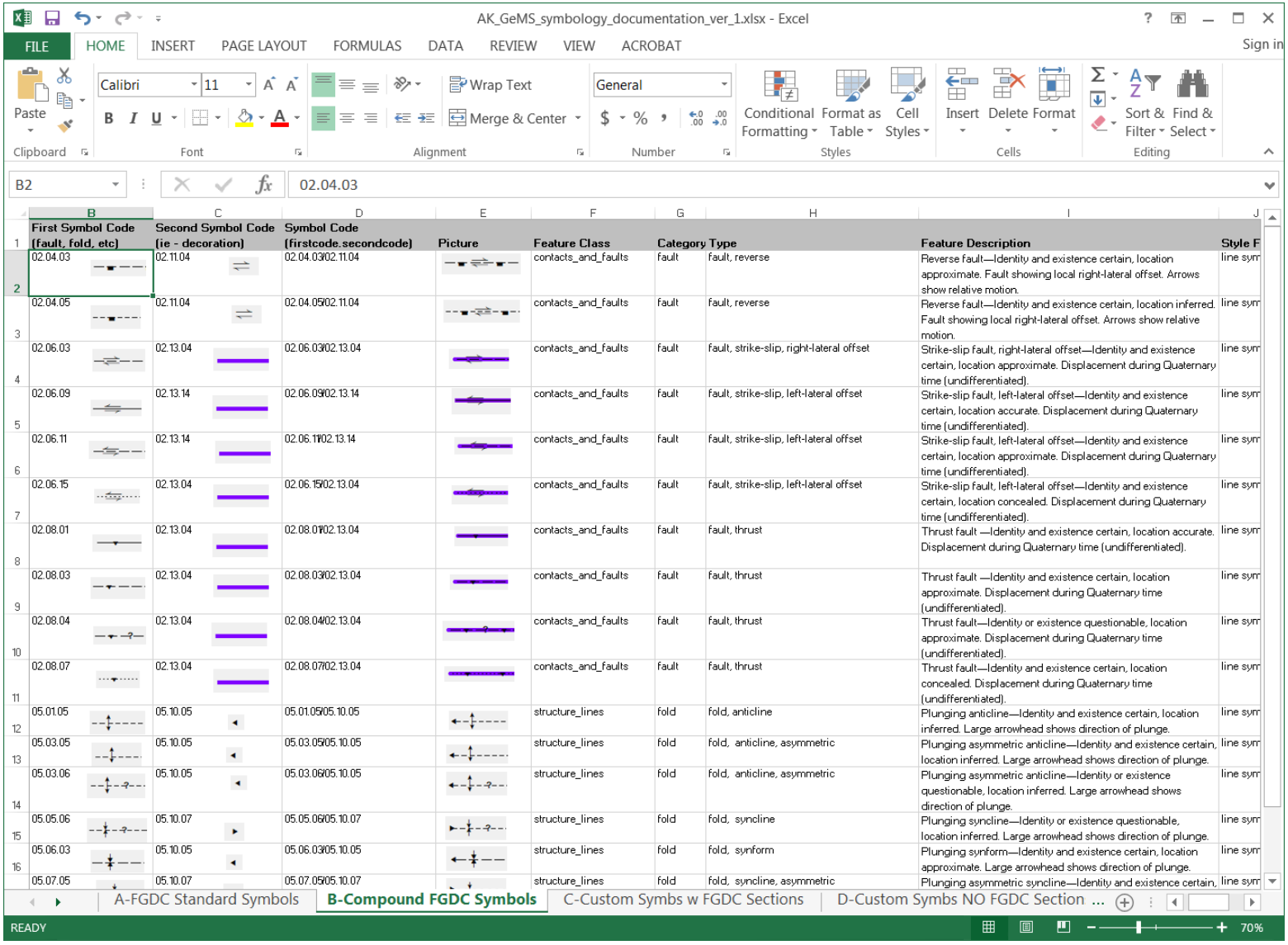
A1 Symbol Type

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Symbol Type	FGDC Section	FGDC Sub-Section	FGDC Page	Symbol Co	FGDC Co	Feature Class	Category	Type	Feature Description	Associated Symbol I	Style Folder	Usage	Notes
2	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.01	1.1.1	contacts_and_faults	contact	contact, generic	Contact—Identity and existence certain, location accurate	Null	Line Symbol		
3	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.02	1.1.2	contacts_and_faults	contact	contact, generic	Contact—Identity or existence questionable, location accurate	Null	Line Symbol		
4	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.03	1.1.3	contacts_and_faults	contact	contact, generic	Contact—Identity and existence certain, location approximate	Null	Line Symbol		
5	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.04	1.1.4	contacts_and_faults	contact	contact, generic	Contact—Identity or existence questionable, location approximate	Null	Line Symbol		
6	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.05	1.1.5	contacts_and_faults	contact	contact, generic	Contact—Identity and existence certain, location inferred	Null	Line Symbol		
7	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.06	1.1.6	contacts_and_faults	contact	contact, generic	Contact—Identity or existence questionable, location inferred	Null	Line Symbol		
8	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.07	1.1.7	contacts_and_faults	contact	contact, generic	Contact—Identity and existence certain, location concealed	Null	Line Symbol		
9	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.08	1.1.8	contacts_and_faults	contact	contact, generic	Contact—Identity or existence questionable, location concealed	Null	Line Symbol		
10	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.09	1.1.9	contacts_and_faults	contact	contact, internal	Internal contact—Identity and existence certain, location accurate	Null	Line Symbol		
11	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.10	1.1.10	contacts_and_faults	contact	contact, internal	Internal contact—Identity or existence questionable, location accurate	Null	Line Symbol		
12	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.11	1.1.11	contacts_and_faults	contact	contact, internal	Internal contact—Identity and existence certain, location approximate	Null	Line Symbol		
13	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.12	1.1.12	contacts_and_faults	contact	contact, internal	Internal contact—Identity or existence questionable, location approximate	Null	Line Symbol		
14	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.13	1.1.13	contacts_and_faults	contact	contact, internal	Internal contact—Identity and existence certain, location inferred	Null	Line Symbol		
15	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.14	1.1.14	contacts_and_faults	contact	contact, internal	Internal contact—Identity or existence questionable, location inferred	Null	Line Symbol		
16	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.15	1.1.15	contacts_and_faults	contact	contact, internal	Internal contact—Identity and existence certain, location concealed	Null	Line Symbol		
17	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.16	1.1.16	contacts_and_faults	contact	contact, internal	Internal contact—Identity or existence questionable, location concealed	Null	Line Symbol		
18	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.17	1.1.17	contacts_and_faults	contact	contact, gradational	Gradational contact—Identity and existence certain, location accurate	Null	Line Symbol		
19	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.18	1.1.18	contacts_and_faults	contact	contact, gradational	Gradational contact—Identity or existence questionable, location accurate	Null	Line Symbol		
20	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.19	1.1.19	contacts_and_faults	contact	contact, gradational	Gradational contact—Identity and existence certain, location approximate	Null	Line Symbol		
21	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.20	1.1.20	contacts_and_faults	contact	contact, gradational	Gradational contact—Identity or existence questionable, location approximate	Null	Line Symbol		
22	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.21	1.1.21	contacts_and_faults	contact	contact, gradational	Gradational contact—Identity and existence certain, location inferred	Null	Line Symbol		
23	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.22	1.1.22	contacts_and_faults	contact	contact, gradational	Gradational contact—Identity or existence questionable, location inferred	Null	Line Symbol		
24	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.23	1.1.23	contacts_and_faults	contact	contact, gradational	Gradational contact—Identity and existence certain, location concealed	Null	Line Symbol		
25	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-1	01.01.24	1.1.24	contacts_and_faults	contact	contact, gradational	Gradational contact—Identity or existence questionable, location concealed	Null	Line Symbol		
26	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-2	01.01.25	1.1.25	contacts_and_faults	contact	contact, unconformable	Unconformable contact—Identity and existence certain, location accurate	Null	Line Symbol		
27	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-2	01.01.26	1.1.26	contacts_and_faults	contact	contact, unconformable	Unconformable contact—Identity or existence questionable, location accurate	Null	Line Symbol		
28	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-2	01.01.27	1.1.27	contacts_and_faults	contact	contact, unconformable	Unconformable contact—Identity and existence certain, location approximate	Null	Line Symbol		
29	FGDC Primary	1--Contacts, Key Beds, and Dikes	1.1--Contacts	A-1-2	01.01.28	1.1.28	contacts_and_faults	contact	contact, unconformable	Unconformable contact—Identity or existence questionable, location	Null	Line Symbol		

A-FGDC Standard Symbols | B-Compound FGDC Symbols | C-Custom Symbs w FGDC Sections | D-Custom Symbs NO FGDC Sections | E-Symbols w ...

READY 55%

AK_GeMS_symbology_documentation_ver_1.doc & xlsx



AK_GeMS_symbology_documentation_ver_1.xlsx - Excel

First Symbol Code (fault, fold, etc)	Second Symbol Code (ie - decoration)	Symbol Code (firstcode.secondcode)	Picture	Feature Class	Category	Type	Feature Description	Style F
02.04.03	02.11.04	02.04.03|02.11.04		contacts_and_faults	fault	fault, reverse	Reverse fault—Identity and existence certain, location approximate. Fault showing local right-lateral offset. Arrows show relative motion.	line sym
02.04.05	02.11.04	02.04.05|02.11.04		contacts_and_faults	fault	fault, reverse	Reverse fault—Identity and existence certain, location inferred. Fault showing local right-lateral offset. Arrows show relative motion.	line sym
02.06.03	02.13.04	02.06.03|02.13.04		contacts_and_faults	fault	fault, strike-slip, right-lateral offset	Strike-slip fault, right-lateral offset—Identity and existence certain, location approximate. Displacement during Quaternary time (undifferentiated).	line sym
02.06.09	02.13.14	02.06.09|02.13.14		contacts_and_faults	fault	fault, strike-slip, left-lateral offset	Strike-slip fault, left-lateral offset—Identity and existence certain, location accurate. Displacement during Quaternary time (undifferentiated).	line sym
02.06.11	02.13.14	02.06.11|02.13.14		contacts_and_faults	fault	fault, strike-slip, left-lateral offset	Strike-slip fault, left-lateral offset—Identity and existence certain, location approximate. Displacement during Quaternary time (undifferentiated).	line sym
02.06.15	02.13.04	02.06.15|02.13.04		contacts_and_faults	fault	fault, strike-slip, left-lateral offset	Strike-slip fault, left-lateral offset—Identity and existence certain, location concealed. Displacement during Quaternary time (undifferentiated).	line sym
02.08.01	02.13.04	02.08.01|02.13.04		contacts_and_faults	fault	fault, thrust	Thrust fault —Identity and existence certain, location accurate. Displacement during Quaternary time (undifferentiated).	line sym
02.08.03	02.13.04	02.08.03|02.13.04		contacts_and_faults	fault	fault, thrust	Thrust fault —Identity and existence certain, location approximate. Displacement during Quaternary time (undifferentiated).	line sym
02.08.04	02.13.04	02.08.04|02.13.04		contacts_and_faults	fault	fault, thrust	Thrust fault—Identity or existence questionable, location approximate. Displacement during Quaternary time (undifferentiated).	line sym
02.08.07	02.13.04	02.08.07|02.13.04		contacts_and_faults	fault	fault, thrust	Thrust fault—Identity and existence certain, location concealed. Displacement during Quaternary time (undifferentiated).	line sym
05.01.05	05.10.05	05.01.05|05.10.05		structure_lines	fold	fold, anticline	Plunging anticline—Identity and existence certain, location inferred. Large arrowhead shows direction of plunge.	line sym
05.03.05	05.10.05	05.03.05|05.10.05		structure_lines	fold	fold, anticline, asymmetric	Plunging asymmetric anticline—Identity and existence certain, location inferred. Large arrowhead shows direction of plunge.	line sym
05.03.06	05.10.05	05.03.06|05.10.05		structure_lines	fold	fold, anticline, asymmetric	Plunging asymmetric anticline—Identity or existence questionable, location inferred. Large arrowhead shows direction of plunge.	line sym
05.05.06	05.10.07	05.05.06|05.10.07		structure_lines	fold	fold, syncline	Plunging syncline—Identity or existence questionable, location inferred. Large arrowhead shows direction of plunge.	line sym
05.06.03	05.10.05	05.06.03|05.10.05		structure_lines	fold	fold, synform	Plunging synform—Identity and existence certain, location approximate. Large arrowhead shows direction of plunge.	line sym
05.07.05	05.10.07	05.07.05|05.10.07		structure_lines	fold	fold, syncline, asymmetric	Plunging asymmetric syncline—Identity and existence certain,	line sym

Future Work

- Continue adding custom symbols to style
- Integrate style_info table into data dictionary & DB template to assist with robust popups on interactive maps
- Begin transition to ArcPro style becoming the primary style
- Explore symbolizing with Dictionary Symbology

Question?