# OREGON GEODATA COMPATIBILITY GUIDELINES

## *INTRODUCTION*

There is a great need in Oregon for a Framework, or foundation, of easily and economically shareable information concerning the physical, biological, sociological, and economic features of our State. This kind of information is commonly called geographic information, which means that the information can be linked to specific geographic locations by such geographic locators as an address, a tax lot number, a mile post, a watershed unit, etc. It is widely acknowledged that 85% to 90% of all information collected and used by government agencies and utilities is geographically related. The use of guidelines and standards will make the collection, sharing and use of a geographic information Framework more efficient and less expensive.

The geographic data Framework in Oregon should be a consistent, standardized set of digital geospatial data and supporting services that will:

- provide a geospatial foundation to which an organization can add detail and attach attribute information
- provide a base on which an organization can accurately register and compile other themes of data, such as zoning, permits, assessment data, accident data, hazardous waste site data, etc.
- orient and link the results of an application to the landscape.

The Oregon geographic data Framework will help data producers locate their information in its correct position and provide a means of integrating this information with other geospatial data. Benefits from the development of a statewide geographic data Framework include reduced expenditures for data, increased ease of obtaining and using data collected by others, accelerated development of critical applications, increased number of customers for data products linked to the Framework, and improved recognition of programs.

One of the most important task*s* in developing a geographic data Framework for Oregon is to develop data standards for the various data themes that are most commonly needed and shared by users. When data standards are clearly defined, useful data can and will be developed and shared by multiple data producers and users all across the state.

**The guidelines presented here are intended to direct the creation of standards for geographic data** and establish a vision for a statewide geodata Framework that closely parallels Framework development throughout the rest of the country. The national effort is guided by the Federal Geographic Data Committee.

## *ROAD MAP*

### Vision Statement

In the fall of 2000, a diverse group of individuals and organizations from the Oregon Geographic Information System (GIS) Community participated in a forum on GIS issues in Salem, Oregon. As a result of this forum, the Oregon GIS Community developed, and the Oregon Geographic Information Council adopted, the following **vision statement** to guide future activities.

*The Oregon Geographic Information Council (OGIC) envisions an environment for developing and managing Oregon's geospatial assets that:*

***a.*** *Encourages and supports the contributions of everyone in the Geographic Information Community;*

***b.*** *Leverages the human, technical, and information resources of the Geographic Information Community to accomplish measurable statewide and local objectives and to solve real problems;*

***c.*** *Provides an organized Framework to enable data integration and sharing of both spatial and non-spatial applications and information;*

***d.*** *Raises the awareness and knowledge of all citizens and businesses in the state about the uses and benefits of all geospatial technologies;*

***e.*** *Serves as a facilitator between geospatial technology and the broader realm of information technology;*

***f.*** *Prevents or discourages misuse or abuse of public data;*

***g.*** *Spreads the benefits of geographic information and geospatial technology broadly and equitably to improve the quality of life and the environment for Oregon's citizens.*

The **objectives** to be achieved as a result of that vision were identified as follows:

- **Coordinate Geographic Information Management Statewide**
- **Promote the View of Geographic Information as a Critical Information Asset**
- **Promote Partnerships and Collaboration to Develop and Use Geographic Information**
- **Enable Access to Geographic Data**
- **Address Legal and Policy Issues Related to Geographic Data Distribution**
- **Improve Geographic Information Framework Management**
- **Enable Integration of Non-Framework Geographic Data**
- **Improve Data Quality**
- **Support Data Sharing**
- **Support Provision of Services for Geographic Information Development and Use**
- **Promote Broader Use and Benefit of Geographic Information Systems**

As another outcome of the forum, the Oregon Geographic Information Council developed the 'Oregon Strategic Plan for Geographic Information Management', adopted in June 2001. The Strategic Plan calls for the establishment of a Framework Implementation Team (FIT) and the design of an inclusive data standards development process. The Framework Implementation Team has been established and is composed of representatives from all levels of government, utilities, academia, and the private sector. The Oregon Geographic Information Council's Framework Implementation Team has identified and prioritized 13 primary Framework data themes, containing over 100 individual data elements. There are Framework Working Groups working concurrently on 10 of these themes, with over 200 people in the various groups. Each Group has two items on its agenda:

- Develop or revise the implementation plan for the Framework theme
- Propose an existing or revised data content standard for the Framework theme

The individual Framework Work Groups will conduct research to determine if a national standard or other state standard exists that will meet the needs of the GIS community in Oregon, perhaps with slight modification. The flowchart in Figure 1 indicates the drafting and endorsement phases of the standards initiative. A key element of the process is the presentation of each standard for endorsement by the GIS community at a semiannual Standards Forum.

The standards process is very inclusive and will be driven by the needs of the GIS community. When the community has determined the appropriate standards, those standards will be endorsed at the executive level in state government, mandated for state agencies and academic institutions, and strongly recommended for adoption and use by other levels of government and the private sector.

## Standards Development and Endorsement Process

The Oregon Geographic Information Council (OGIC) and the Oregon Watershed Enhancement Board (OWEB) both have certain mandates related to data standards. The OGIC is mandated by a Governor's Executive Order to develop geographic information guidelines and standards to be adopted by the Information Technology Executive Council. The Oregon Watershed Enhancement Board is mandated by ORS541.365 to establish protocols, policies and

procedures necessary to integrate and organize geographic information and to coordinate the information, data and data retrieval needs of the natural resource agencies of the state with the Oregon Geospatial Data Clearinghouse. The following standards development and endorsement process has been agreed upon by the Oregon Geographic Information Council and the Oregon Watershed Enhancement Board:

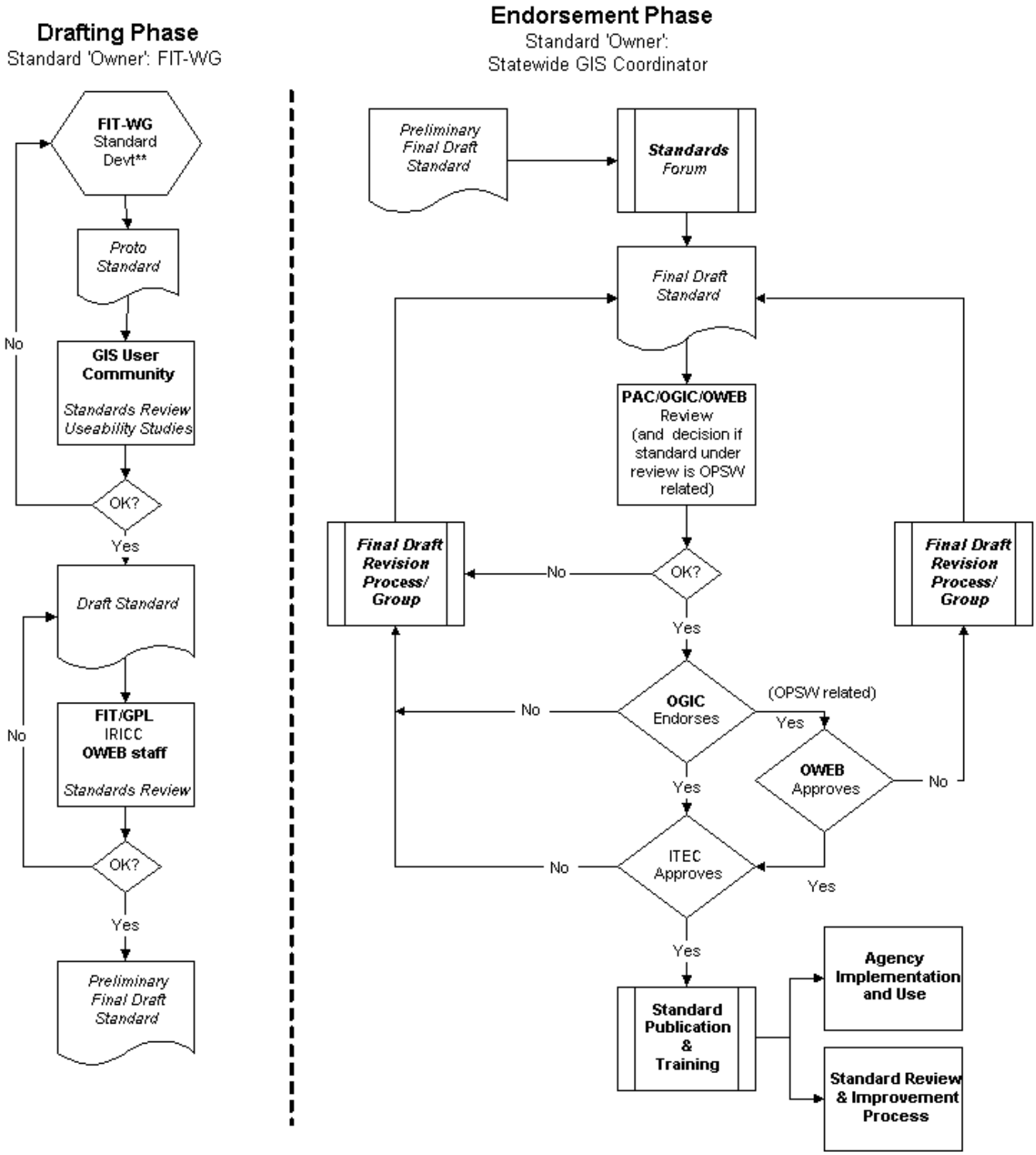
*Formulation and Refinement*

1. The Framework Implementation Team will identify standards requirements, including standards for each of the defined Framework data themes.
2. OWEB will identify those data themes that are relevant to the implementation of the Oregon Plan for Salmon and Watersheds (Oregon Plan) so that each FIT Working Group will know if OWEB Board approval will be required and involvement of the Oregon Plan teams will be necessary.
3. The Framework Implementation Team (FIT) Working Groups will draft and/or identify required standards. The FIT Working Groups will test proposed standards against the guidelines presented here. The FIT will submit proposed standards to the GIS Community for review.
4. The FIT Working Groups will revise standards as appropriate based on input and useability tests by the GIS Community. The FIT, the GIS Program Leaders (GPL), and the Interorganizational Resource Information Coordinating Council (IRICC) will review the revised standards. If the standard is related to the Oregon Plan, the OWEB staff will also review the revised standard.
5. The FIT Working Groups will revise standards as appropriate based on these reviews and the FIT will move each standard to the Endorsement phase of the process.

*Endorsement*

5. Each draft standard will be presented to the GIS Community at a Standards Forum. The FIT Working Groups will revise standards based on input from the Forum, if necessary.
6. If standards are endorsed at the Forum, OGIC's Policy Advisory Committee will review and recommend proposed standards to OGIC. If the standard is related to the Oregon Plan, an OWEB Program review will be completed before a recommendation is made to OGIC. If revisions are needed, the FIT Working Groups will make revisions and the reviews will be done again.
7. If the standard relates to the Oregon Plan and OGIC endorses it, OWEB will review and approve the proposed standard. OGIC, and OWEB if appropriate, will provide to the Oregon Information Technology Executive Council (ITEC) a policy recommendation for specific standards adoption.
8. The Oregon Information Technology Executive Council will review and adopt the proposed standards and authorize them for State agencies and academic institutions, while sending a recommendation for adoption to the OGIC and the OWEB for distribution to the GIS Community at large. Any required revisions during the endorsement phase will be done by the FIT Working Groups.

# FIGURE 1




** The relationship of any specific standard under development to the Oregon Plan for Salmon and Watersheds (OPSW) will be made explicit as early as possible.

## Standards Classification

The following table indicates the standards currently identified and scheduled for development by the Oregon FIT:

**Table of Standards Classification**

| | |
|---|---|
| ***Data Useability and Transfer Standards*** | |
| Content Standard for Geospatial Metadata | Documents data sets, describing content, history, accuracy, quality, and other characteristics of data |
| Projection and Datum Standard | Defines a particular means for representing the three dimensional Earth on a two dimensional map surface |
| Archival Standard | Defines a particular methodology and protocol for archiving geodata as updates are made incrementally |
| ***Data Content Standards*** | |
| Geodetic Control | Basic reference Framework for all geodata |
| Cadastral (property ownership) | Land rights data fundamental to a modern land records system |
| Administrative Boundaries | Widely used district, service, and government boundaries |
| Cultural Features | Situs addresses, building outlines, archaeologic sites |
| Transportation | Statewide road centerline network and related features |
| Digital Orthoimagery | Georeferenced image from photography or remote sensing |
| Elevation | Digital elevation model of georeferenced vertical positions |
| Hydrography | Surface water network and related features |
| Geoscience Features | Geology, geomorphology, soils, caves, geohazards |
| Bioscience Features | Fish habitats, fire data, terrestrial species ranges, vegetation |
| Land Cover/Use | Public and industrial ownership, land cover, land use |
| Climate Features | Rainfall, snowfall, temperature ranges, rain intensity/flow |
| Utilities | Local service facilities and cross-country transmission features |

## *GUIDELINES*

The objectives of this section of the Geodata Compatibility Guidelines are three-fold:

- to guide the overall process for creation and adoption of geodata standards
- to establish a vision for geodata Framework development throughout the state
- to provide a template for the development of individual geodata standards

There is a need among geodata users in Oregon for a few common themes of geographic data that can be easily and economically shared by all. To enable the ease and economy of data sharing, these common data themes must be developed in a standardized fashion.

The remainder of this document offers specific guidance on the formulation of proposed geodata standards. The technical and operational context subsection describes a distributed geographic data Framework in Oregon within

which geodata standards should be developed. The issues in the technical/operations subsection represent the minimum set of topics to be addressed in the development of each individual geodata standard and describe the technical and operational context for the Oregon geodata Framework. The data characteristics subsection contains a brief description of the common Framework data themes that need to be standardized, including suggested minimum graphic and attribute content. Each individual data standard may contain recommended data characteristics that vary from the Guidelines, based on the theme expertise within the group tasked with developing individual standards.

## Expectations

Statewide standards support the Oregon geodata Framework. There are several expectations for geodata standards:

***Within Task Force Scope*** - Geodata standards will be within the scope of the vision statement and objectives of the Oregon Framework Implementation Team, as stated earlier in this document, and the goals and objectives of the Oregon Geographic Information Council. Geodata standards must relate to geospatial data, cover appropriate topical areas, and standardize either data or processes to advance data sharing and minimize duplication of effort.

***Future Focused*** - Future focused means that geodata standards are intended to remove impedances to sharing information rather than changing existing successful data sharing arrangements. Geodata standards should be developed to promote new and enhanced interaction with existing coordinating mechanisms, such as OGIC and OWEB, that have interest in the generation, collection, use, and transfer of spatial data. Geodata standards need to focus on solving future problems. Geodata standards are not intended to re-formalize existing solutions.

***Structured*** - Geodata standards need to be developed and presented in a structured manner that will lead to understandability and useability by consumers. This guideline provides minimal guidance for development and documentation of standards. There are many structured methodologies that can be employed by standards developers that will lead to complete and understandable standards. This guideline does not specify a development methodology.

***Technology Independent*** - Geodata standards will not constrain technology development. They will not be developed or implemented in a way that limits the use of new and emerging technologies. To maximize use of the standard, they also will not be written or implemented in a way that limits any vendor or technology.

***Integrated*** - Geodata standards will be integrated with one another and with related standards. This means there will not be overlapping definitions, authorities, or procedures. Standards development will be coordinated to eliminate duplicate efforts and to maximize the efforts of the volunteers contributing to and implementing standards. Geodata standards will lead to an integrated geographic data Framework for Oregon.

***Evolving*** - Geodata standards will evolve as technology and institutional mandates change. The standards will be written to allow for evolution and will accommodate backward compatibility for information gathered under previously known standards. There will be known update and maintenance procedures that are timely and responsive to changes. The procedures will be documented as a part of the standards development process.

***Supportable*** - Geodata standards must be supportable by the geospatial vendor community. They will be developed in a manner that is supportable by known or emerging technology.

***Publicly Available*** - Geodata standards will have a broadly based public notice of their availability. Geodata standards will not be developed from copyrighted or proprietary standards that would limit the ability of the final standard to be publicly available. They will not contain any copyrights or other limitations on their use or reproduction. Geodata standards will be available electronically and via the Internet.

***Complete and Consistent*** - Geodata standards will be complete in terms of the standards components and methodology described in this guideline. Geodata standards will have a consistent form and format.

## Geodata Standards Goals

The goal of the Framework Implementation Team is to provide guidelines for the development and documentation of geodata standards, with a minimal structure for standards developers. This structure is intended to support FIT Working Groups, in their efforts to develop and recommend the use of geodata standards.

Geodata standards are intended to increase interoperability among automated geospatial information systems. A major objective of geodata standards is the eventual development of a statewide digital spatial information resource with the involvement of all geodata users, including but not limited to, utilities, academia, private sector, Federal, State, tribal, regional, and local governments. This statewide information resource, integrated by guidelines and standards, will enable sharing and efficient transfer of spatial data between producers and users. Enhanced coordination will build information partnerships among government institutions and the public and private sectors, avoiding wasteful duplication of effort and ensuring effective and economical management of information resources in meeting essential user requirements.

## Geodata Standards Format

The following guidelines with regard to format will apply to all geodata standards developed and promulgated through the activities of the Oregon Framework Implementation Team, the Oregon Geographic Information Council, and the Oregon Watershed Enhancement Board:

- Geodata Standards shall have a title page that will include the title of the standard, the responsible FIT Working Group or other subcommittee, and contact information including postal and e-mail addresses.
- Geodata Standards shall have a table of contents. All pages will be numbered and dated.
- Geodata Standards shall contain an introduction that will describe the following:
    - Mission and Goals of Standard
    - Relationship to Existing Standards
    - Description of Standard
    - Applicability and Intended Uses of Standard
    - Standard Development Procedures
        - ⇨ Participants
        - ⇨ Comments and Reviews
    - Maintenance of the Standard
- The body of the standard shall follow the introduction.
    - The body of the standard will address all topics in the technical/operational subsection of this guideline.
    - If specific topics are not applicable to an individual data theme, describe why that topic does not apply.
    - Individual standards may necessitate additional technical/operational topics not articulated in this guideline.
    - The data characteristics of any individual standard may vary from those indicated in the data characteristics subsection of this guideline.
    - Every standard should contain a minimum set of graphic and attribute data elements.
    - Each standard may, in addition, include an optional set of graphic and attribute data elements.
- References will be listed in a separate section.

- The Framework Implementation Team shall receive digital copies of the standard from the working group in Microsoft Word format. Digital versions shall be made available at the Oregon Geospatial Data Clearinghouse's home page in PDF format at http://www.gis.state.or.us.

Standards will also address the following topics:

- Content

  Identify what is being standardized and the scope of the standards project.

- Need

  Identify why this standard is being proposed, describing as much as possible the benefits of developing the standard and the consequences of not developing the standard.

- Participation

  Identify participating agencies or organizations and methods that were used to assure a consensual development process.

- Integration

  Describe the relationship of this standards proposal to ongoing geodata standards efforts and existing geodata standards. If there are relationships with other existing standards, identify both the standard and the relationship.

## Geodata Standards Technical and Operational Context

The following discussion establishes the context within which geodata standards for Oregon will be developed. Each of the issues below plays an important role in the direction of standards development and will be addressed as appropriate within the content of individual standards. At a minimum, each standard should be checked against all of the following issues to ensure that each issue has been resolved appropriately.

***Data Environment***

Access to a published version of geodata sets (current and past versions) by information networks and digital media should be supported. Users will be able to find available Framework geodata through the Oregon Geospatial Data Clearinghouse where all Framework metadata will be stored and accessible. It may be appropriate for some geodata sets, however, to be stored and maintained in a distributed environment at the site where they are produced. In this case, a copy of the official data set will be available from the Clearinghouse, or appropriate arrangements must be made to provide real-time data access from distributed locations.

***Reference Systems***

Use of a common means of referencing coordinate positions on the Earth is essential to allow geodata from various sources and different geographic locations to be joined and integrated. In addition, to be used as the locational Framework for other thematic data, the coordinate system must be well established, clearly specified, and consistent with national and world use. Multiple datums are currently in use for various data themes. The Oregon geodata Framework should support the use of a single consistent datum for referencing horizontal coordinate information and a single consistent datum for referencing vertical coordinate information. In addition, support should be given to efforts toward converting existing data to the latest recognized horizontal and vertical datums where such conversion is feasible and of value. The latest recognized datum for horizontal coordinate information for geodata

is the North American Datum of 1983/1991. The latest recognized datum for vertical coordinate information is the North American Vertical Datum of 1988.

***Integration of Themes***

Geodata sets will be integrated across themes. This goal may be difficult to achieve for places where data for various themes are collected at different resolutions and by different data producers. However, as integrated geodata sets are developed, these data sets should be held to the same standards as geodata containing a single theme.

***Encoding***

Geodata should be encoded using vector or raster spatial data models as appropriate to theme and feature content. Raster data models are appropriate for image data; vector data models for geodetic control, planimetrics, hypsography, transportation, hydrography, administrative boundaries, infrastructure, cadastral data, land cover, soils, geology, etc. Vector-based spatial objects must conform to topological rules.

***Resolution***

To meet the different needs of users, the geographic data Framework in Oregon should support geodata at varying resolutions. Multiple resolutions of the same data theme (for example, land use data at different levels of generalization and having positional accuracies of 50, 10, and 1 meter) may exist for any given location. Where practical, and where suitable higher resolution data exist, the lower resolution data may be generalized from the higher resolution data. The data should be generalized according to a standardized set of rules for each theme. Alternate rule sets may be needed for a broad range of generalization.

***Accuracy***

Accuracy considerations are critical for data interoperability. The accuracy of any particular dataset should be appropriate for the applications for which it is used. The accuracy, at whatever level, must be documented in the metadata according to the minimum criteria indicated in the Oregon Core Metadata Standard.

***Edge Matching***

As a general principle, geometric seamlessness is desireable. However, the accruacy of geometric postions of geodata to be integrated from various sources should not be compromised to achieve geometric seamlessness. For example, if a road crosses the boundary of two (otherwise equivalent) geodata sets from two different sources, the positions of the road at the common edge should be geometrically joined only if it can be achieved within the postional accuracy of the dataset.

If it is not possible to achieve geometric seamlessness within the positional accuracy of the datasets, the disjoint lines that represent the location of the road should instead be associated through a common attribute feature, resulting in "logical seamlessness." The coding schemas necessary for such logical seamlessness should follow the schemas currently under development at the national level. The reasoning for this is based on the assumption that organizations that integrate data would not have information better than those that contributed the data, and so there is little basis for "repairing" the data. Of course, data producers should be encouraged to work with those in adjoining jurisdictions to align their data and remove these ambiguities.

***Feature Identification Code***

To allow maintenance of users' existing data investments, to minimize the effort required to integrate geodata from various sources, and to link data represented at different resolutions, a consistent method of identifying units of geodata is needed.

To provide for these capabilities, the geodata Framework in Oregon should employ a model of geographic reality that utilizes the concept of a 'feature', which is a description of geographic phenomena (for example, a road) at or near the Earth's surface. Each occurrence of a phenomenon (e.g., a road) should be assigned a unique, permanent feature identification code. A feature should be linked to spatial objects (such as points, lines, and polygons) to identify the location of the feature; different sets of spatial objects should exist for different resolutions.

The feature identification code:

- provides users a "key" through which they can associate geographic data from various sources to their own attribute data,
- serves as a tracking mechanism for performing transactional updates,
- provides a link among representations of a feature at different resolutions and across different areal extents.

Once assigned, the "permanent" code should change only when absolutely necessary and following a standardized process.

***Attributes***

When a feature is captured in digital form, it may be further described by a set of attributes and relationships. Attributes define the feature's characteristics; examples include name and function. Relationships may be defined to express interactions that occur between features, such as flow in a river system or connectivity in a transportation network.

***Transactional Updating***

The geodata Framework in Oregon should support transactional updating so that data producers make change files available and users only need to process changes. This approach reduces the impact of changes on existing investments. The metadata for geodata sets should support the concept of date stamping for individual features or, at a minimum, for individual tiles or other geographic organizational schemas.

***Records Management and Archival***

Past versions of geodata should be retained so that information is available for historical or process studies. Access to past versions is necessary to support historical thematic data and time-based studies essential in many applications. Past versions of geodata should be retained in an accessible geodata archive with the appropriate metadata.

***Metadata***

Metadata detailing the characteristics and quality of the geodata must be provided. Metadata must follow, at a minimum, the Oregon Core Metadata Standards and should make every effort to meet the more rigorous standards set forth in the Federal Metadata Content Standard, where feasible. Metadata is of crucial importance to the geodata Framework in Oregon. A user should be able to access metadata regarding any geodata set completed for any location easily and effectively. The metadata should provide sufficient information to allow the user to determine if that geodata set will meet the intended purpose, as well as telling the user how to access the data.

## Data Characteristics

The information content of the Oregon geodata Framework should include the following commonly shared foundational data themes:

- geodetic control
- cadastral data
- administrative boundaries
- cultural features
- transportation
- digital orthoimagery
- elevation
- hydrography
- landcover/land use
- climate
- geoscience features
- bioscience features
- utilities

These themes serve as the shared foundation and reference upon which most, if not all, other thematic data sets are compiled. The Federal Geographic Data Committee's Development of a National Digital Geospatial Data Framework specifies a similar list of commonly shared data themes. In addition, many other states have adopted similar lists of data themes as a necessary foundation upon which to develop a shared and shareable statewide geodata Framework. The list of data themes above reflects the most commonly needed and shared geodata in Oregon. Each of the data themes indicated above should be standardized in order to ensure the ease and economy of data sharing state wide. The standards to be developed and adopted for each individual data theme should address, at a minimum, the graphic and attribute content indicated below. In addition, it is anticipated that the standards for each data theme will address a host of issues and data content appropriate to that theme, as determined by the data producers and users of that data theme.

Geodetic Control

Geodetic control provides the means for determining locations of features referenced to common, nationally-used horizontal and vertical coordinate systems. Geodetic data provide the basic reference Framework for all geodata and provide a method for relating different layers and sets of geodata to one another. Geodetic data are essential in developing a common coordinate reference for all other geographic features. Horizontal or vertical location is used as a basis for obtaining locations of other points. The Oregon geodata Framework should include, at a minimum, the following geodetic control feature and attribute data:

- geodetic control points, referenced to the National Spatial Reference System maintained by the National Geodetic Survey
- station name
- bench mark
- GPS base station
- monument/survey marker
- feature identification code
- latitude and longitude (with accuracy code) for each control point, or state plane coord., or UTM coord.
- ellipsoid height or orthometric height (with accuracy code) for each control point
- selected projection

The latitude, longitude, and ellipsoid height should be determined relative to the Geodetic Reference System of 1980 reference ellipsoid, a mathematical model of the Earth. The orthometric height should be determined relative to the most current geoid model for the United States, GEOID93, developed by the National Geodetic Survey.

Cadastral (property ownership)

Cadastral, or land rights, information is arguably the most important geographic data set for local government users. Cadastral information is the graphic and attribute data describing parcels of land and the rights people hold to those parcels. Cadastral data serves as the foundation upon which the majority of local thematic geodata is compiled. In Oregon, the Public Land Survey System (PLSS) serves as the cadastral reference grid to which land rights features and attributes are linked. The cadastral geodata Framework should include at least the following features and attributes:

- 1/4 section, section, township, and range lines (PLSS)
- PLSS section, township, and range numbers
- subdivision boundary, blocks, lots
- subdivision name
- tax lot boundary
- feature identification code
- accuracy level
- boundary corner
- document reference

Administrative Boundaries

Administrative and governmental boundaries are the district, service, governmental, election, and census polygons that serve to organize administrative and governmental functions. Administrative and governmental boundaries define geographic areas within which resources can be targeted and services can be reasonably managed. The geographic features for administrative and governmental boundaries that should be considered for inclusion in the Oregon geodata Framework are:

- fire or emergency district
- public school district
- utility service boundary
- tax code boundaries
- zoning development boundary
- wilderness
- greenways
- watershed council boundary
- political boundary
- county boundary
- city boundary
- American Indian Reservations and Trustlands
- zip code boundary
- census blocks and tracts

Each should have the name and the applicable Federal Information Processing Standard (FIPS) code, if available, to serve as its unique identifier. In addition, the boundaries of the features should include information about other features (such as roads, railroads, or streams) with which the boundaries are associated.

Cultural Features

Addresses are an important locational key for local governments, particularly for emergency services. Addresses are typically attribute information that are linked to individual tax lots as discrete situs addresses. One of the

primary difficulties in developing an effective and comprehensive situs address database for local government is that there are often multiple addresses for individual tax lots, and sometimes a single address for multiple tax lots. Because of the one-to-many and many-to-one aspect of the relationship between addresses and tax lots, it is necessary, or at least advisable, to develop a graphic point coverage for situs addresses. There are also many other cultural features that are an important part of this theme. The geodata Framework for cultural features in Oregon should include the following feature and attribute data elements:

- situs address point coverage
- street number, name, prefix and/or suffix direction, and type
- archaeological sites
- public building outlines
- cemeteries
- demographic data
- historic sites
- fire water sources
- fire lookouts
- critical facilities
- hazardous materials
- recreation sites

Transportation

The primary and secondary road network and associated features, facilities, and attributes constitute the transportation theme. This theme includes a linear referencing system important for locating incidents within the network. In addition, a feature identification code should be developed and applied to every segment of the network and to all associated features and facilities. The geodata Framework in Oregon for transportation data should include, at a minimum, the following feature and attribute data elements:

- airports
- bridges
- culverts
- traffic analysis zones
- transportation structures
- road centerlines
- address ranges
- railroads
- trails
- ports
- heliports
- light houses
- military operations
- navigation hazards
- airports, runways
- VOR
- cablecar and chairlifts
- linear referencing system
- name
- feature identification code
- functional classification

Digital Orthoimagery

An orthoimage is a georeferenced image prepared from a perspective photograph or other remotely-sensed data in which displacements of images due to sensor orientation and terrain relief have been removed. Many geographic features can be interpreted and compiled from the orthoimage. Orthoimages can serve as a backdrop, in addition to linking the results of an application to the landscape. The Oregon geodata Framework should include, at a minimum:

- digital orthoimages, cast on the latest available datum
- feature identification code for each image
- measurable accuracy and resolution
- image georeferencing

The geodata Framework will likely include imagery that varies in resolution from sub-meter to tens of meters. High-resolution data (one meter or smaller pixels) are thought to be the most useful to support local data needs. For some regional, state, and federal uses, lower resolution imagery may be required.

Elevation Data (hypsography)

Elevation refers to a spatially referenced vertical position above or below a datum surface. Digital, georeferenced elevation data can exist in several forms, including digital elevation models (DEMs), triangulated irregular networks, vector contour files, and spot elevations. The other forms of elevation data can be derived from DEMs, so the DEM should serve as the minimum element for elevation data within the Oregon geodata Framework. The geodata Framework for elevations of land surfaces should at least include:

- digital elevation models
- feature identification code
- density of elevation values
- selected base datum

Many existing land surface elevations are referenced to the National Geodetic Vertical Datum of 1929, but implementation of the National Geodetic Vertical Datum of 1988 should be addressed in any standard that deals with elevation data.

Hydrography

Hydrography defines a surface water feature that may or may not be connected to other surface water features. These surface water features are commonly referred to as reaches. The hydrography geodata Framework in Oregon should at least include the following feature and attribute components:

- stream reaches
- open water shorelines
- miscellaneous features (wells, springs, watersheds, etc.)
- name
- feature identification code
- connectivity (flow paths)
- direction of flow
- measurable accuracy level or range
- classification by reach type

Utilities

It may be that standards for utilities are developed in two or more phases, one or more for service facilities that are provided or managed at the local government level, and one or more for cross-country transmission lines,

distribution lines, and facilities generally managed by public utilities or the private sector. The general data content for the infrastructure geodata Framework in Oregon should, at a minimum, include the following:

- transmission/distribution lines (electric, gas, telecommunications)
- water/wastewater/stormwater pipelines
- node facilities (manholes, valves, poles, transformers, towers, outfalls, etc.)
- feature identification code

Geoscience Features

[NOTE: Descriptive text for this theme needed here.] The features of the Geoscience Framework data theme for Oregon should include:

- geology
- geomorphology
- geohazards
- soils
- caves
- feature identification codes

Bioscience Features

Bioscience features relate to biological datasets of statewide concern. Many of the bioscience features relate to the biological information needs of the Oregon Plan for Salmon and Watersheds established by Executive Order. The goal of the Oregon Plan is to enhance, restore, and protect Oregon's native salmonid population, watersheds, fish, and wildlife habitat and water quality while sustaining a healthy economy. Thus, the features of the Bioscience Framework data theme for Oregon should include:

- plant, fish, and wildlife species locations and ranges
- fish and wildlife habitats
- current and historic vegetation communities
- wetlands
- seed zones
- fire occurrence, burned areas, fuel model
- feature identification codes

Landcover/Land Use

[NOTE: Descriptive text for this theme needed here.] The features of the Landcover/Land Use Framework data theme for Oregon should include:

- industrial ownership
- landcover
- land use
- public ownership
- feature identification codes

Climate

[NOTE: Descriptive text for this theme needed here.] The features of the Climate Framework data theme for Oregon should include:

- 100 year peak flow
- 24 hour rain intensity
- annual rainfall
- annual snowfall
- RAWS
- temperature ranges
- feature identification codes

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[Note: Much of the text used in the body of the Guidelines document and in Appendices A and B was borrowed from the FGDC's Standards Reference Model, 1996 and the Development of a National Digital Geospatial Data Framework, 1995.]

## Appendix A - FIT Working Groups Evaluation Criteria

The FIT Working Groups will test prototype standards documents against the Compatibility Guidelines at step 2 of the standards formulation and refinement process, prior to release of the standards to the GIS Community for the first time. The following describes the review criteria to be used at this stage:

*Within Task Force Scope*

Is the standard topic included in the Oregon Geodata Compatibility Guidelines?

Is the type of standard proposed a data standard or a process standard?

Does the standard proposal relate to geospatial data or processes?

Does the standard proposal advance data sharing or minimize duplication?

Does the standard proposal have a statewide scope?

*Future Focused*

Does the standard proposal remove an impedance to data sharing?

Does the standard proposal promote new or enhanced coordination?

The standard does not re-formalize an existing standard or procedure.

*Structured*

Is the standard presented in an understandable and useable manner?

Does the standard follow the format of the Geodata Compatibility Guidelines?

Does the standard contain all necessary documentation?

*Technology Independent*

Does the standard proposal stand independent of a specific technology solution?

The standard proposal does not limit any appropriate vendor from access.

*Integrated*

Are there other similar standards available or is there other similar standards development ongoing?

The standard proposal does not overlap with an existing standard.

Is the standard development coordinated with related standards?

*Evolving*

Does the standard allow for updates?

Does the standard include documented maintenance and update procedures?

Are the ways to submit updates documented in the standard?

*Supportable*

Can the standard be implemented with known technology?

Are there identified consumers for the standard?

*Publicly Available*

The standard will not be developed from proprietary information.

The standard does not carry any copyright or licensing limitation on use.

What are the proposed mechanisms for making the standard available electronically?

*Complete and Consistent*

Does the proposal have all the necessary components?

Does the proposal follow a reasonable methodology for development?

Is the proposal in a consistent and readable format and presentation?

## Appendix B - Standards Taxonomy

*[NOTE: There are many different types of standards. To assist the GIS Community in better understanding standards issues and to provide some context within which the work of the Oregon Framework Implementation Team can be placed, the following information was modified from the Federal Geographic Data Committee's Standards Reference Model document.]*

The taxonomy of standards is derived from the principles of information engineering as modified by the FGDC Standards Working Group's Technical Advisory Group. Information engineering is a design and standards development technique developed by IBM in the late 1970's and early 1980's. It is often applied to systems development and has been used for standards development and maintenance. An information engineering approach was selected because it provides minimal guidance on structure, yet allows for standards to achieve coordination and interoperability status. This approach does not dictate step-by-step processes.

One way that information engineering provides a structured approach to standards development is by providing a method to describe different standards types. It also provides a means to describe the relationships among various standards of the same type. For example, two data standards can be related to one another, eliminating duplicate definitions and domains of values. In this manner it is well adapted to the diversity of the National Spatial Data Infrastructure and the FGDC.

The four basic categories of information engineering standards are:

- data
- processes
- organizations
- technology

One geodata standard may contain several categories of standards.

**Data Standards**

Data are the most widely recognized and documented component of standards and information technology. Data modeling describes how the bits of information are defined and structured so they can be applied in a meaningful way. Most geodata standards will be of this type.

Data standards describe objects, features or items that are collected, automated, or affected by activities or functions of agencies. Data are organized and managed by institutions. Data standards are semantic definitions that are structured in a model.

*Data Classification* - Data classification standards provide groups or categories of data that serve an application. Data classification standards are the attributes common to elements of a group. Examples are wetland and soil classifications. See process standards for standards on how to apply a data classification standard.

*Data Content* - Data content standards provide semantic definitions of a set of objects. Data content standards may be organized and presented in a data model such as an entity-relationship model or an IDEF1X model.

*Data Symbology or Presentation* - Data symbology or presentation standards define graphic symbols. They standardize the language for describing those symbols. See processes standards for methods for applying symbols and the rules for displaying them.

*Data Transfer* - Data transfer standards are independent of technology and applications and facilitate moving data among systems, without prior specification of the intended end use of the data. The Spatial Data Transfer Standard (SDTS) is an example of a data transfer standard, which is endorsed by FGDC. SDTS is FIPSPUB 173. Profiles or domains of values for SDTS will be defined by FGDC Subcommittees and working groups. Transfer standards that are specific to a technology, such as the FTP (File Transfer Protocol) on the Internet, are outside the scope of the FGDC.

*Data Useability*- Data Useability standards describe how to express the applicability or essence of a data set or data element and include data quality, assessment, accuracy, and reporting or documentation standards. The FGDC Content Standard for Geospatial Metadata is an example of a Data Useability standard.

**Process Standards**

Processes or functions describe tasks and how information and technology are used to accomplish organizational goals. Process standards may also be called service standards. They describe how to do something, procedures to follow, methodologies to apply, procedures to present information, or business process rules to follow to implement other standards. A smaller portion of geodata standards will be process standards.

The intent of Geodata Process standards are:

- to establish a threshold for minimally acceptable data,
- to determine the best data for an application, or
- to promote interoperability and broad based use of data.

*General Data Transfer Procedures* - General data transfer procedure standards are the activities required to convert data to a general data format, such as SDTS, for general access.

*Specific Data Transfer Procedures* - Specific data transfer procedure standards are the activities or requirements to fulfill a specific data request for a known activity in a known data structure.

*Existing Data Access Procedures* - Existing data access procedure standards are the procedures required to gain access to an existing data set in a known data format, such as the methods and procedures required to access an existing data posting on the World Wide Web or a bulletin board.

*Classification Methodology* - Classification methodology standards are the procedures to follow to implement a data classification standard. They describe how data are analyzed to produce a classification. The processes that are followed to achieve data precision are examples of classification methodologies.

*Data Collection* - Data collection procedure standards are the methods and processes for the collection of new or conversion of existing data.

*Storage Procedures* - Storage procedure standards address the mechanisms and schedules for archiving or backing up data. If appropriate, the storage procedures also address the storage media.

*Presentation Standards* - Presentation standards are the methods for displaying or formatting information from a data set or data standard.

*Data Analyzing Procedures* - Analytical procedures include the methods for computing, comparing, contrasting, assembling, or evaluating a data set for an application or specified product.

*Data Integration* - Data integration procedures are the methods for combining various data sets into a unified, geographically harmonious data set. Data generalization standards are a data integration process standard.

*Quality Control and Quality Assurance* - Quality control and quality assurance processes are respectively the methods followed to achieve a specified quality and the methods to check the quality of an existing data set. Precision for measurements or other activities are included in these standards.

**Organizational Standards**

The organizational component of information engineering consists of the rules for assigning responsibilities and authorities for the people who perform tasks and use technology. These include things like who does which tasks, what data do they need, and what are the attendant skill requirements.

Organizational or institutional standards are the specifications for communication among communities. These are the human and institutional interactions necessary to carry out data, activity, and technology standards. Ways to organize, communicate, identify responsible parties, and coordinate roles are examples of organizational standards.

**Technology Standards**

Technology includes things like software, hardware, and system protocols. In system design, the technology may be specifically described in terms of known application solutions such as computer aided mass appraisal, topologic processing, or coordinate geometry computations.

Technology standards relate to the tools, environment, and interfaces among systems, and are often called information technology specifications. They are the tools to produce, manipulate, manage, organize, disseminate, or otherwise implement activity or data standards.

## Appendix C - Standards Outline

The following outline will be followed by all working groups of the Oregon Framework Implementation Team in development of individual standards documents.

*Title Page*
*Introduction*
- Mission and Goals of Standard
- Relationship to Existing Standards
- Description of Standard
- Applicability and Intended Use of Standard
- Standard Development Procedures
  - Participants
  - Comment Opportunities and Reviews
- Maintenance of the Standard

*Body of the Standard*
- Scope and Content of the Standard
- Need for the Standard
- Participation in Standards Development
- Integration with Other Standards
- Technical and Operational Context (elements included as appropriate)
  - Data Environment
  - Reference Systems
  - Global Positioning Systems
  - Integration of Themes
  - Encoding
  - Resolution
  - Accuracy
  - Edge Matching
  - Feature Identification Code
  - Attributes
  - Transactional Updating
  - Records Management
  - Metadata
  - Other Topics (optional)
- Data Characteristics
  - Minimum Graphic Data Elements
  - Minimum Attribute or Non-graphic Data Elements
  - Optional Graphic Data Elements
  - Optional Attribute or Non-graphic Data Elements

*References*
*Appendices*

## Appendix D – Geodata Groups Referenced and Defined

### Federal Geographic Data Committee

The Federal Geographic Data Committee coordinates the development of the National Spatial Data Infrastructure (NSDI). The NSDI encompasses policies, standards, and procedures for organizations to cooperatively produce and share geographic data. The 17 federal agencies that make up the FGDC are developing the NSDI in cooperation with organizations from state, local and tribal governments, the academic community, and the private sector. www.fgdc.gov

### Framework Implementation Team

Framework Implementation Teams are locally formed, interdependent partnerships of federal, state, local, and tribal authorities, academia, and the private sector (**I-Teams**) to implement state and regional portions of the NSDI in accordance with national interoperability specifications and data standards. I-Teams are voluntary, open, flexible and adaptive collaborations for shared capital planning, building, using and financing spatial data.

### Framework Implementation Team Work Groups

The Oregon Framework Implementation Team has established I-Team Work Groups that are each tasked with one of the 13 Oregon Framework data themes. Each Framework Work Group is tasked with developing a data content standard and an implementation plan for their respective Framework data theme.

### Information Technology Executive Council

The Governor's Information Technology Executive Council (ITEC) is the policy making body in state government for the evolution and implementation of a Statewide Enterprise IRM Strategy. The ITEC membership consists primarily of state agency executive leaders and is charged with the development and adoption of:

- Information Resources Policies, Procedures, Standards, and Guidelines
- The Enterprise Information Resources Management Strategy
- The Oregon Statewide Technology Architecture
- Implementation of methods that efficiently guide the use of the State's IT resources
- Statewide training programs that improve the skills of the state's IT staff.

### Oregon Geographic Information Council

The Oregon Geographic Information Council develops policy guidelines and provides coordination and leadership for the management and use of geographic information and geographic information systems (GIS) technology. The OGIC also endorses and coordinates the development of data standards for geographic information.

OGIC is chaired by the State CIO and council membership includes 24 state agencies, the Statewide GIS Coordinator, two federal representatives and four local government representatives. The enabling Executive Order, EO-00-02, establishes a relationship between the policies and guidelines of OGIC and the State's Enterprise Information Resources Management Strategy.

### Oregon GIS Community

The Oregon GIS Community includes everyone who works with GIS software, uses geographic information, or manages or coordinates a program or project that uses GIS software or geographic information.

### Oregon Watershed Enhancement Board

The Oregon Watershed Enhancement Board is a state agency led by a policy oversight board. Together, they promote and fund voluntary actions that strive to enhance Oregon's watersheds. The Board fosters the collaboration of citizens, agencies, and local interests. OWEB's programs support Oregon's efforts to restore salmon runs, improve water quality, and strengthen ecosystems that are critical to healthy watersheds and sustainable communities.

### Policy Advisory Committee

The Policy Advisory Committee provides strategic planning, budgetary, and policy development for the Oregon Geographic Information Council.

### Technical Advisory Committee

The Technical Advisory Committee, also known as GIS Program Leaders (GPL), serves as a forum for public agencies in Oregon to coordinate development of Geographic Information Systems (GIS) and provides the Oregon Geographic Information Council with technical advice.