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Digital Mapping, Charting, and Geodesy Analysis Program (DMAP)

Technical Review of Consolidated Vector Product Format Specifications and Related Documents

Vector Product Format
MIL-STD-2407 Change Notice 2

General Specifications for VPF Products
MIL-PRF-89049A

Foundation Feature Data
MIL-PRF-89049/1

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14. ABSTRACT

Technical reviews of the Consolidated Vector Product Format Specifications and their related documents were performed by the Digital Mapping, Charting, and Geodesy Analysis Program (DMAP). This review consisted of a review of Vector Product Format MIL-STD-2407 Change Notice 2, General Specifications for VPF Products MIL-PRF-89049A, and Foundation Feature Data MIL-PRF-89049/1. Background, discussion, recommendations, and conclusions are presented for each review.

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DMAP TECHNICAL REVIEW OF CONSOLIDATED VECTOR PRODUCT FORMAT SPECIFICATIONS AND RELATED DOCUMENTS

Vector Product Format
MIL-STD-2407 Change Notice 2

1.0 Background

Vector product format is a generic geographic data model designed to be used with any digital geographic data in vector format that can be represented using nodes, edges, and faces. It is intended to allow flexibility in encoding and yet permit direct data access from a variety of applications operating on different computer systems. It establishes a standard data model and organization, providing a consistent interface to data content, defined in a product specification that determines the content of the feature tables and the relationships between them.[1]

Several changes have been made to the basic specification since issuance. This is a review of the latest changes to the MIL-STD-2407, VPF Specification, Change Notice 2.

2.0 Discussion

VPF Change Notice 2 primarily incorporates nine functional changes to VPF structure and three other change areas involving text and tables of the specification document. Each of the structural changes will be briefly commented upon in section 2.1.

The nine primary structural changes are:

- Adds the capability to describe and store of feature relations within and across coverages
- Provides for coordinates to be stored as integer values
- Adds limited 2½ D functionality
- Provides for multi-value attribution
- Adds the capability to store metadata to the feature and attribute levels
- Defines standardized schema for encoding default data into attributes which are non-enumerated
- Adds metadata columns to the Geographic Reference Table (grt) to store the units of measure code for the vertical and sounding measures
- Changes select field lengths within the standardized metadata tables from fixed length to variable length in order to accommodate naming conventions
- Deletes the reference of text type "N".

The three text changes are:

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[1] NIMA MIL-STD-2407 *Vector Product Format.*
Manuscript approved August 23, 2002.

- Updates text description and information for compliance with DIGEST and ISO standards
- Corrects and updates section on geodetic ellipsoids, datums, and projections
- General corrections and update of text and tables.

2.1 Structural Change Comments

Each of the changes to the Change Notice 2 are indicated by bullets and shown in italics. DMAP's comments follow each bullet.

- *Adds the capability to describe and store of feature relations within and across coverages*

  While useful, this change adds complexity for the support of capabilities that may not be frequently used.

- *Provides for coordinates to be stored as integer values*

  Agree. This modification improves coordinate accuracy and establishes uniform resolution over all coordinate values, unlike floating point where resolution varies with the magnitude of the coordinate.

- *Adds limited 2½ D functionality*

  Adds complexity to overcome initial limitation of 2-D mesh topology. While perhaps solving the problem of highway overpass situations, it indicates the need for full 3-D or 4-D compliant design. A full 3-D with temporal capabilities would be beneficial to the Navy in permitting the representation of volume bounding surfaces – useful in mapping rings, eddies, current jets, as well as air masses. Many environmental features have a temporal component, associated with tidal forces or seasonal variation.

- *Provides for multi-value attribution*

  Yield increased versatility, but not without an increase in complexity. Philosophically conflicts with the idea of a cartographic entity having single measurable attributes, i.e., a single entity cannot be "two" things at once. However, features of this type are frequently used in marine applications where attributes are a function of depth, such as temperature and salinity.

- *Adds the capability to store metadata to the feature and attribute levels*

  Agree. However, would also like to see the inclusion of metadata as XML files external to the VPF file structure that meet FGDC standards where applicable.

- *Defines standardized schema for encoding default data into attributes which are non-enumerated*

  Table 35A, p. 71a (draft) – different values are used to indicate unknown, unpopulated, etc., except for integers and floating point values. Should not different values be used to indicate the attribute status for these types as well?

- *Adds metadata columns to the Geographic Reference Table (grt) to store the units of measure code for the vertical and sounding measures*

  This is a beneficial idea, clearly removing any ambiguity that might result when the units of measure are not explicitly stated.

- *Changes select field lengths within the standardized metadata tables from fixed length to variable length in order to accommodate naming conventions*

  A beneficial change which should have little or no impact on existing application software.

- *Deletes the reference of text type "N".*

  Changing to a true 16-bit character set is a plus. However, the old type "N", while not used and obsolete, could have remained in the specification for backward compatibility.

2.2 Text Change Comments

- *Updates text description and information for compliance with DIGEST and ISO standards*

  Ok.

- *Corrects and updates section on geodetic ellipsoids, datums, and projections*

  While these updates are beneficial for completeness, DMAP suggests that emphasis be placed on the preferred use of WGS-84 for unprojected products. For projected products the use of Universal Polar Stereographic (UPS) or Universal Transverse Mercator (UTM) is recommended.

- *General corrections and update of text and tables.*

  Ok, changes produced improved readability and clarity.

2.3 Other Editorial Notes

Only two minor editorial errors were found. Some of the section headings in the Table of Contents have ending periods, most do not. DMAP suggests the ending periods be removed.

Normally when a Change Notice is generated the changes are noted in the margin with a vertical line, thus providing a mechanism to know what has been changed. None of the changes made to the Change Notice were marked in the margin (as was done in the General Specification).

2.4 Metadata

While the inclusion of additional metadata at the feature and attribute level is an improvement, the inclusion of metadata in Extended Markup Language (XML) format external to the VPF file structure should be considered. The effect of this inclusion of "external" XML metadata would be to increase the effectiveness of data sharing and cataloguing across multiple systems on the "network". XML based metadata is becoming widely used to provide a common method of metadata exchange. In keeping with the addition of "external" XML metadata, the National Imagery and Mapping Agency (NIMA) should comply with the Federal Geographic Data Committee FGDC metadata standard where feasible.

3.0 VPF Overview

VPF was designed to support a 2-dimensional planar mesh and its associated topology, with the idea that the topological information would increase the processing efficiency during analysis function common within GIS. However, it is fairly infrequent that we see full advantage taken of the topological information. Also, the restrictions imposed by a 2-dimensional planar mesh for the mapping for a 3-dimensional world are starting to become more evident as the usage of VPF becomes more widespread. This is illustrated by the "2 ½ D limited functionality" added by this change notice.

In short, the advantages of VPF have not been fully exploited and VPF is being "complicated" to ameliorate some of its shortcoming in trying to make it do a job for which it was not originally designed. This leads to the suggestion that perhaps VPF is due for a replacement that is more suited to today's GIS needs. The sophistication of GIS operations and data has increased markedly since the introduction of VPF. VPF was an outgrowth of some of the earliest work in GIS twenty years ago and is nearing obsolescence.

4.0 Cost Benefit

While these changes to VPF do improve the versatility and solve a few problems, they are not without cost. However, not knowing how many software systems will need modification, some of the changes being significant, it is difficult to evaluate the impact of these changes against the benefits derived. Thus changes made to the VPF structure are not without significant cost and these costs should be considered when changes are made and weighed against the desired benefits.

As the complexity of GIS data continues to advance and additional changes to VPF are required in the future, it might be prudent to inquire at what point are we "beating a dead horse" and instead direct the VPF modification effort toward the adoption of a new DOD GIS data structure.

5.0 Conclusions and Recommendations

Overall these changes are beneficial, albeit not without additional complexity and the associated cost of implementation. It is clear that we are nearing the inherent limitation of the VPF file structure to support the increasing sophistication of current GIS needs. Therefore, it becomes prudent to begin planning and discussion to define the VPF replacement or we may be putting good effort after bad, trying the place new wine in old skins.

- Recommend FGDC compliant XML metadata files external to VPF structure.
- Begin discussion and planning to replace the "aging" VPF format.
- Make editorial changes noted in section 2.3.

6.0 Acknowledgments

The Oceanographer of the Navy (N096) funded this effort to evaluate the Vector Product Format Standard Change Notice 2 under the direction of LCDR Karen Ruppe. This evaluation, funded under Program Element 0603704N, is a part of the Naval Digital Mapping, Charting, and Geodesy Analysis Program (DMAP) long-term focus of enhancing the Navy's use and development of digital MC&G technologies. DMAP greatly appreciates the ongoing efforts of Dr. Edward Mozley, SPAWAR Program Manager.

General Specifications for VPF Products
MIL-PRF-89049A

1.0 Background

Vector Product Format (VPF) products are no longer being used exclusively as stand-alone products, but rather as source data for geographic information systems (GIS), in which a user may have integrated in a single display or application a variety of data from several source products. The increasing use of a vector product data in this manner has led to a need for a standardized feature and attribute dictionary that crosses traditional product lines.

The features and attributes contained in the National Imagery and Mapping Agency (NIMA) Profile of the Digital Geographic Information Exchange Standard (DIGEST) Feature and Attribute Coding Catalog (FACC) and are taken from the DIGEST Part 4, FACC ... not a set glossary of feature and attributes, but rather a catalog of various feature and attribute codes used by digital data products. Because it is structured this way, a single geospatial entity can in many cases be coded in several different ways to get the same meaning.[2]

The above paragraph can more clearly be stated by saying that features and attributes can be used independently. Because of this independence it is possible to express the same geographic entity in multiple ways. To illustrate, take the geographic entity "house". It could be called a "building, dwelling", or a "structure, wooden, domestic", or a "house". These are not actual FACC codes but clearly illustrate the problem. Thus this specification eliminates the ambiguity and clearly specifies the feature and possible associated attributes that will be used in NIMA VPF products.

The same situation occurs for the placement of features into coverages or layers. A river might be placed into "transportation" layer, or perhaps into a "hydrological" feature coverage. Similarly, features and their coverage assignments are specified.

The general purpose of this specification is to standardize the usage of features and attribute codes across all NIMA VPF products. In addition to standardizing feature and attribute code usage, this specification also standardizes coverage or layer content. In this fashion, the same feature will occur in the same coverage whenever employed by a VPF product.

An overview of the products currently covered by this specification is given in Table 1. The table also indicates the VPF products that have been discontinued or superseded (stricken out).

[2] MIL-PRF-89049A, Appendix A, pgs 99-100.

Table 1. List of VPF Products

Spec #	Title	Nov 98 FFD Spec	Hardcopy Level of Detail
89049/1	Foundation Feature Data (FFD)		Variable 1:50 – 1:250K
89049/2	Shuttle Radar Topography Mission (SRTM) Water Body Data	~~Vector Map (VMAP)~~	Water bodies derived from SRTM data
89049/3	Digital Topographic Data		
89049/4	Digital Nautical Chart (DNC) Ver 2		General charts <1:500K Coastal charts 1:7 – 1:500K Approach charts 1:25 – 1:100K Harbor charts ≥1:50K
89049/5	World Vector Shoreline Plus (WVSPlus)		1:250K/1:1M/1:3M/1:12M/1:40M/1:120M
89049/6		~~Digital Topographic Data (DTOP) Minimum Essential Data Sets (MEDS)~~	~~Topo Line Maps or TTADB 1:50 – 1:100K~~
89049/7	Digital Littoral Data (DLD)	~~Littoral Warfare Data (LWD)~~	Combat Chart/Amphib Assault Chart ≥1:50K/1:25K
89049/8		~~Digital Flight Information Publication (DFLIP)~~	~~FLIP (1:62.5 – 1:2M)~~
89049/9		~~Vector Vertical Obstruction Data (VVOD)~~	~~N/A~~
89049/10A	Tactical Ocean Data Level 0 (TOD0)		Navy OPAREA
89049/11A	Tactical Ocean Data Level 1 (TOD1)		Bottom Contour Chart (BC)
89049/12A	Tactical Ocean Data Level 2 (TOD2)		Bathymetric Navigation Planning Chart (BNPC)
89049/13	Tactical Ocean Data Level 3 (TOD3)	~~Vector Relocatable Target Assessment Data (VRTAD)~~	Bathymetric Navigation Planning Chart (BNPC) for shallow water areas
89049/14	Tactical Ocean Data Level 4 (TOD4)		Hull Integrity Test Site (HITS) Chart

2.0 Discussion

DMAP sees this change specification as beneficial in that it reduces ambiguity and minimizes any conflict that might occur when combining material from multiple products. Thus there is not much to say in the way of critical comments. The changes made are in line with the proposed changes dictated by the "underlying" VPF structure specification and the changes within the NIMA VPF product line. Additionally, the textual changes improve the clarity and accuracy of the document.

2.1 Standard Coverages (Section 3.8.1)

The expansion of the standard coverages to support Mission Specific Data Sets (MSDS) from the original 4 to 17 provides better conceptual resolution and aids the user in coverage selection for the location of a given feature of interest.

To illustrate for the reader the proposed standardized layers, the following table is provided. Note that this table lists a group of standardized coverages developed for use by VPF products and mission-specific data sets (MSDS) that are covered by this general specification. These standardized coverages replace the older schema of four VPF product coverages: topographic, hydrographic, aeronautical, and littoral.

Table 2. General Specification Standard Coverages and Definitions

Coverage		Definition
AER	Aeronautical	Flight information
ATN	Aids to navigation	Guidance and control of aircraft and ship movement
BND	Boundaries	Demarcation between contiguous political or geographic entities
DFS	Defensive Structures	Defensive or operational military purposes
DQ	Data Quality	Source or information and quality
ELE	Elevation	Relief or elevation of terrain
GTR	Ground Transportation	Goods, materials, or passengers transportation
IWA	Inland Water	Water and drainage features and associated structures
MLT	Maritime Limits	Areas and limits of significance to marine navigation
OEN	Ocean Environment	Measurement of the physical characteristics and features of the oceans and seas with special reference to safe navigation
PHY	Physiography	Natural features of Earth's surface terrain (either dry or water covered (bottom physiography)). Also includes geophysical features.
POP	Population	Man-made features used to house, employ, administrate, provide medical care, and entertain the populace of an area.
PHR	Ports and Harbors	Harbors and ports including breakwaters, seawalls, piers and other mooring structures, and cargo handling facilities used for the loading and discharging of cargo and passengers.
SLP	Slope	Maximum % of incline from the horizontal at any point on the earth's surface.
SMC	Surface Materials	Surface material at any point on the earth's surface. Determined by CoE.
UTI	Utilities and Industry	Infrastructure of home and business utilities and commercial production and sale of goods and

Coverage		Definition
		services.
VEG	Vegetation	Natural and man-induced plant cover over the earth's surface.

2.2 New Features

Several new features were added under this change. The only item of mention is that the "contaminated area" feature code is stated as TBD. It would seem reasonable to propose a feature code under this change request rather than leave it to a later time.

The following table shows the features that have been proposed as new features and their FACC codes.

Table 3. Features added to General Specification

Coverage	Feature Name	FACC Code
AER	Refueling Track	GA046
AER	Holding Pattern	GA060
AER	Aeronautical Communications Service	GA300
GTR	Traffic Lights	AQ160
GTR	Street Lights	AQ161
GTR	Street Signs	AQ162
POP	Park Bench	AK123
POP	Picnic Table	AK124
POP	Planter	AK140
POP	Statue Pedestal	AK141
POP	Overhang (Storefront)	AL016
POP	Sidewalk	AQ035
POP	Curb	AQ036
POP	Overhead Walkway	AQ152
POP	Fire Hydrant	BH171
POP	Contaminated Area	**TBD**
UTI	Sewer Drain	AQ114
UTI	Manhole Cover	AQ115
All coverages	General Miscellaneous Feature	ZD019

2.3 Editorial Notes

2.3.1 Table G-2

The footnote for Table G-2 erroneously references Table G-2. DMAP believes it should reference the preceding Table G-1. Also, add Appendix G to the Index.

2.3.2 Unit of measure (Section 3.9.1)

The statement is made that "the unit of measure for the VPF General Specification is metric. However, some attributes in the DIGEST FACC (see 3.10) are defined in other units of measure (e.g., feet, nautical miles)."[3] Section 3.10 then refers the reader to the associated specifications for a listing of FACC feature codes and attributes used for specific product thematic layers. DMAP suggests that a simple sentence be added to Section 3.9.1 stating which unit of measurement governs (e.g., the General Specification or the specific product specification) and thus remove any ambiguity.

3.0 Conclusions and Recommendations

The changes reviewed are beneficial and an overall improvement. DMAP recommends acceptance of this change notice with the following noted exceptions:

- Develop a specific FACC code for "contaminated area" feature code.
- Add a sentence to Section 3.9.1 of the General Specification that removes any ambiguity as to which unit of measurement governs (e.g., metric, feet, nautical miles).
- Change footnote for Table G-2 and add to Appendix G to Index.

4.0 Acknowledgments

The Oceanographer of the Navy (N096) funded this effort to evaluate the General Specification for VPF Products Performance Specification under the direction of LCDR Karen Ruppe. This evaluation, funded under Program Element 0603704N, is a part of the Naval Digital Mapping, Charting, and Geodesy Analysis Program (DMAP) long-term focus of enhancing the Navy's use and development of digital MC&G technologies. DMAP greatly appreciates the ongoing efforts of Dr. Edward Mozley, SPAWAR Program Manager.

[3] MIL-PRF-89049A, pg. 8.

Foundation Feature Data (FFD)
MIL-PRF-89049/1

1.0 Background

Foundation Feature Data (FFD) is designed to be the initial or underlying feature data set under the Geospatial Information Framework. This product is designed to provide a basic foundation of service-required features. FFD is a vector-based product that portrays a selected set of key geographic features of military significance in a standardized georelational structure.[4] The changes that are being made to MIL-PRF-89049 (General Specification for Vector Product Format) are the subject of this review.

2.0 Discussion

DMAP focused on the changes being made in the Vector Product Format (VPF) and General Specifications and then compared those to the changes found in FFD since the last FFD review done in November 1998. The primary changes to the FFD specification directed by this change notice relate to the coverage or layer names and to the addition of several new features. Other changes also bring FFD in-line with changes being made to the basic VPF data structure and the overall VPF product updates. The following are the changes, additions, and deletions noted:

- Changes in coverages (layers)
  - TRN to AER, GTR
  - BND to PHY
  - HYD to IWA, OEN, PHY, UTI

- Change in FACC Codes
  - Breakout of BA010 Coastline/Shoreline to BA024 Shoreline
  - Breakout of BH095 Marsh / Swamp to ED010 Marsh and ED020 Swamp

- Addition of Features (from previous FFD)
  - ZD019 "General Miscellaneous Feature" to all coverages
  - BE010 "Depth Curve"
  - BH160 "Sebka"
  - DB160 "Rock Strata / Rock Formation"
  - DB170 "Sand Dune / Sand Hills"
  - AD010 "Power Plant"
  - AQ113 "Pipeline /Pipe"
  - EA010 "Cropland"
  - EB010 "Grassland"

[4] MIL-PRF-89049/1, pg. 1.

- EB020 "Scrub / Brush / Bush"
- EE020 "Land Devoid of Vegetation"

- Deletion of Features
  - Depth Contour and Contour Line

DMAP also researched Federal Geographic Data Committee (FGDC) and Environmental Systems Research Institute, Inc. (ESRI) metadata standards and the process of internal vice external data holdings. This is included in Section 3.0.

2.1 Feature Coverage Changes and Additions

Table 1 indicates the coverage changes involved and Tables 2 and 3 list the changes in the feature coverage assignment or feature codes. Table 4 lists those features added since the last review of FFD.

Table 1. Change in Coverages (General Specification revisions)

Nov 98 FFD	General Specification	Jun 01 FFD
BND	BND	BND
ELE	ELE	ELE
HYD	OEN	OEN
POP	POP	POP
TRN	GTR, AER	GTR, AER
	UTI	UTI
VEG	VEG	VEG

It should be noted that the feature BE015, depth contour, was dropped from the ELE coverage and added to OEN as BE010, depth curve. While these features are similar in name, they differ substantially in meaning. BE015, depth contour is intended to be a line composed of points that are of equal depth. BE010, depth curve, however, is a line that indicates that all points seaward of this line are of this depth or greater. In the first case the line indicates actual depths and in the second case acts as an inference based on the depth information to provide a "safety contour". Thus the two features, while similar, are not identical. This ambiguity could lead to interpretation errors by the user if the distinction is not well understood by the user. Perhaps both a change of name and symbol would clarify the difference for the user. As a suggestion, the BE010, depth curve, might be renamed Depth Safety Curve to diminish the ambiguity.

Table 2. Features Dropped from Nov 98 FFD

Coverage	Feature Name	FACC Code	Comment
ELE	Depth Contour	BE015	BE010 Depth Curve as added in OEN
ELE	Contour Line (Land)	CA010	

The reader should also note the addition of the feature ZD019, General Miscellaneous Feature (new to General Specification and FFD). The author is unclear as to the proper usage of this feature. The specification yields two attributes that are associated with this feature: "nam" name, and "txt", text attribute. From these two attributes one can conclude that a ZD019 has a name and it has a text description, both of which are encoded as character strings and that this feature would be used to "tie" text to certain geographical extents. While this technique does offer flexibility it also could lead to obfuscation of essential information needed by the user. This leads to the assumption that ZD019 would have generic symbolization requiring a manual query of all ZD019 to determine if the information was of value -- something which might or might not happen. If the information is important enough to capture, then it should be represented as a suitable FACC code with attributions rather than thrown into a catch all category. DMAP would recommend that the use of ZD019 be restricted to clearly defined situations.

Table 3. Coverages and Features Changed from Nov 98 FFD

Nov 98 FFD		Jun 01 FFD	
Coverage	**FACC / Feature Name**	**Coverage**	**FACC / Feature Name**
TRN	GB005 Airport / Airfield	AER	GB005 Airport / Airfield
TRN	GB035 Heliport	AER	GB035 Heliport
TRN	GB055 Runway	AER	GB055 Runway
TRN	GB065 Seaplane Base	AER	GB065 Seaplane Base
TRN	ZD020 Void Collection Area	AER	ZD020 Void Collection Area
TRN	ZD040 Named Location	AER	ZD040 Named Location
TRN	ZD045 Text Description	AER	ZD045 Text Description
BND	BA010 Coastline/ Shoreline	PHY	BA024 Shoreline
TRN	AN010 Railroad	GTR	AN010 Railroad
TRN	AN050 Railroad Siding / Railroad Spur	GTR	AN050 Railroad Siding / Railroad Spur
TRN	AN060 Railroad Yard / Marshalling Yard	GTR	AN060 Railroad Yard / Marshalling Yard
TRN	AP010 Cart Track	GTR	AP010 Cart Track
TRN	AP030 Road	GTR	AP030 Road
TRN	AP050 Trial	GTR	AP050 Trial
TRN	AQ040 Bridge / Overpass / Viaduct	GTR	AQ040 Bridge / Overpass / Viaduct
TRN	AQ070 Ferry Crossing	GTR	AQ070 Ferry Crossing
TRN	AQ130 Tunnel	GTR	AQ130 Tunnel
TRN	BH070 Ford	GTR	BH070 Ford
TRN	ZD020 Void Collection Area	GTR	ZD020 Void Collection Area
TRN	ZD040 Named Location	GTR	ZD040 Named Location
TRN	ZD045 Text Description	GTR	ZD045 Text Description
TRN	AQ130 Tunnel	IWA	AQ130 Tunnel
HYD	BH010 Aqueduct	IWA	BH010 Aqueduct
HYD	BH020 Canal	IWA	BH020 Canal

Nov 98 FFD		Jun 01 FFD	
Coverage	**FACC / Feature Name**	**Coverage**	**FACC / Feature Name**
HYD	BH030 Ditch	IWA	BH030 Ditch
HYD	BH050 Fish Hatchery / Fish Farm / Marine Farm	IWA	BH050 Fish Hatchery / Fish Farm / Marine Farm
HYD	BH080 Lake / Pond	IWA	BH080 Lake / Pond
HYD	BH090 Land Subject to Inundation	IWA	BH090 Land Subject to Inundation
HYD	BH130 Reservoir	IWA	BH130 Reservoir
HYD	BH140 River / Stream	IWA	BH140 River / Stream
HYD	BI020 Dam / Weir	IWA	BI020 Dam / Weir
HYD	BI030 Lock	IWA	BI030 Lock
HYD	ZD020 Void Collection Area	IWA	ZD020 Void Collection Area
HYD	ZD040 Named Location	IWA	ZD040 Named Location
HYD	ZD045 Text Description	IWA	ZD045 Text Description
HYD	BA040 Water (Except Inland)	OEN	BA040 Water (Except Inland)
HYD	ZD020 Void Collection Area	OEN	ZD020 Void Collection Area
HYD	ZD040 Named Location	OEN	ZD040 Named Location
HYD	ZD040 Text Description	OEN	ZD045 Text Description
TRN	BB190 Pier / Wharf / Quay	PHR	BB190 Pier / Wharf / Quay
HYD	BA030 Island	PHY	BA030 Island
HYD	AC030 Settling Basin / Sludge Pond	UTI	AC030 Settling Basin / Sludge Pond
HYD	BH040 Filtration Beds / Aeration Beds	UTI	BH040 Filtration Beds / Aeration Beds
HYD	BH155 Salt Evaporator	UTI	BH155 Salt Evaporator
HYD	ZD020 Void Collection Area	UTI	ZD020 Void Collection Area
HYD	ZD040 Named Location	UTI	ZD040 Named Location
HYD	ZD045 Text Description	UTI	ZD045 Text Description
VEG	BH095 Marsh / Swamp	VEG	ED010 Marsh ED020 Swamp

Table 4. Features Added to Jun 01 FFD

Coverage	Feature Name	FACC Code
AER	General Miscellaneous Feature	ZD019
BND	General Miscellaneous Feature	ZD019
ELE	General Miscellaneous Feature	ZD019
GTR	General Miscellaneous Feature	ZD019
IWA	General Miscellaneous Feature	ZD019
OEN	Depth Curve	BE010
OEN	General Miscellaneous Feature	ZD019
PHR	General Miscellaneous Feature	ZD019
PHR	Void Collection Area	ZD020
PHR	Named Location	ZD040

Coverage	Feature Name	FACC Code
PHR	Text Description	ZD045
PHY	Sebka	BH160
PHY	Rock Strata / Rock Formation	DB160
PHY	Sand Dune / Sand Hills	DB170
PHY	General Miscellaneous Feature	ZD019
PHY	Void Collection Area	ZD020
PHY	Named Location	ZD040
PHY	Text Description	ZD045
POP	General Miscellaneous Feature	ZD019
UTI	Power Plant	AD010
UTI	Pipeline / Pipe	AQ113
UTI	General Miscellaneous Feature	ZD019
UTI	Void Collection Area	ZD020
UTI	Named Location	ZD040
UTI	Text Description	ZD045
VEG	Cropland	EA010
VEG	Grassland	EB010
VEG	Scrub/Brush/Bush	EB020
VEG	Land Devoid of Vegetation	EE020
VEG	General Miscellaneous Feature	ZD019

2.2 Order of Preference

There is an ambiguity in the order of preference among specifications. In both the General Specification (Section 2.4) and the FFD specification (Section 2.3), each state "the text of this document takes precedence." This needs to be further clarified, (e.g., perhaps the product specification should indicate that they take precedence over the VPF or General Specification). DMAP suggests that a simple sentence be added stating which order of preference governs (e.g., the General Specification or the specific product specification) and thus remove any ambiguity.

3.0 Metadata

The majority of GIS tools currently available are inadequate in making the metadata, embedded in VPF, available to the user. Additionally, systems which catalog data holdings are then required to access the VPF table structure to obtain the meta data necessary. This places an unnecessary burden of having to read VPF on a general cataloging system where many different types of GIS data are cataloged.

A simpler approach is to separate the metadata from the VPF structure so that it becomes available to a "librarian" that may not have a VPF reader, but would like to catalog the material as a part of the library holdings. This separates the function of cataloging the

information from the function of reading or actually using the VPF data. With many different storage formats for GIS data in use, it is an unnecessary burden to require the "librarian" to maintain or develop the systems required to interpret each format. Thus a simplification results when the metadata is stored externally in association with the VPF data in a more universal format. In this case, XML, Extended Markup Language, is suggested. This XML should contain metadata that is in agreement with the FGDC standard.

Unfortunately, sufficient time was not available to perform an exhaustive comparison of FGDC metadata standards with the metadata fields contained in FFD and other VPF products. A general familiarity with the VPF metadata fields and FGDC fields leaves the author with the impression that more could be done to improve both the accessibility and the content of VPF metadata. As time permits, DMAP will conduct further investigation into metadata. FGDC and GPV and subsequently make a more detailed recommendation.

Additional background material on FGDC metadata and ESRI metadata implementation is provided for the reader in the following sections.

3.1 Review of Metadata Standards

3.1.1 FGDC Content Standard for Digital Geospatial Metadata

The Federal Geographic Data Committee (FGDC) began development of the FGDC Content Standard for Digital Geospatial Metadata (CSDGM) in the summer of 1992 and which was approved in June 1994 and endorsed in June 1998.

The following information is copied from *Content Standard for Digital Geospatial Metadata Workbook,* Version 2.0, Federal Geographic Data Committee, May 1, 2000. This document provides an excellent overview for metadata and can be obtained on-line at http://www.fgdc.gov/publications/documents/metadata/workbook_0501_bmk.pdf. The tables provide a summary outline and examples of metadata and what it could contain.

Table 5. Examples of Metadata

Identification Title? Area covered? Themes? Currentness? Restrictions?
Data Quality Accuracy? Completeness? Logical Consistency? Lineage?
Spatial Data Organization Indirect? Vector? Raster? Type of elements? Number?
Spatial Reference Projection? Grid system? Datum? Coordinate system?
Entity and Attribute Information Features? Attributes? Attribute values?
Distribution Distributor? Formats? Media? Online? Price?
Metadata Reference Metadata currentness? Responsible party?

Metadata describe different aspects of data, including:

Identification -- What is the name of the data set? Who developed the data set? What geographic area does it cover? What themes of information does it include? How current are the data? Are there restrictions on accessing or using the data?
Data Quality -- How good are the data? Is information available that allows a user to decide if the data are suitable for his or her purpose? What is the positional and attribute accuracy? Are the data complete? Was the consistency of the data verified? What data were used to create the data set, and what processes were applied to these sources?
Spatial Data Organization -- What spatial data model was used to encode the spatial data? How many spatial objects are there? Are methods other than coordinates, such as street addresses, used to encode locations?
Spatial Reference -- Are coordinate locations encoded using longitude and latitude? Is a map projection or grid system, such as the State Plane Coordinate System, used? What horizontal and vertical datums are used? What parameters should be used to convert the data to another coordinate system?
Entity and Attribute Information -- What geographic information (roads, houses, elevation, temperature, etc.) is included? How is this information encoded? Were codes used? What do the codes mean?
Distribution -- From whom can I obtain the data? What formats are available? What media are available? Are the data available online? What is the price of the data?
Metadata Reference -- When were the metadata compiled? By whom?

3.1.2 ESRI Profile

A further study by DMAP was done by looking at the Environmental Systems Research Institute, Inc. (ESRI) Profile of the Content Standard for Digital Geospatial Metadata[5]. The stated objective of this profile is to make metadata more accessible and useful on a daily basis when browsing, searching, and managing data [using] ArcGIS software. This profile defines additional elements to support that process and to document characteristics of datasets that are not addressed by the [FGDC] CSDGM. It adds several elements to those defined by the FGDC standard. These additions provide information not addressed in the FGDC standard, information in terms native to ESRI data formats and software, and information used for the automated management and update of metadata records. The elements added by the ESRI Profile are summarized in Appendix D of the profile[6]. A copy of this profile can be obtained on-line from http://www.esri.com/metadata/esriprof80.html.

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[5] *ESRI Profile of the Content Standard for Digital Geospatial Metadata*, ESRI Technical Paper, July 2001, *Objective* and *Scope*, pg. 3.
[6] Ibid, *Elements of the ESRI Profile*, pg. 2.

4.0 Conclusions and Recommendations

DMAP recommends the acceptance of the proposed changes and would make the following suggestions.

- Consider ways of preventing the misinterpretation of BE010, depth curve, as a depth contour.
- Clarify and restrict the use of ZD019, General Miscellaneous Feature.
- Clarify the order of ruling precedence to be used when two or more specifications are in conflict as noted in Section 2.2 of this review.
- Include FDGC compliant metadata in XML format external to the VPF data structure.

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