Standard for Developing Digital Data Specification Standards Documents

Prepared by

Digital Data Working Group
Resources Inventory Committee

February 05, 1998

Version 1.0

Published by the
Resources Inventory Committee

Canadian Cataloguing in Publication Data

Main entry under title:

Standard for developing digital data specification standards
documents [computer file]

Available through the Internet.

Issued also in printed format on demand.

Includes bibliographical references: p.

ISBN 0-7726-3491-2

1. Resources Inventory Committee (Canada) – Publishing – Handbooks, manuals, etc. 2. Electronic publishing – British Columbia – Handbooks, manuals, etc. 3. Authorship – Style manuals. 4. Technical reports. 5. Technical writing. I. Resources Inventory Committee (Canada) Digital Data Working Group.

Z286.E43S72 1998 808'.066578'09711 C98-960059-9

Additional Copies of this publication can be purchased from:

Government Publications Centre
Phone: (250) 387-3309 or
Toll free: 1-800-663-6105
Fax: (250) 387-0388
www.publications.gov.bc.ca

Digital Copies are available on the Internet at:
http://www.for.gov.bc.ca/ric

Abstract

This document is to be used as a guide to develop digital data specifications for resource inventories that fall within the scope of the Resources Inventory Committee (RIC). The standard provides a common way for custodians to document their digital data specifications and specifically digital data with a geographic or “map” component. The standard is a common “template” which is tailored by the custodian to define digital data specifications for RIC inventories for which they are responsible. It identifies the content that should be included in the specification, common standards to be used in developing or defining the specification, and guidelines to assist in completing the specification.

The standard was developed to address the following concerns:

1) The current “gap” between field inventories where digital data is being collected and no or incomplete, digital data specification exists.

2) To ensure custodians comply with existing government standards when defining thier digital data specifications.

3) To ensure consistent delivery of digital data to the custodian, particularly where the work is delivered by contract.

4) To provide a common structure, content and look to all digital data specifications.

5) To make the custodians job of developing digital data specifications easier.

Acknowledgments

Funding of the Resources Inventory Committee work, including the preparation of this document, is provided by the Corporate Resource Inventory Initiative (CRII) and by Forest Renewal BC (FRBC). Preliminary work of the Resources Inventory Committee was funded by the Canada-British Columbia Partnership Agreement of Forest Resource Development FRDA II.

The Resources Inventory Committee consists of representatives from various ministries and agencies of the Canadian and the British Columbia governments as well as from First Nations peoples. RIC objectives are to develop a common set of standards and procedures for the provincial resources inventories, as recommended by the Forest Resources Commission in its report “The Future of our Forests”.

For further information about the Resources Inventory Committee and its various Task Forces, please access the Resources Inventory Committee Website at: http://www.for.gov.bc.ca/ric.

Digital Data Working Group

Those responsible for development of the document were:

Evert Kenk, GDBC, MELP (Team Leader)

Martin Davis, ISB, MOF

Peter Friesen, GDBC, MELP

Bruce Mackenzie, ISB, MELP

Bruce Whyte, CSLUB, SBTC

Table of Contents

Section 0 - Document Introduction

This is a “how to” guide for documenting digital data specifications for data being captured in a Resources Inventory Committee (RIC) inventory. Following is a standard “template” for any document describing digital data specifications. The intent is to provide the necessary information required by those involved in digital data capture of any RIC inventory data to ensure consistent delivery of digital data in a specified digital form or structure. The document or specification being defined should describe the form (or structure) of the data as it would exist in its distribution archive or the source from which it is being accessed. It should describe the form the data is expected to be in when delivered by contract. The document should not attempt to describe a single process for digitally capturing the data. The reason for this is there might be a number of ways of getting the data into the specified form.

The rest of this document describes what content is to be included in each section of a RIC Inventory Digital Data Specification document. It also specifies whether the section is Mandatory or Optional. The content to be developed for each section is based on one or more of the following conditions:

i) The content is derived from an existing Standard, ie an accepted Government standard already exists for that particular section. All documents will support already accepted Government standards.

ii) The content is derived using a Standard Method, ie an accepted method(s) already exist(s) for defining the content of that particular section. All documents will use the accepted method(s) for developing that section.

iii) Where possible, Guidelines will be provided for those sections where Standards, or Standard Methods for completing the content do not exist.

As a general rule, an attempt was made to provide as much common content for each section as is reasonably possible. This involved providing sections with common wording to be used in all documents, sections with wording that require some tailoring for specific documents, and sections where options or pick lists are provided.

This document is focused on defining digital data specifications for new data capture. It is recognized that legacy data does exist which may not meet current or new specifications.

What follows is a detailed description of each section that might be included in a RIC Inventory Digital Specification document.

Comments on the content or suggestions for improving this document are appreciated and should be sent to the Resources Inventory Committee, Digital Data Working Group $^{c}/_{o}$ Evert Kenk at:

FAX: (250) 356-7831 Email: ekenk@mail.gdbc.gov.bc.ca

How to Use This Document

The document format is a guide to using the material provided. Note this section is not to be included in the final standards document.

General information, direction and guidelines are presented in this format.

Common wording (or boilerplate) to be used in all digital data specification documents is presented in this format. Where wording must be modified to suit a particular specification it is identified in the guide as follows, <*name of Ministry or agency*>. Fill in the space as appropriate.

Where common wording (or boilerplate) to be used in all digital data specifications is to be chosen from a list of options this format is used:

- Option 1
- Option 2 (etc.)

Examples are contained in boxes. For example tables the caption is contained in a box.

Section 1 - Introduction

This section is mandatory. It is recommended the following common wording be used in all documents tailored to the specific inventory.

Background

This document describes the digital data specifications for <*name of inventory*> data with a focus on spatial data collected for use in Geographic Information Systems (GIS). It is part of a series of related documents produced by the Resources Inventory Committee (RIC), which are intended to ensure BC government agencies are providing resource information which meets recognized standards for quality and consistency. It is anticipated the information in this document will be useful to contractors or staff involved in collecting resource inventory data, managers charged with overseeing data-collection projects, custodians maintaining resource inventory datasets, and end-users seeking to apply resource inventory data to resource management and land-use issues.

Purpose of the Standard

The purpose of this document is to define the digital form and structure of <*name of resource inventory*> digital data as managed by <*name of Ministry or agency*> of the Province of BC. It defines:

- standards for describing thematic content;
- standards for physical data specification;
- georeferencing standards;
- quality assurance guidelines; and,
- recommendations for cartographic representation of the data.

This standard is introduced to achieve key provincial government objectives for digital data, by:

- making it easier to share digital spatial data between user groups using different hardware and software;
- making it easier to integrate digital spatial data by adhering to Provincial standards for georeferencing resource inventory data sets; and,
- providing quantitative and qualitative measures of data quality to ensure data-collection efforts are effective, to ensure the Province receives good value in contracted projects.

Scope of the Standards

The digital data standards in this document will be applied to <*name of resource inventory*> as managed by <*name of Ministry or agency*>, a Province of British Columbia agency represented at the Resources Inventory Committee.

This document describes basic georeferencing and digital data definitions for <*name of resource inventory*>, including coordinate systems, registration and logical and physical descriptions for attribute and spatial aspects of the data sets. The document describes, recommends or prescribes methods for digital data capture, quality assurance and graphic data representation, as well as project metadata related to the digital capture.

The document focuses on providing those standards and guidelines required by those involved in digital data capture of <*name of resource inventory*> data to ensure consistent delivery of digital data in the specified digital form or structure. The specification describes the form (or structure) of the data as it <*exists in its distribution archive or the source from which it is being accessed* AND/0R *the form the data is expected to be in when delivered by contract*>*.* The document does not attempt to describe a single process for digitally capturing the data, as there might be a number of ways of getting the data into the specified form.

Intended Users of the Standards

This document is technical in nature, and is intended for a specialist audience of persons compiling, managing and using the <*name of resource inventory*> digital resource inventory dataset.

This intent is for this document to be used by three major groups:

- government staff managing contracts for the collection of <*name of resource inventory*> data, or maintaining the resource inventory datasets;
- private-sector contractors and government staff actively involved in the collection, storage and maintenance of <*name of resource inventory*> digital data sets;
- end-users seeking to understand the meaning and structure of <*name of resource inventory*> datasets for use in analysis and graphic display.

Contractors and government staff involved directly with collecting <*name of resource inventory*> data will refer to this Standard for specific technical guidance on the form and structure of the data sets they prepare. Managers of such data-collection projects will use this Standard to evaluate whether resource inventory projects have been properly conducted.

Section 2 - Logical Data Description

This section is Mandatory. Provided are the necessary standards and guidelines to develop the content for this section based on the use of existing Government standard methods and current practice.

The purpose of this section is to document a logical description of the data being collected. The intent is to provide a single integrated definition of the data that is unbiased toward any single application of the data being collected and is independent of how the data are physically stored or accessed. The intent is to provide a common understanding of the data being collected as well as provide a basis for systems database design and definition of the Physical Data Description (Section 3).

The logical data description is a data model, comprised of both a diagram and structured description (data dictionary) of the data objects, their relationships and their attributes. Although only the data dictionary is mandatory, it is strongly recommended that the graphical model also be developed to provide a complete logical description of the inventory data.

A RIC standard currently exists which is to be followed for delivering the data model. This standard and the sections most pertinent to delivering the logical data description are:

1. LandData BC - Corporate Data Model Framework, Section 2.2 – Information Architecture

2. LandData BC - Corporate Data Modelling Standards and Guidelines - Interim (1996/1997), Section 3 - Data Modelling Guidelines and Appendix A - BC Environment Administration Practices (Derived in Part From Ministry of Forests Administration Practices), both parts, Logical Data Models and Naming Conventions.

Further reference documentation in support of logical model development includes:

1. Introduction, SAIFLite, Release 1.1, March 1996, at Internet URL http://www.env.gov.bc.ca/gdbc/fmebc/comment4.htm
2. Spatial Archive and Interchange Format: Formal Definition, Release 3.2, January 1995, Surveys and Resource Mapping Branch, BC Ministry of Environment, Lands and Parks. Also at Internet URL http://www.env.gov.bc.ca/gdbc/saif32/

The above documentation provides the necessary standards and guidelines to create the logical description including both the model diagram (an Entity Relationship Diagram or equivalent) and the data dictionary. It also provides guidelines for effectively modelling the spatiotemporal aspects of inventory data, or the geographic component of the data, which is commonly managed in a GIS.

The current data modelling standard is restricted to a limited set of allowable classes, subclasses, relationships and enumerations as defined in SAIFLite. If this set is found to be to limiting any extension should be based on the full SAIF model.

The primary focus of the logical data description is to model geographic objects, which are principally features, but leaving out the detail of physical shape construction. A Provincial Geographic Feature Catalogue database is currently being maintained at the BC Environment Web Site (URL is http://www.env.gov.bc.ca/gis/featurecodes.html). As new types of geographic objects or “features” are defined in support of an inventory they should be described in the Provincial Geographic Feature Catalogue database.

Section 3 - Physical Data Description

This section is Mandatory. Provides guidelines and options to develop the content for this section based on standard methods and current practice.

This section provides a precise specification of the physical format of data exchanged between contractors and the data custodian.

Preferably, it will also specify the physical format of data archived for plotting and analysis.

Specify how much attribute data is to be stored in the GIS files. Attributes stored entirely within GIS feature attribute tables are easier to distribute with their spatial features, but attributes stored in a relational database are easier to access with non-GIS software. If there are only one or two attributes for each feature, it may be simpler to store them in feature attribute tables in GIS. This is NOT recommended for formats that do not explicitly define a structure for storing attributes.

Section 3a - Attributes

Specify database table schema as SQL Data Definition Language commands, or as a list of table/file names, column names, types, and widths.

Column names within an RDBMS may be up to 30 chars. Where these are longer than 10 chars, equivalent names 10 chars or less should be specified also, to facilitate sharing in dBASE IV format. Names should contain only upper-case letters, digits, or underscores ('_'), start with a letter, and contain no blanks.

Specify a domain for each column as a range or list of values. The list of values may be in another database or data source.

Specify database constraints on columns or between tables and/or columns.

Specify a meta-format (or coding specification) for each column as left/right justified Upper/lower case, etc.

For each attribute, specify one of these dBASE IV compatible datatypes for exchange convenience:

1. Character (fixed width or maximum width such as VARCHAR2 in Oracle). Preferably, no columns longer than 255 characters.
2. Number (specify width, and number of decimals)
3. Integer (specify width)
4. Date

These data types are not recommended, because they are not supported in all common attribute formats:

- Logical/Boolean (not supported in Oracle)

- Time/date (as a built-in unique or proprietary datatype)
- Memo in dBASE
- Long in Oracle

Beware of arbitrary limits such as max. 2000 chars in a VARCHAR2 column in Oracle, or only one Memo column in a dBASE table.

Example schema definition

COLUMN NAME	SHORT COLUMN NAME	WIDTH	TYPE	N.DEC	FORMAT *
AREA	AREA	4	NUMBER	0	-
PERIMETER	PERIMETER	4	NUMBER	3	-
WATERSHED_NUMBER	WSHED_NBR	8	INTEGER	-	-
APPLICATION_ACCEPTANCE_DATE	ACCPT_DT	4	DATE	-	-
FEATURE_CODE	FCODE	10	CHAR	-	an-x-u
SOURCE_FEATURE_CODE	SRC_FCODE	10	CHAR	-	an-x-u
APPLICATION_STATUS	APPL_STAT	16	VARCHAR2	-	an-e-l-l
APPLICATION_COMMENT	COMMENT	30	VARCHAR2	-	c-e-l-l

***** Field Specification conventions used in this example taken from Chapter 2 of "INTERIM (1996) 'Terrain Database Manual' Standards for Digital Terrain Data Capture in British Columbia, June 1996. In absence of other standards for field specifications it is recommended this standard be used in the interim.

Data format

All attribute data must be in the following format:

Choose one or more of (in decreasing portability):

- dBASE IV(.DBF)
- Comma-Separated Values (.CSV)
- Microsoft Access (.MDB)
- SAIF
- Oracle Export (.EXP)
- INFO export (.E00 - Attribute data format of ARC/INFO)
- IGDS (as labels, text nodes, or text strings)

Section 3b - Spatial

Coordinate System

All data must be in the following coordinate system. Note that the Offsets are separate from the false Easting and/or false Northing that may be part of the projection definition. For example, BC Albers has a false Easting of 1,000,000 metres.

Select one of the following to match the coordinate system of the physical data format:

IGDS - UTM			
Horizontal Unit of Resolution	cm	Horizontal Measurement Unit	metre
Vertical Unit of Resolution	cm	Vertical Measurement Unit	metre
X Offset:	0	Y Offset:	0

IGDS - MoF UTM			
Horizontal Unit of Resolution	mm	Horizontal Measurement Unit	metre
Vertical Unit of Resolution	mm	Vertical Measurement Unit	metre
X Offset:	2143484	Y Offset:	7443484

IGDS - BC Albers			
Horizontal Unit of Resolution	cm	Horizontal Measurement Unit	metre
Vertical Unit of Resolution	cm	Vertical Measurement Unit	metre
X Offset:	0	Y Offset:	0

ARC/INFO – UTM – Single Precision			
Horizontal Unit of Resolution	metre	Horizontal Measurement Unit	metre
Vertical Unit of Resolution	N/A	Vertical Measurement Unit	N/A
X Offset:	0	Y Offset:	0

ARC/INFO – BC Albers – Single Precision			
Horizontal Unit of Resolution	metre	Horizontal Measurement Unit	metre
Vertical Unit of Resolution	N/A	Vertical Measurement Unit	N/A
X Offset:	0	Y Offset:	0

ARC/INFO – Geographics – Double Precision			
Horizontal Unit of Resolution	decimal degrees	Horizontal Measurement Unit	degree
Vertical Unit of Resolution	N/A	Vertical Measurement Unit	N/A
X Offset:	0	Y Offset:	0

ESRI Arc Shape - UTM			
Horizontal Unit of Resolution	metre	Horizontal Measurement Unit	metre
Vertical Unit of Resolution	N/A	Vertical Measurement Unit	N/A
X Offset:	0	Y Offset:	0

ESRI Arc Shape – BC Albers			
Horizontal Unit of Resolution	metre	Horizontal Measurement Unit	metre
Vertical Unit of Resolution	N/A	Vertical Measurement Unit	N/A
X Offset:	0	Y Offset:	0

ESRI Arc Shape - Geographics			
Horizontal Unit of Resolution	decimal degrees	Horizontal Measurement Unit	degree
Vertical Unit of Resolution	N/A	Vertical Measurement Unit	N/A
X Offset:	0	Y Offset:	0

SAIF – UTM – Double Precision			
Horizontal Unit of Resolution	metre, cm or mm	Horizontal Measurement Unit	metre, cm, or mm
Vertical Unit of Resolution	metre, cm or mm	Vertical Measurement Unit	metre, cm or mm
X Offset:	0	Y Offset:	0

SAIF – BC Albers – Double Precision			
Horizontal Unit of Resolution	metre, cm or mm	Horizontal Measurement Unit	metre, cm or mm
Vertical Unit of Resolution	metre, cm or mm	Vertical Measurement Unit	metre, cm or mm
X Offset:	0	Y Offset:	0

SAIF – Geographics – Double Precision			
Horizontal Unit of Resolution	decimal degrees	Horizontal Measurement Unit	degrees
Vertical Unit of Resolution	metre, cm or mm	Vertical Measurement Unit	metre, cm or mm
X Offset:	0	Y Offset:	0

MapInfo - UTM			
Horizontal Unit of Resolution	metre	Horizontal Measurement Unit	metre
Vertical Unit of Resolution	cm	Vertical Measurement Unit	metre
X Offset:	0	Y Offset:	0

MapInfo – BC Albers			
Horizontal Unit of Resolution	metre	Horizontal Measurement Unit	metre
Vertical Unit of Resolution	cm	Vertical Measurement Unit	metre
X Offset:	0	Y Offset:	0

MapInfo – Geographics – Double Precision			
Horizontal Unit of Resolution	decimal degrees	Horizontal Measurement Unit	degree
Vertical Unit of Resolution	cm	Vertical Measurement Unit	metre
X Offset:	0	Y Offset:	0

Tiles

Data must be divided into the following geographical partitions:

> This choice is constrained by the choice of map projection. If not using geographic coordinates, ensure that each tile fits entirely within one projection, (e.g. one UTM zone).
>
> In general, bigger delivery tiles make file maintenance easier, and reduce the opportunities for mismatches at tile edges. However, geographic areas must not be so large as to cause file sizes to exceed the capacity of common hardware and software.
>
> Options are:

- Seamless. All data in one seamless dataset.
- <*Administrative or Geographical Area*> (e.g. Forest District, Watershed).
- 1:250,000 NTS Mapsheets
- 1:50,000 NTS Mapsheets
- 1:20,000 BCGS Mapsheets
- 1:10,000 BCGS Mapsheets

Format

Spatial data must be submitted in the following format:

> This choice is constrained by the software available to the agencies exchanging geographic data.
>
> Options are:

- Unix ARC/INFO coverage
- PC ARC/INFO coverage
- ARC/INFO export (E00), uncompressed (i.e. exported with NONE compression option)
- IGDS 2D
- IGDS 3D

- ESRI Arc Shape
- MapInfo
- SAIF

Feature Classification

All features must be classified into distinct types.

For ARC/INFO, ARC Shape, or MapInfo:

Each feature must have a feature code from the BC Government Feature Database in its feature attribute table, stored in a 10-character attribute called ‘FCODE’

For IGDS, one or both of:

- Each feature class must have a unique combination of level, style, colour, and weight.
- Each feature must have a feature class number stored in a linkage.

Layers / Layer Names or Numbers

All spatial data must conform to the following layering scheme:

Provide a data dictionary listing all features to be included. For each feature in the dictionary, specify a feature class, and a layer, level or filename to contain it.

For layer-based formats (e.g. MapInfo, ARC/INFO, ARC Shape), specify a name for each layer.

Coverage Name	***Feature Code***	***Feature Class Description***	***Topology***
QWTR	*GA24850000*	*River/Stream*	*Line*
QTRN	*AR08450000*	*Highway – Divided*	*Line*

For level-based formats (e.g. IGDS) specify a file name/type and level number for each layer.

8.3 file names are recommended for compatibility with DOS.

File Name/Type	***Level***	***Style***	***Color***	***Weight***	***Feature Code Number***	***Description***	***Topology***
**.FC1*	*8*	***	*77*	*1*	*1023*	*Glacier*	*Line*

Linkages to Attributes

Where attributes are stored in a database separate from the spatial format (e.g. dBASE or Oracle), specify a common key column in both the spatial and the attribute schemas to link database records to spatial features. These should have the same data type, width, and name.

Point Attribute Table for Point Sample Sites.

TES_TAG is the name of the item that maintains the link between Sample Site points and their attributes. It consists of the project number followed by a '_', followed by a user assigned polygon number.

COLUMN	ITEM NAME	WIDTH	OUTPUT	TYPE	N.DEC	ALTERNATE NAME	INDEXED
1	AREA	4	16	F	0	-	
5	PERIMETER	4	12	F	3	-	
9	TES_PROJECT#	4	5	B	-	-	
13	TES_PROJECT-ID	4	5	B	-	-	
17	FCODE	10	10	C	-	-	indexed
27	SRC_FCODE	10	10	C	-	-	
37	TES_TAG	16	16	C	-	-	indexed
53	COMMENT	30	30	C	-	-	

If the format has no standard method of linking spatial features to attribute data (e.g. IGDS), or if the standard method is not used, then specify what method will be used.

Linkages to Attributes

Example of Ministry of Forests INCOSADA Spatial Data Standards for IGDS

Under the INCOSADA specifications spatial features stored in IGDS have a unique key called the Feature ID. Feature IDs are unsigned 128-bit integers stored as a 32-digit lowercase ASCII hex string (e.g. 7452b930d20711d09d920000c91a9cb1). Feature IDs are stored using User Data Linkages. The Linkage ID is the Ministry of Forests Linkage ID code registered with Bentley Microsystems. The user-defined data portion of the User Data Linkage contains 32 bytes of FID data.

The exact data layout for the Feature ID User Data Linkage is given in the following C code (for Intel x86 and compatible architectures):

```
typedef  struct {
        unsigned short words    : 8;    // words to follow; Must = 19
        unsigned short class    : 4;    // reserved       ; Must =  0
        unsigned short user     : 1;    // user bit on    ; Must =  1
        unsigned short modified : 1;    // unused         ; Must =  0
        unsigned short remote   : 1;    // unused         ; Must =  0
        unsigned short info     : 1;    // unused         ; Must =  0
        unsigned short UserID;          // interim standard: = 0x7e7e
        unsigned char  fid[32];         // 128-bit Feature ID (in ASCII
hex, lowercase)
        unsigned int   sequenceNum;     // sequence number for networks,
```

etc
} INCOSADA_FID;

Example

Special Use Permit #S12345
FID: 7452b930d20711d09d920000c91a9cb1

Topology Implementation

Common spatial data topologies are:

- point
- polyline (linestring, arc)
- polygon (area)
- polygon coverage (chloropleth) (complete spatial partition of the map area. Polygons abut each other without overlap)
- network (linestrings are joined at common endpoints, and intersections recorded in a table)
- region (areas which may overlap each other, and may be composed of multiple disjoint polygons)
- route (ordered list of lines formed into continuous route)
- dynamic segment (section of a route with attributes)

Most GIS formats explicitly support spatial data topologies. For formats which do not support topology (eg IGDS), specify very clearly how these topologies are to be represented. Specify the spatial data topology for each layer and feature class.

River routes must be formed as an ARC/INFO route layer route.bl within the lwss coverage. The arcs making up one river centre line must be linked to form one continuous route, beginning at the mouth of the river and ending at its headwater. It must have an associated lwss.ratbl feature attribute table.

Topology Implementation
This section defines how spatial data types are stored in IGDS format.

Point Features
Description & Rules

This includes all zero-dimensional or point data features other than DEM points or polygon inside points. A point feature has a geographic location. It may also have an alignment or orientation. The alignment is *a counterclockwise angle from the positive x direction (i.e. Grid East).*

IGDS Representation

Point features will be represented as cells (IGDS Element Type 2). The alignment is stored as an angle in the transformation matrix. Features with no alignment will carry an angle of 0.0. The scale is also represented in the transformation matrix.

Feature Codes & Ids

Feature Code and Feature ID will be present for all point features.

Linear Features
Description & Rules

A feature whose spatial geometry is one-dimensional. This includes splines and arcs, which will be approximated by lines. All linear features such as roads must be digitized on the center line of the road. Road features must not be coded as construction lines. Linear features that cross map-sheet boundaries must be edge-tied between mapsheets. Note that this includes mapsheets that lie in different UTM zones.

IGDS Representation

Linestrings (IGDS Element Type 4) will be used to represent linear features.

Feature Codes & Ids
Feature Code and Feature ID will be present for all line or linestring elements that are part of the linear feature.

Comments
Patterning or other representational techniques must not be applied to linear features in positional files.

Polygon Features
General Rules

No shapes or complex shapes will be used in positional files. All *polygons will be defined by one or more linestrings (IGDS Element Type 4) that are connected as per topology rules defined later.*

Polygon inside points and labels must carry a Feature Code and the same Feature ID as the containing polygon.

Polygons that cross map-sheet boundaries must be edge-tied between mapsheets. This can be done exactly between mapsheets in the same UTM zone, and must be done to the nearest UOR across zone boundaries.

Polygons that cross map-sheet boundaries must not be closed along the neatline; instead, the Polygon Neatline must be noded and the endpoints of the polygon linework snapped to it.

Polygon Neatlines

Description & Rules

In order to provide explicit closing of polygons that cross map-sheet boundaries, a special feature called a Polygon Neatline will be present in each mapsheet that contains polygons. This feature consists of a set of Line elements which outlines the area of the map. Where a polygon edge crosses the mapsheet boundary the Polygon Neatline will be noded and the polygon vertex snapped to it. Note that the Polygon Neatline should never be a distance of more than one-half a UOR from the standard MoF Mapsheet Neatline. IGDS Representation The Polygon Neatline is represented by a set of Line elements (IGDS Element Type 3). Feature Codes & Ids. The Polygon Neatline elements will carry a Feature Code. They will not carry a Feature ID.

Overlapping Polygons

Description & Rules

Polygons will be captured as complete objects, including holes (excluded areas) if applicable. (This implies duplicate line work may be present, if the edges of two polygons happen to coincide). Polygons will contain an inside point and conform to the Right Hand Rule or Downstream Rule. Polygons may contain holes, which are represented by polygons contained entirely inside the parent polygon and

which do not contain an inside point. Holes will obey the Right Hand Rule. Polygons that extend outside the map sheet neat line will be noded at the neatline. The linestrings lying outside the neatline will not appear in the file. As specified in section 6.4.2, the neatline will be noded where it intersects the polygon. There may be more than one polygon with the same Feature ID; this corresponds to the idea of *polygon sets. Polygon sets are used to represent tenures or regions that consist of one or more disjoint parcels or areas.*

IGDS Representation

An overlapping polygon or set of polygons is represented by one or more linestrings (IGDS Element Type 4). The linestrings forming the polygon(s) must intersect only at endpoints. Holes are represented by polygons contained entirely inside the parent polygon and which do not contain an inside point. Linework for holes should be digitized in a counter-clockwise direction. Holes carry the same Feature Code and Feature ID as the parent. Each polygon will contain an inside point, which will be represented as a text node (IGDS Element Type 7).

Feature Codes & Ids

Each linestring that makes up a polygon (including polygon holes) will have a Feature Code and a Feature ID. Holes carry the same Feature Code and Feature ID as the parent polygon. The polygon inside point will have a Feature Code (not necessarily the same as the containing polygon) and the same Feature ID as the containing polygon.

Non-Overlapping Polygons (Continuous and Discontinuous Coverages)
Description & Rules

Represents non-overlapping polygons. A coverage of non-overlapping polygons may be either continuos or discontinuous, i.e. may completely cover the area of the map or may contain holes. A coverage of non-overlapping polygons consists of:

a set of edges, i.e. non-intersecting linestrings which meet at endpoints only. These form the boundaries of the polygons
a set of polygon inside points (which may have text labels attached)

Thus polygons are single-line digitized (i.e. shared lines are not duplicated). Each polygon is a closed sequence of linestrings that contains an inside point. Polygon holes are implied. A closed sequence of linestrings that do not contain an inside point form a hole in the coverage. If this occurs the coverage is said to be discontinuous. A coverage is continuous if and only if every closed area contains an *inside point.*

IGDS Representation

Polygons will contain an inside point represented as a text node (Type 7).

Feature Codes & Ids

Each linestring will have a Feature Code. Linestrings will not have a Feature ID (since a single linestring may be associated with more than one polygon). Each inside point will have a Feature Code and a feature ID. Each text label will have a Feature Code and a Feature ID.

Templates

An empty template for each type of file or coverage should be supplied in electronic form to facilitate standardization and consistency.

Empty templates for each of these data files and coverages may be downloaded from <*URL for source* >

Section 4 - Georeferencing

This section is Mandatory. The content is based on existing Government standards.

Coordinate System

The position of a point on the earth's surface is located by its coordinates. Choose one of the following methods:

i) The first method specifies location in terms of a spheroid (geographic coordinates) which specifies latitude, longitude and elevation. Latitude and longitude should be stated in degrees or portions of degrees. The elevation is an expression of z typically in metres measured from the relevant vertical datum. Use of "geographic coordinates" is the standard for "seamless" databases. Most GIS systems do not allow computation of distance and area measurements in geographic coordinates, thus requiring transformation to a planar (map) projection.

ii) The second method specifies location in terms of rectangular (projection) coordinates that specify northing, easting and elevation. Northing and easting should be stated in metres. The elevation is an expression of z typically in metres measured from the relevant vertical datum.

Horizontal Datum

The horizontal datum specifies a mathematical approximation of the earth's shape. Data custodians must provide a horizontal datum. In many cases this will be a function of the Basemap Registration, e.g., if the data is tied to TRIM it is mapped to NAD83.

The choices for horizontal datum are:

- NAD27 - North American Datum 1927, based on the non earth-centered Clarke Spheroid of 1866.

NOTE: NAD27 must not be used for new data capture

- NAD83 - North American Datum 1983, earth-centered ellipsoid derived from Geodetic Reference System 1980 (GRS80)

Vertical Datum

The vertical datum provides a reference for the measurement of elevation. This is to be specified if the data includes a value for elevation. Only one option is allowed.

- CVD28 - Canadian Vertical Datum 1928, a reference surface used as the basis of elevation, depth and tide measurements. All vertical measurements are based on mean sea level as defined by this datum.

Projection

Projection must always be specified. Choices are as follows.

- Spherical - **Geographics** (Lat/Long)
- Rectangular - **UTM** - Universal Transverse Mercator is the ellipsoidal Transverse Mercator projection with specific parameters pre-defined. British Columbia spans UTM zones 7-11, each zone is 6 degrees of longitude in width, the central meridian being the longitude at the midpoint of the 6 degree span. Rectangular coordinates are metric with Easting values offset by 500,000 metres.
- Rectangular - **Albers (British Columbia)** - This projection pre-defines specific parameters for use with the Albers Equal Area Conic projection. For British Columbia these parameters have been defined as:

  central meridian -126° 0′ 0″

  1st standard parallel 50° 0′ 0″

  2nd standard parallel 58° 30′ 0″

  latitude of origin 45° 0′ 0″

  Rectangular coordinates are metric with Easting values offset by 1,000,000 metres.

NAD27 - NAD83 Conversion

Where a dataset contains data that has been upgraded to the new datum, the method of transformation must be identified. Use of the National Transformation Grid Version 2.0 is recommended for all datum conversions. Options are:

- National Transformation Grid Version 2.0 (recommended)
- National Transformation Grid Version 1.1

NOTE: When compared to Version 1.1, Version 2.0 of the National Transformation Grid provides greater detail in urban areas and more accurate control in pockets of the northeast of the Province. This will be significant in areas of the northeast of the Province where the required accuracy is 20 metres or less.

Reference:

Standard for the Use of Map Projections in British Columbia for Resource, Cultural and Heritage Inventories

Resources Inventory Committee, September, 1996

For further information on NAD27, NAD83 and the National Transformation Grid contact:

Geospatial Reference Unit

GDBC,

Ministry of Environment, Lands and Parks,

Province of British Columbia

Section 5 - Registration

This section is Mandatory. The content is based on existing Government standards and current practice.

For theme based data collection, all custodians must identify the base mapping to which their data has been referenced. Choices are:

- Provincial Baseline Digital Atlas 1:10 000 (TRIM2)
- Provincial Baseline Digital Atlas 1:20 000 (TRIM)
- Provincial Baseline Digital Atlas 1:250 000
- Provincial Baseline Digital Atlas 1:2 000 000
- TRIM Watershed Atlas (1:20 000)
- BC Ministry of Environment Watershed Atlas (1:50 000)

Base Positional Accuracy

Provide the base positional accuracy definition corresponding to the choice made above. Choices are:

- Provincial Baseline Digital Atlas 1:20 000 (TRIM) / 1:10 000 (TRIM2) –

  90% of all well-defined planimetric features are coordinated to within 10 metres of their true position.

  90% of all discrete spot elevations and DEM points are accurate to within 5 metres of their true elevation.

  90% of all points interpolated from the TRIM (including contour data) are accurate to within 10 metres of their true elevation.

  True position/elevation is defined as the coordinates that are obtained from positioning with high order ground methods.

- Provincial Baseline Digital Atlas 1:250 000

  Planimetric positional data represents a structuring of digitally scanned National Topographic Series (NTS) hardcopy mapsheet layers and so reflects both the accuracy of the original compilation and the errors introduced by the mylar media input to the scanning process. The published accuracy of the original input ranges from ±125 metres to ±500 metres horizontal and ½ to 2 contour intervals vertical. This data has also been subject to a simple x,y shift to approximate NAD83 positioning. This approximation is within 20 metres of the true NAD83 position, therefor the overall accuracy of the data remains at, + or –, 125 to 500 metres.

- Provincial Baseline Digital Atlas 1:2 000 000

  Planimetric positional data represents a structuring of digitally scanned constituent layers of the provincial 1J Series mapsheet and so reflects the accuracy of the original compilation. This digital product has been produced for a cartographic representation of thematic information at a scale of 1:2 000 000. As such, the positional accuracy is not adequate for any precise linear or areal calculations. Its intended use is for a general depiction of content information.

- TRIM Watershed Atlas - 1:20 000

  Heights of land, watershed boundaries, and river segments are derived from TRIM planimetric and DEM baseline datasets. As such the accuracy of this product is limited to that described for the Provincial Baseline Digital Atlas 1:20 000 (TRIM).

- BC Ministry of Environment Watershed Atlas - 1:50 000

  The positional accuracy of water features will be slightly less than the standard accuracy of the 1:50,000 NTS source maps. The positional accuracy of the watershed polygons is interpolated from 1:50 000 contours and so reflects both the accuracy of the 1:50 000 base and the errors introduced by manual interpolation of heights of land from the contours.

Section 6 - Digital Data Capture Rules/Requirements

This Section is mandatory. Guidelines for developing the content of this section are based in most part on current practice.

Section 6a - Quality of Digital Data Capture

Quality of digital data capture is composed of accuracy, precision, resolution, and degree of detail. For a discussion of these terms, refer to “Scale, Accuracy, and Resolution in a GIS” at http://www.env.gov.bc.ca/gis/gisscale.html.

Required quality of digital data capture should be stated for each feature type, or group of feature types. In the case of positional accuracy quality of digital data capture is usually specified in terms of maximum error. Error may be specified as percent probability:

90% of all points must be positioned on NAD83 within 10 metres. All points must be within 25 metre accuracy on NAD83. [The NAD83 datum on the ground is defined by geodetic control monuments and Active Control Points as maintained by GDBC at http://www.clbc.com:8001/gsru.

or as statistical error:

Any sample of at least 3% of points must have less than a 10 metre Root Mean Square Error when compared to their surveyed locations.

Interpretation accuracy/error

Mapping is a process of delineating and classifying the real world for representation as spatial features with textual attributes. The methods for interpreting the real world must be specified in a way that gives clear guidelines for both data collectors and data users. General discussion associated with sources of interpretation error including level or field reconnaissance, sampling intensity, class distinctness, “fuzziness” of interpretive boundaries, etc., are appropriate in this section. Where the mapping is following an established RIC standard, these should include Survey Intensity Levels. Survey Intensity Levels for a RIC inventory should be defined in the Field Inventory Standard for a given RIC inventory. Given this exists it should be referenced.

At least one sample point within each polygon must have been collected using the methods for Survey Intensity Level III for <RIC Inventory>.

Absolute (datum-related) positional accuracy/error

Absolute positional accuracy specifies how closely the location of a feature in its coordinate space (in either long/lat, or a projection plane) reflects its true location on the ground. The location of a ground point can be established by:

1. survey to ground control points
2. location by Global Positional System (GPS) satellite receiver

The accuracy/error can be stated as a maximum permitted deviation between a feature's mapped coordinate location and its location as established by survey or GPS.

Point locations must be established relative to the Provincial Geo-Spatial Reference as defined by geodetic control monuments maintained by GDBC (http://www.clbc.com:8001/gsru/.

OR

When using GPS each vertex of polygonal feature boundaries must be established by registering at least 180 readings (i.e. data collected once per second averaged over 3 minutes) of at least four satellites for 100 metre level accuracy. OR. For greater accuracy using differential GPS, consult the British Columbia Standards Specifications and Guidelines for Resource Surveys Using GPS, Release 2.0, March 1997.

Relative (internal) positional accuracy/error

Relative positional accuracy specifies how closely the shape of a feature in its coordinate space reflects its true shape on the ground, and its relationships to other features in the dataset. The true shape of a feature can be established by: 1. digitizing from air photos using photogrammetric methods,

2. ground survey or measurements,

3. location of perimeter or interior points by GPS.

The accuracy/error can be stated as a maximum permitted deviation between a feature's mapped coordinate size and shape and its size and shape as established by one of these methods.

The calculated area of each digital feature must be within 15% of its calculated area as determined by field survey of its perimeter using GPS. OR. Survey traverses of less than 500 m must conform to an accuracy of 5 metres + 1:100 when the absolute positional accuracy required is 10 metres. The traverse should be balanced using a compass rule adjustment.

Digitizing accuracy/error

Digitizing accuracy specifies how closely the location and shape of a feature in its digital coordinate space reflects its location and shape in mapping on physical media such as paper or mylar excluding interpretation error. It is the error commonly associated with the digitizing process. The required accuracy/error of mapped features is related to the scale of data capture, and can be specified in terms of deviation between checkplots and physical media.

All features must be within 0.5 mm of the original map features when plotted on check plots at map scale. For data captured from existing hardcopy maps at 1:20,000 scale, all features must be within 10 metres of their mapped location in projection coordinates.

GPS accuracy/error

Where field data are to be collected with GPS instrumentation, clear guidelines should be present for the level of accuracy required. "British Columbia Standards, Specifications and Guidelines for Resource Surveys Using Global Positioning System (GPS) Technology - Release 2", published by Geographic Data BC, March 31, 1997, provides a classification system in Section B which is suitable for reference from a data capture specification.

Precision

Precision is the degree of exactness with which a quantity is expressed, i.e. the least significant digit of numbers used to represent data. Precision of each numeric value captured should be specified in section 3 - physical data model. Usually, the precision of spatial coordinates is far greater than needed for resource surveys, so is not an issue.

Resolution

Resolution is the degree to which closely related entities can be discriminated. This includes the minimum separation of points along the same feature, and the minimum separation between two features.

For 1:20 000 or smaller scale mapping vertices along the lines defining linear or polygon features must be at least 20 metres apart in ground coordinates.

No two linear features may be less than 20 metres apart,

Resolution may also refer to the amount of detail, or the smallest feature that may be captured.

Section 6b - Minimum Feature Size

In most data acquisition situations the capture of a feature will be influenced by external factors related to the level of detail and logical consistency of the required input. Depending on the type of inventory and the type of feature, this effect will either dictate the geometry of the feature and/or whether the feature should be included in the inventory.

This section defines size thresholds for each type of feature captured. These thresholds define the point at which i) the geometry of the feature changes, or ii) the feature is not captured.

A table can be used to illustrate the thresholds for any affected feature: Example

Feature	Polygon	Line	Point	Reason
Designated Area	area ≥ 1ha.			B, C
Building	area > $900m^2$ and perim. > 100m		area ≤ $900m^2$ or perim. ≤ 100m capture approx. centre	A
River	width > 20m	width ≤ 20m capture approx. centreline		B, C

This table can be read as follows:

Designated Area features are captured as closed polygons when the total area of the feature is greater than or equal to 1 hectare. If the total area is less than 1 hectare, the feature is not captured.

Building features are captured as closed polygons when the total area of the building is greater than 900 square metres and the perimeter of the building is greater than 100 metres. If the total area is less than or equal to 900 square metres or the perimeter of the building is less than or equal to 100 metres, the building is captured as a point.

Rivers are captured as closed polygons when the width of the river is greater than 20 metres. If the width of the river is less than or equal to 20 metres, the centreline of the river is captured.

In addition to the threshold value, the specification must define the **reason** for the threshold, e.g.,

A - based on plot display, i.e., a minimum plot size for a polygon at a particular scale can govern whether the feature is captured as a point or a polygon.

And/or

B - discernibility on the source material, i.e., features below a certain size may not be accurately captured on source material such as aerial photography or satellite imagery.

And/or

C - related to positional accuracy, i.e., certain features should not be captured when their total size is less than the defined locational accuracy.

Section 6c - Data Capture Rules/Requirements

Note this set of options will be added to as necessary.

Include any of these rules that apply to the spatial datasets being captured.

- **Right-Hand Rule**

  An arc that bounds an area feature must be captured such that the feature lies to the right of the line. Equivalently, the boundary of the feature must be oriented in a clockwise direction.

Applicability:	*This rule applies to discrete area features*

- **Direction-of-flow Rule**

  Linear features having a defined discernible gradient or direction-of-flow must be digitized in the downward or downstream direction.

Applicability:	*This rule applies to linear spatial data types.*
Example:	*rivers, pipelines, slides, etc.*

- **Pseudo-node Rule**

  Pseudo-nodes (i.e. 2-nodes, or nodes where only two arcs meet) should be avoided, except where necessary to meet the maximum element size constraints of a particular software product.

- **Self-Intersection Rule**

  Arcs must not intersect (i.e. touch or cross) themselves except at their end nodes. This includes the component arcs of polygons.

- **Inter-Feature Intersection Rule**

  Arcs in a feature class with coverage or network topology must intersect (i.e. touch or cross) each other only at mathematically exact nodes. It may be required that this rule be extended to a group of feature classes; in this case the group must be specified. For three-dimensional data this rule does not apply to the vertical coordinate (e.g. in a highway network two roads that cross each other via an overpass need not be noded together)

Applicability:	*This rule applies to coverage and network spatial data types.*
Example:	*In TRIM rivers and roads are a group of feature classes that are noded together. In Ministry of Forests Inventory data Forest Cover has coverage topology and all edges are noded together.*

- **Polygon Integrity Rule**

  Polygonal feature classes must not contain undershoots or overshoots (i.e. 1-nodes, or nodes that touch only one arc).

- **Single Inside Point Rule**

  A polygonal feature must contain at most one inside point for attribute linkage.

Applicability:	*This rule applies to discrete polygon and coverage spatial data types*

Example: In Ministry of Forests Inventory data Forest Cover has coverage topology, and each forest cover polygon contains a single inside point

- **Horizontal Feature Rule**

  Z-values on a feature with no discernible gradient (i.e. considered to be horizontal within the accuracy of the dataset) should have the same value.

Example: Lakes

- **Vertex Density Rule**

  a) A maximum vertex density (or equivalently a minimum vector length) should be specified. This is stated in terms of the maximum number of vertices per coordinate system unit, or equivalently as the minimum vector length in coordinate system units. This number should be chosen to ensure that the accuracy of the resulting linework is within the stated accuracy of the dataset (i.e. any point on the digitized lines is within the accuracy distance of the actual ground position of the feature being digitized).

Example: If dataset accuracy is 20 m, the minimum vector length should be 10 m.

b) A minimum vertex density (or equivalently a maximum vector length) may be specified. This is stated in terms of the minimum number of vertices per coordinate system unit, or equivalently as the maximum vector length in coordinate system units. One reason for specifying this is to ensure that the accuracy of lines is maintained under projection transformations.

Example: The northern and southern boundaries of the province are linear in Geographic coordinates. However, linear features representing them are usually densified to avoid creating distortion in planar projections.

Applicability of Data Capture Rules to Spatial Data Types

Rule	***Point***	***Linear***	***Discrete Polygon***	***Coverage***	***Network***
Right-Hand Rule			x		
Direction-of-flow Rule		x			
Pseudo-node Rule		x	x	x	x
Self-Intersection Rule		x	x	x	x
Inter-Feature Intersection Rule				x	x
Rule	***Point***	***Linear***	***Discrete Polygon***	***Coverage***	***Network***
Single Inside Point Rule			x	x	
Horizontal Feature		x	x	x	x

Rule					
Vertex Density Rule		x	x	x	x

Section 7 - Tools for Data Capture

This section is optional. It is provided where the custodian requires specific tools be used for the digital data capture process. Guidelines for developing the content of this section are provided.

For some inventories tools specifically tailored for digitally capturing data specific to that inventory may have been developed. Examples of such tools might include forms based applications for capturing attribute information, or modelling tools based on algorithms used to assist in interpretation or class definition.

If such tools are available they should be identified and described as part of the digital data specification. For each such tool the following information should be provided.

1) The name of the tool.
2) The purpose of the tool.
3) Whether use of the tool is mandatory. (Note that use of tool may be mandatory if tool supports some aspect quality assurance such as automated domain or "allowable value" checking.)
4) Minimum and recommended platform (hardware/software) requirements for using the tool.
5) Source for acquiring the tool.
6) Whether any administrative or legal/licensing conditions apply to the tool.
7) How to use the tool or reference to users manual.
8) References to any other documentation about the tool.

Section 8 - Metadata

Although this section is mandatory the guidelines have been developed in lieu of a currently accepted standard.

The logical data model should include metadata elements related to accuracy, timeliness, sources, etc. This type of metadata should be stored in a permanent archive with the features in the archive.

This section outlines metadata that should be stored with digital files from individual projects, to facilitate tracing their history.

Metadata stored with project data should contain:

- A reference to the document(s) defining the data's logical and physical data models.
- Information related to how and when it was collected. For example:
  - Contract identification
  - Project identification
  - Survey year
  - Data collection methods
  - Project administrator
  - Agency and person responsible for field survey / data collection
  - Agency and person responsible for data recording / entry and / or digitizing
- Operational or administrative information related to contracting stages or processing should NOT be in the metadata.

Two types of metadata occur:

1. a record of field mapping information in the header of the RIC Inventory Data Form (Table below)
2. a meta data table stored with each spatial dataset.

All metadata must be included with all data sets when submitted to any government repository at the end of a project or contract. See fields 1 - 9 below

Project metadata

Table 1- Example of Fields and Attributes for typical RIC Field Inventory data form

Field #	Name	Description	Length	Format*	DBF field name
1	Project Name	The common name of the project – usually a well known local place or feature.	40	c-e-l	Proj_Name
2	Geographic Location	The geographic area of the mapping project	40	an-e-l-u	Geog_Loc
3	Data owner/ custodian	The public or private-sector organization responsible for maintaining the data.	40	c-e-l-u	Org_Name
4	Project Manager	The person responsible for the mapping project.	40	c-e-l-u	Proj_Man
5	Mapper	The field specialist doing the inventory. Where more than one mapper is working on the project, the project leader.	30	c-e-l-u	Mapper
6	Survey Intensity Level	A class used to indicate the extent to which the data has been checked on the ground. Classes are:	1	n-x-r	SIL
7	Year Surveyed	The year (YYYY) in which the ground survey for the project was completed.	4	n-x-r	Year_Surv
8	Date Recorded	The completion date (mm-dd-yyyy) for entering project and inventory data.	8	n-x-r	Date_Rec
9	Recorder Name	The person and agency who originally digitized the Mapping data.	30	c-e-l-u	Recor_Name

***** Field Specification conventions used in this example taken from Chapter 2 of "INTERIM (1996) 'Terrain Database Manual' Standards for Digital Terrain Data Capture in British Columbia, June 1996. In absence of other standards for field specifications it is recommended this standard be used in the interim

Dataset metadata

Note: The instructions in this document will be revised if the BC Government standardizes on a common content standard for Geospatial Metadata. A commonly used standard is the U.S. Federal Geographic Data Committee (FGDC) Content Standards for Digital Geospatial Metadata. An important emerging standard for metadata is ISO TC211, which would likely be adopted by both the

U.S and Canada when completed. As a guideline one of these two standards should be followed, particularly the mandatory items.

Metadata should be made available in .DBF format, for maximum compatibility with archive databases.

Section 9 - Quality Assurance Procedures

This section is mandatory. Guidelines for developing the content of this section are based in most part on current practice in well-managed environments.

Quality Assurance is an important component of any digital data capture program. It is the process by which consistency of the digital data being delivered is confirmed to be in compliance with the digital data specification itself. As such it is mandatory to describe quality assurance as applies to the particular inventory.

Following are guidelines as to the content for this section. It is important to note that the scope of this section is limited to quality assurance relating directly to the digital data capture process (e.g. digitization, keypunching, scanning or any other computer automated digital capture technique) and to the structure of the resultant digital data. Quality assurance relating to actual content as captured in the field or office through inventory, survey, measurement, or interpretation is not included.

This section should state whether Quality Assurance is carried out or not. It should identify whether the process is informal and not rigorously applied, or whether the process is formal and rigorous. It should distinguish between visual checks and automated techniques and identify the stage during which each takes place that is what is the overall QA process.

For each step in the QA process the following should be described:

i) What is being checked.
ii) The materials (e.g. check plot) or tools (e.g. validation program) required to undertake the QA step. If data capture tools, as provided by the custodian, play a role in quality assurance this should be described in Section 10, Data Capture Tools.
iii) A description of the procedure and if relevant an example of the output should be provided including what to look out for in the output.
iv) How to address any defects that are found.

If the QA process is documented, the relevant documents should be referenced.

Although the level of quality assurance, and the rigour to which it is applied, will vary from inventory to inventory, it is recommended the following minimum quality assurance be performed on each digital data set.

i) a validation of all domains or “allowable values”;

ii) a validation that all classes and their representation are consistent with the data model, that is each geographic object (class or feature) is represented by the right Geometric Object (spatial primitive);

iii) a verification that all mandatory fields are populated,

iv) a verification of any specified digitizing rules as identified in Section 6c, Digitizing Rules; and,

v) a verification of digital capture accuracy, if one is specified in Section 6a, Digital Capture Accuracy

Note that BC Environment has a Quality Assurance process specified for their ARC/Info environment. It can be accessed via the Internet at: http:/www.env.gov.bc.ca/gis/.

Section 10 - Cartographic/Representation/Output

This section is optional. It should be present if the custodian wishes to specify how the dataset is to be rendered either as hardcopy cartographic output or as a screen image in a GIS or viewing tool. Following are guidelines based on current practice for what this section should contain.

The specifics of the guidelines will be platform-dependent. Where more than one platform will be used to view the data multiple specifications should be provided.

Generally the following items must be specified in order to ensure a consistent view of the dataset in every output format.

Symbology

Symbology describes how spatial elements are to be depicted graphically. It includes such things as line colour, line style, line weight, line pattern, fill colour, fill pattern, point symbol (e.g. in Microstation, a graphic cell).

Annotation/Labeling

Labels are usually formed from some combination of attribute values, possibly concatenated, encoded or symbolized in some way. It should be specified how labels are related to the original attribute values. Any special symbol sets should be indicated. Any rules governing the positioning of labels should be specified. Any software products used to generate cartographic labels should be identified.

Cartographic alteration/Visual Enhancement

In some cases it may be necessary to alter or delete positionally correct features for the purposes of visual clarity (Note that any such alteration should be applied to output products only, NOT the original source data!). This includes such alterations as offsetting coincident linework, deleting segments of lines where they cross text elements or other lines, and adding graphic elements. Any alterations made to features of a given feature class should be specified.

Surround

Surround content should be specified, including: Title, provincial logo, mapsheet name or description of area covered, version number, tick marks, last update date, legend, scale, scale bars, north arrow (at map centre), statement of projection and datum, plot date, originator of plot, base map, source of thematic data, legend with symbology, neatline with fiducial tickmarks or grid (either lat/long or UTM)

A sample layout should be provided.