Identifying Foundational Data Elements for Oregon's GIS Framework, v 1.0

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Contents

Revisions

Date	Who	Changes
9/2016	TBurcsu	Document initiated. V 0.1
11/9/2016	TBurcsu	Distributed to FIT leads v 0.2
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Overview

This document describes a new 5-year strategy for categorizing Framework data elements for use in priority-setting and decision making for the Oregon GIS Framework. This document also contains guidance for implementing the strategy within Framework themes. The new strategy, proposed by the Framework Implementation Team Leads (FIT leads) in August 2016, is intended to increase progress toward the completion[1] of Oregon's GIS Framework by identifying the highest priority data elements across all themes using a logical classification that emphasizes relationship to geodetic control. Data elements are the smallest category of features or feature types that are identified and tracked in the Oregon Framework and are, for all intents and purposes, single theme data sets organized by Framework theme. High priority data elements are referred to as *foundational data elements* and are parsed into groups called *tiers.* The strategy will be effective for up to 3 biennia, and will be updated to reflect changes in the GIS Framework during the third biennia or earlier if the FIT leads recommend that it is no longer effective.

The new strategy emphasizes the Framework goals of accelerating completion of the Framework and ensuring horizontal and vertical integration across themes. An advantage of the new strategy is that through its emphasis on geodetic control, it lays the ground work for vertical integration of Framework elements and prepares the State for the datum change anticipated in 2022.[2] Another advantage is that all elements are categorized regardless of theme, minimizing or eliminating the potential for FIT themes leads to pit their theme's elements against data elements that have greater potential to move all of the Oregon Framework forward but are in a different theme. A disadvantage is that some data elements and themes that have traditionally been emphasized may be deemphasized. As the strategy will be relatively short-lived, deemphasized data elements can be reemphasized in the future.

The priorities identified from the new strategy can be used to guide inter-agency funding of Framework data elements. The priorities will also guide proposal selection for funding from those submitted to the 2017-2019 Framework funding request for proposals, due out in the first quarter of 2017.

Next Steps

FIT leads should work with team members to assign data elements to tiers using the guidance below and the accompanying data elements spreadsheet. While the Oregon Framework Coordinator performed an initial assignment of data elements, reassignment of data element tiers is fully expected and welcomed as FIT leads and team members are expected to have the best knowledge about their theme's data elements. The rationale used by participants to sort data elements should be documented in the spreadsheet or in a memo, and questions or issues that arise as the data elements are sorted should be recorded and reported to the Oregon Framework Coordinator. Everyone is working to complete this task by the end of January 2017.

[1] Completion is achieved when a data element has been developed to the statewide extent, the element's maintenance has been ensured, and appropriate access to the data element has been ensured.
[2] For more information see NOAA's New Datums webpage (http://www.geodesy.noaa.gov/datums/newdatums/index.shtml)

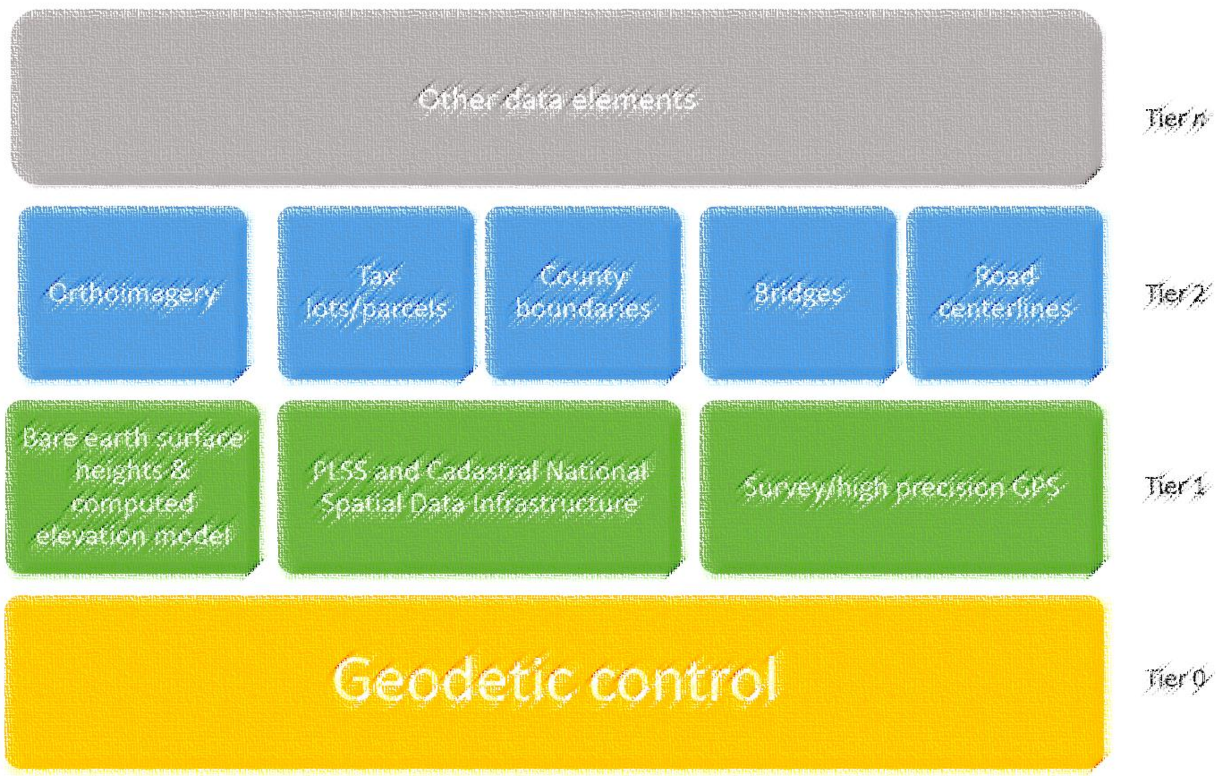
Introduction

The Framework Implementation Team theme leaders (FIT leads) proposed an updated strategy for prioritizing work areas for Oregon's GIS Framework. The strategy will be used in the decision making process for funding projects through the Framework funding program. The strategy focuses on two programmatic goals:

1. Accelerating the development, maintenance, and access to Oregon's GIS Framework
2. Ensuring Framework themes can be integrated horizontally and vertically

The FIT leads agreed that a subset of data elements serve as the key geometric and geographic references for other data elements. These *foundational data elements* are particularly important to the Oregon Framework community's efforts to provide consistent data that meets a wide variety of user needs and to increase efficiency of data production and maintenance within the State of Oregon. **Foundational data elements are defined, for the purposes of this strategy, as the collection of data elements whose geometries serve as the basis for the vast majority of Framework data elements.**

Figure 1. A rough sketch of a subset of Framework data elements, where geodetic control is the most basic of the foundational data elements. The diagram includes only a sample of data elements and was not intended to provide a mapping of every data theme and element in the revised prioritization scheme. Tier 1 data elements are situated immediately above geodetic control. Tier 2 data elements are situated immediately above tier 1 elements. Tier n represents tier 3 and greater elements at the top of the diagram. Additional tiers may exist and are not depicted in the diagram.



The Prioritization Scheme

Foundational data elements are data elements that serve as the base geospatial data for other Framework data elements. Because there are numerous data that meet this definition, foundational data elements can be differentiated using a logical classification scheme (Box 1) that is based on:

1. relationship to the geodetic control network
2. data element dependencies in terms of predecessor and successor data elements

The most basic foundational elements are those that directly use geodetic control/information (see **Error! Reference source not found.**).[3] Geodetic control is used in this document to refer to survey information that establishes the horizontal and vertical location of a point on the Earth, measured using the most accurate methods available.[4] It also refers to the reference system that includes the accepted horizontal and vertical datums for the State of Oregon. For clarity, geodetic control is assigned to a tier 0 position (see **Error! Reference source not found.**). Positioning geodetic control at the base of the hierarchy helps ensure vertical integrity across data elements. Geodetic control data provides the basis for a single reference system that is used to establish the positions of geographic data. [5] Referencing universally compatible[6] positional and elevation data is key to achieving a vertically integrated geospatial data Framework. In Oregon, geodetic control data is funded and maintained by government entities at the federal, state, and municipal levels.[7]

Other data elements lie above geodetic control and directly or indirectly reference Oregon's geodetic control network. Data that directly reference geodetic control are t*ier 1* data and include elements such as digital elevation and depth models. Tier 1 data elements frequently serve as the geometric or geographic reference for one or more data elements and are both horizontally and vertically accurate, however, some exceptions exist. An exception is the Public Land Survey System (PLSS) which does not directly reference geodetic control nor the vertical datum realization but is the basis for many Framework data elements. Because it does not reference the vertical datum realization, it was positioned as a tier 1 data element.

Elements that directly reference tier 1 elements of height, PLSS or Cadastral National Spatial Data Infrastructure, are georeferenced to GPS data, are derived entirely from remote sensing technologies, or derived directly from land survey data are considered tier 2 elements. These elements may be directly

[3] Guidance for utilizing geodetic control or a geodetic reference system has not been developed specifically for Oregon's Framework and its participants. Additional work to identify and document the guidance requirements is needed and should be performed by the Geodetic Control FIT. At present Framework participants make use of geodetic control in a variety of ways including but not limited to use of the Framework recommended projection and datum and tying survey control points to existing geodetic frameworks. Certainly other applications are common; additional work by the Geodetic Control FIT to describe guidance requirements is likely to illuminate the variety in more detail.

[4] Lo and Yeung 2002, pg. 50. *Concepts and Techniques of Geographic Information Systems*. Prentice Hall.

[5] Epstein and Duchesneau 1984. The Use and Value of a Geodetic Reference System. Report to the Federal Geodetic Control Committee; FGDC 1997 (citation information missing)

[6] Epstein and Duchesneau 1984; FGDC 1997 (citation information missing)

[7] Partners include the National Geodetic Survey, Bureau of Land Management, US Forest Service, and Oregon Department of Transportation, among others.

derived from height data elements (e.g., watercourse centerlines) or are georeferenced using horizontal and vertical data (e.g., orthoimagery).

Tier 3 includes elements that can be contextualized by, are based entirely on tier 2 elements, or are based on a mixture of tier 1 and 2 elements.

Tier 4 includes elements that are based on tier 2 and/or 3 elements or are derived from models that incorporate multiple elements and data of varying tiers (the exception is the tier 1 coastline element).

Data elements that reference a mixture of tiers should be categorized using a "lowest common denominator" approach, where the highest tier number data element trumps lower tier number data elements.

Guidance for Assigning Tiers

Step 1. Review data elements for their position relative to geodetic control or tier 0.

Below are several questions that are useful for helping one to think about the data element in terms of the new strategy. The questions and responses are coded into the data elements spreadsheet.

1. Does the data element directly reference geodetic control?
   1.1. Format: limited choice (yes-no-other-don't know)
2. Does the data element indirectly reference geodetic control?
   2.1. Format: limited choice (yes-no-other-don't know)
3. Can you trace the data element back to geodetic control? How many data elements lie between the data element of interest and geodetic control?
   3.1. Format: limited choice (1-2-3-4-GT4)
4. What do you consider to be the reference data for this data element of interest? What is the reference data for the data element of interest's reference data?
   4.1. Format: free text
5. How confident are you in your responses?
   5.1. Format: limited choice (Likert scale 1 – 5)
6. Comments: please summarize the rationale for a data element's tier where appropriate

Step 2. Use the logical classification scheme for assigning elements to tiers

Once you have reviewed the data elements and considered their base data, you can use the logic below to assign each element to a tier (see Box 1). The Oregon Framework Coordinator used the logic scheme to provide an initial tier to each data element. You and your team members may opt to assign a different tier or keep the initial tier assignment. Please keep in mind that the objective is to achieve the most accurate classification. You and your team members have the best knowledge for achieving this objective. Please keep in mind the difference between the *current* composition of any data elements and its *realistic ideal* composition. The current composition refers to the predecessors and reference data for an element at present. The realistic ideal composition refers to the targeted composition of the element and can be viewed as the next step or phase for improving the data element.

Box 1. A logical classification scheme for Framework data element tiers. Example Framework data elements and other non-Framework data sets are included as examples to help illustrate the tiers.. ● = yes, ○ = proposed

	Oregon Framework data elements	Non-Framework data sets or information
Tier 0. Geodetic control elements		
Geodetic control	●	
Other control	●	
Horizontal datum		●
Vertical datum		●
Oregon Coordinate Reference System		●
Oregon's projection standard		●
Oregon real-time GNSS network		●
Tier 1. Basic reference elements		
Bare earth surface heights (bathymetry/hypsography points and/or TIN)		●
Bare earth surface height computed digital elevation model (bathymetric/terrain raster)	●	
Shoreline/coastline (ocean and major watercourses (Columbia R., Willamette R.))	○	
PLSS and Cadastral National Spatial Data Infrastructure (formerly Geographic Coordinate Data Base)	●	
remote sensing raw data and imagery		●
GPS points and measurements		●
Tier 2. Elements that directly reference tier 1 elements		
Physical and human elements directly derived from surface height data elements (e.g., HUCs, watercourse centerlines, building height, contours, aspect)	●	
Image data that directly references surface height data elements and that directly references the geodetic control network (e.g., orthoimagery)	●	
County, state, tribal, and national boundaries - these should be generalized from locally derived boundaries or boundary nodes (see note under county boundaries above)	●	

	Oregon Framework data elements	Non-Framework data sets or information
Human-made features mapped using land survey, GPS, or LiDAR such as tax lots/parcels and bridges	●	
Other natural and physical features derived entirely from tier 1 data elements	●	●
Tier 3. Elements that reference tier 2 elements or a combination of tier 1 and 2 elements		
Physical features derived from tier 2 physical features	●	
Land ownerships within national and state boundaries (e.g., federally-owned lands, state-owned lands, local-owned lands, tribe-owned lands)	●	
City limits	●	
Other boundaries, such as taxing districts	●	
Digital Raster Graphics	●	
Political boundaries that reference tier 2 elements	●	
Elements digitized from orthoimagery : streets, sidewalks, buildings, hydrography (where LiDAR is unavailable – also see physical features derived from tier 2)	●	
Tier 4. Elements that reference tier 2 and/or 3 elements, are derived from models (but is not the tier 1 coastline element)		
Vegetation distributions and boundaries derived from modeling and/or classification	●	
Wildlife distributions derived from modeling, statistical analysis, or other data collection and analytic means		●
Physical data and information derived from modeling, statistical analysis, or other data collection and analytic means such as classification (e.g., water supply watersheds)	●	
Hazard or risk information derived from modeling, statistical analysis, or other data collection and analytic means (e.g., flood zones)	●	

	Oregon Framework data elements	Non-Framework data sets or information
Land management delineations within or across ownerships (e.g., parks, recreation sites, forests, roadless areas, easements, CRPs, land use)	●	
Human elements that reference tier 2 and/or 3 elements, such as districts and land use designations	●	
Human or natural elements mapped using DRGs as reference, using other methods in a GIS such as heads up digitizing of non-orthorectified imagery, or using other methods of unknown or low to moderate precision (e.g., centroids or labels typically derived from or representative of polygon features)	●	
▫ Address points	●	
▫ City points	●	
▫ Unincorporated places	●	
▫ Stream gages	●	
▫ Soils	●	
▫ Storm drainage basins	●	

Application to the Framework Funding Program

Oregon's GIS Framework program administers a grant program intended to support efforts to develop, enhance, steward, or create/improve access to Oregon GIS Framework data. In the past, proposed projects were funded based on a broad set of criteria designed to address the many goals and needs of the Framework community and Oregon GIS Framework. Community members set the program priorities by sorting data elements within and across themes. Over time, the Oregon GIS Framework data element collection expanded and is currently comprised of over 254 elements. As a result, prioritization of data elements and project proposals has become increasingly difficult, and funded projects selected have been highly diverse. While most funded projects have value within Oregon's GIS Framework, past efforts have not resulted in the desired level of completion (in terms of data element development, stewardship, and access) of Oregon's GIS Framework and it is not clear that significant progress toward the goal of vertical integration has been made. This strategy for categorizing data elements is intended to inform the funding decision process by identifying the Framework data elements that serve as the basis for most other Framework data, can be considered the fundamental building blocks of the Oregon Framework or foundational data elements, and therefore priority data elements.

The FIT leads identified foundational elements as the highest priority data elements in the Oregon GIS Framework at present. The FIT leads also recognized that the Framework community consists of creative and intelligent members who can complete high-quality projects that will enhance Oregon's GIS

Framework. Using a new strategy for prioritizing Framework data elements, the objectives for the 2017-2019 funding program are:

1. In the short-term,
    a. Complete Framework data elements that provide the geographic foundation of Framework
    b. Inject resources into high-quality efforts that enhance Oregon's Framework
2. In the long-term,
    a. Increase the capacity for data integration, horizontally and vertically
    b. Prepare the State of Oregon for the new datum for geodetic control that will replace NAD83 in 2022

Estimated Timeline

November 9 – 15	**FIT leads review new strategy document**
November 16	**Feedback on new strategy document due to Oregon Framework Coordinator by COB**
November 30	**FIT leads meeting**
December 21	**Strategy document finalized (for distribution to themes teams, if needed)**
December 9 – January 31	**Assignment of data elements to tiers**
February 6	**Tiers finalized**
Early February	**(new!) RFP criteria work group meeting**
February 10	**RFP criteria first draft distributed to FIT leads**
February 14 – February 20	**Initial comment period for RFP criteria**
February 24	**RFP criteria second draft distributed to FIT leads (GPL and PAC also?)**
March 1	**RFP criteria finalized**
March 6	**RFP released to public**
March 10	**Reviewing team formed**
March 17	**Framework Data Development Program RFP review, DAS**
May 1	**Submission deadline by 11:59 PM**
May 2 – May 9	**Reviewing team initial review period**
May 11	**Proposal presentations**
May 19	**FIT review of proposals/GPL review of proposals**
May 23	**FIT and GPL recommendations submitted to PAC and Reviewing Team by COB**
May 23 – May 26	**PAC reviews proposals based on policy criteria and recommendations from FIT and GPL.**
May 26	**PAC recommendations submitted to Reviewing Team by COB May 26**
May 29 – 31	**Final review by Reviewing Team and recommendation formulation**
June 2	**Reviewing Team recommendation submitted to OGIC**

June 14	**OGIC reviews proposals and recommendations and evaluations by Review Team, GPL, PAC, and FIT**
June 23	**Funded projects proponents informed/funded project summaries posted to GEO website**
July 1	**Contract development initiated**

APPENDIX

Proposals for Sorting Data Elements into Tiers

The Oregon Framework Coordinator developed several proposals for sorting Framework data elements and implement the new prioritization strategy. The proposals are described below. I tested proposal 2, which seemed to balance the required preparation and follow-up work. After carrying out proposal 2, I conducted an assignment of the data elements into tiers, as described in proposal 3. I used the exercise to develop the contents of Box 1 above. I ruled out proposal 1 because of the extensive work required to implement it.

Proposal 1: Dichotomous Key

A dichotomous key is a tool for identifying entities using a series of questions that have only two possible responses. The approach is commonly used to identify plants and allows a decision to be traced through the decision making process. I propose that FITs use a dichotomous key to identify foundational data elements. If this approach proves too burdensome, I propose the use of a series of questions. The latter approach may not require the level of detail that a dichotomous key may depend on. In example 1, below, is an outline of some of the questions that could be used to identify the tier of a data element.

Example 1. A few questions and responses that could be used in a dichotomous key to identify tier 1 and 2 data elements.

1. Probably the first question: Is this data element's native format a raster?

    1.1.1. Yes -> Does this data element represent surface height above or below water?

        1.1.1.1.1. Yes -> Is this data element a digital elevation model?

            1.1.1.1.1.1.1. Yes -> tier 1

            1.1.1.1.1.1.2. No -> is this a depth model?

                1.1.1.1.1.1.2.1.1. Yes -> tier 1

                1.1.1.1.1.1.2.1.2. No -> go to another question, such as, *Is this data element a digital surface model?* Yes -> Tier 2; No -> go to another question…

        1.1.1.1.2. No -> Is the data element's geometry tied directly to Oregon's geodetic control points?

            1.1.1.1.2.1.1. Yes -> Tier 1 data

            1.1.1.1.2.1.2. No -> Tier 2 data

    1.1.2. No -> go to question 2

2. Does this element function as a geometric reference for other data elements?

    2.1. yes → possibly tier 1 data -> Next question: Is the data element's geometry tied directly to Oregon's geodetic control points?

        2.1.1. Yes -> Tier 1 data

2.1.2. no -> Does this data element reference a data element that directly references geodetic control?

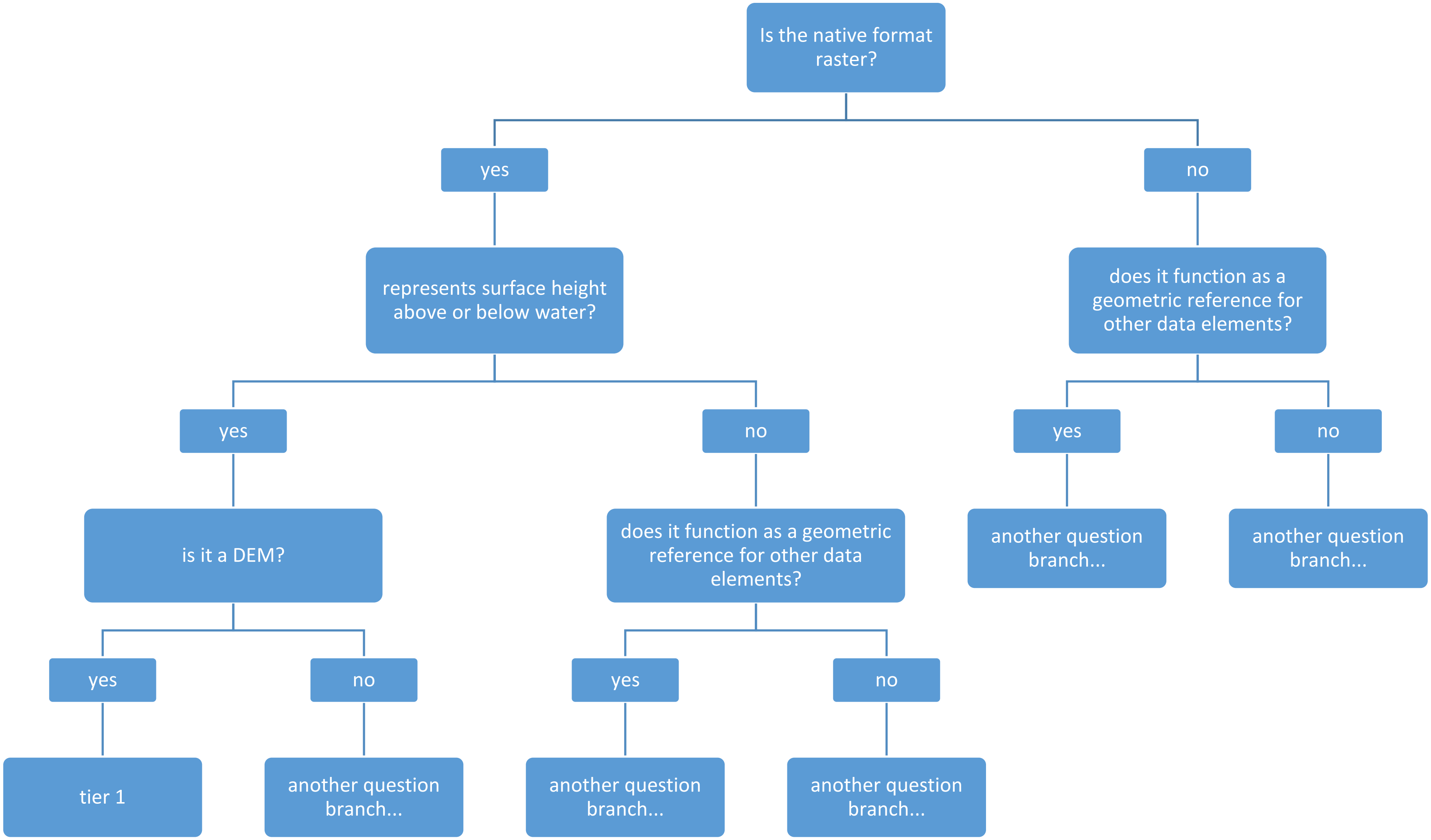
2.1.2.1.1. Yes -> Tier 2 data

2.1.2.1.2. No -> higher than tier 2 data

2.2. No → possibly higher tier than tier 1 -> go to another question to determine tier…

The questions can be arranged in a flow diagram as in Figure 2. This approach requires a lot of forethought about the questions. I would need additional questions to complete the key and put it into action.

Figure 2. Example tree form of the dichotomous key.



Proposal 2: Key Questions in a Spreadsheet

Use a questionnaire and spreadsheet to identify the data tier. This format could make use of a few important questions. An advantage of this approach is less work up front, but a disadvantage is that it could require substantial work to interpret the responses unless responses are controlled. One way to control responses is to use a form or spreadsheet with data validation to limit the possible responses (see attached spreadsheet). I propose using some form of the following sample questions. Additional questions may also be useful.

Here are the sample questions:

1. Does the data element directly reference geodetic control?
   1.1. Format: limited choice (yes-no-other-don't know)
2. Does the data element indirectly reference geodetic control?
   2.1. Format: limited choice (yes-no-other-don't know)
3. Can you trace the data element back to geodetic control? How many data elements lie between the data element of interest and geodetic control?
   3.1. Format: limited choice (1-2-3-4-GT4)
4. What do you consider to be the reference data for this data element of interest? What is the reference data for the data element of interest's reference data?
   4.1. Format: free text
5. How confident are you in your responses?
   5.1. Format: limited choice (Likert scale 1 – 5)

Additional questions that may be useful to include:

1. What is the source, in terms of the data steward and or integrator, of the reference data identified in question 4 (Q4 in the spreadsheet)?
   a. Format: free text
2. Based on your understanding of foundational data and data tiers, in what tier would you place this data element?
   a. Format: limited choice (1 – 5)
3. What is your rationale for the tier you chose?
   a. Format: free text

Feedback could be sought from FIT teams using the following questions: What other questions do you feel would help to sort the data? Are there data elements that could cross tiers, such as data elements that are aggregated from multiple sources? If there are, I could add a response to question 3 that leads the responder to another question that the responder can use to explain the situation.

Proposal 3: Provide definition of foundational data elements and let FIT members identify the tier

Another approach is to provide the definition of foundational data elements to the FIT members and have them classify the data elements. This method is quick and relatively easy to distribute, but has little structure to guide FIT members and would be subject to interpretation of the definition. It will also require additional work when it comes time to sort Tier 2 and higher data.

Results

I recommended that Proposal 2 was the best bet for getting responses in a timely and efficient manner and followed through on this proposal. To implement the proposal, I developed a spreadsheet with a single column devoted to each of five questions:

1. **Directly references geodetic control**
2. **Indirectly references geodetic control**
3. **Number of "layers" away from geodetic control**
4. **Reference layer for this element (free text)**
5. **Response confidence**

I was able to complete question 1 for all 254 data elements, but only able to answer question 2 for a small fraction (Table 1). I was unable to answer question 3 for most elements and did not record my attempts to answer this question for any element. I guessed at the reference layer for most of the 11 elements for which I named a reference layer in question 4, except for geology, which I found in its metadata. I did not attempt to identify my response confidence, as it was fairly low for all but one element.

Table 1. Initial set of questions for classifying data elements into tiers. The questions were designed to understand how close or far away any element is from the geodetic control network that has been identified as the foundation for Framework GIS data in Oregon.

	Q1 Directly references geodetic control	**Q2** Indirectly references geodetic control	**Q3** Number of "layers" away from geodetic control	**Q4** Reference layer for this element (free text)	**Q5** Response confidence
RESPONSES	**254**	**30**	**0**	**11**	**1**

Questions 1 and 2 consisted of 4 responses, the vast majority of which I guessed were not directly tied to geodetic control (Table 2).

Table 2. Summary of Theresa's initial stab at identifying Framework data elements that directly and indirectly reference geodetic control points.

Response	**Q1** Directly references geodetic control	**Q2** Indirectly references geodetic control
yes	20	15
no	224	5
other	5	5
don't know	4	5
no response	1	224
RESPONSES	**254**	**30**

Once I completed the exercise of addressing the questions, I identified that the next steps for the elements were:

1. Identify the elements that are digitized from data that we can consider of “known” tier (Tier 1: PLSS, DEM, and tied to PLSS in the Q4 column)
2. Identify if there are any other elements that are the same tier as Orthoimagery and PLSS
3. Take the information from questions and information above and place each data element into a tier (essentially proposal 3).

I decided to proceed with the next steps in a test mode. Unfortunately, I had insufficient information to complete #1. In order to identify other elements in the same tier as orthoimagery and PLSS, I reviewed the data elements list. As I proceeded, I realized that I would have ideally had the number of levels away from geodetic control each element lies, but also lacked this information and considered other aspects of the elements and the Framework.

During my initial pass through the data elements, I gravitated to an exercise of classifying each element into a tier, somewhat like what was proposed with proposal 3, and stayed with that path. As I worked through the elements list, I thought about how data elements nest. For human features, I initially relied on a top-down hierarchy in which international, national, and state boundaries are the highest level, the key points of reference because of their stability (in the western hemisphere), and that other smaller political and human units nest under these. On my second pass, I reclassified many elements as I considered the goal of the NSDI to create data from the highest precision data available, envisioned as local scale data. As there is variation in the amount of data available at local levels, I considered county boundaries as a logical reference layer for local data generation efforts and for generalizing to create smaller scale data. I also considered different technologies such as high precision GPS vs. GIS-based heads up digitizing and the impact of these technologies on GIS data derived from them, and I surmised that higher precision data should be in a lower tier (i.e., tier 2 or 3) than low precision data (i.e., tier 3 or 4).

For physical and natural elements, I began with the concept of height as a tier 1 element and used this as my initial basis for placing elements into tiers, assuming that any element based on height would be of a higher tier than tier 1 (i.e., tier 2, 3, or 4). I found that casting elements such as climate and wildlife distribution data into higher tiers made sense but differentiating among the higher tiers became quite difficult because these elements are often developed from a wide variety of data sets, some of which directly reference geodetic control and some of which do not.

The shoreline or coastline element is a physical/natural feature that may be derived from height data and may be used for local operations such as representing tax lots. It may also be used to delineate county and state boundaries. Here I surmised that physical and human features needed to align based on shoreline, and therefore shoreline might require designation as a tier 1 data element. I am uncertain about this element and welcome more information about this element.

Ultimately, I identified a set of criteria for classifying all data elements into 5 tiers (see Box 1 above). I found that a logical classification resulted in a different arrangement of the elements into tiers than the questions focused solely on distance from geodetic control (Table 3).

Table 3. Data elements that were initially identified as directly or partially referenced to geodetic control points are listed. The numbers in table cells represent the tier identified using a logical classification scheme.

	Q1. Directly references geodetic	
Data Element	**yes**	**other**
Admin Bnds		
county boundaries - OR	1	
state boundary	2	
Cadastral		
assessor's map boundaries		3
Donation Land Claims		3
GCDB		1
PLSS		1
subdivision plat maps	4	
tax lots		3
Tribal Trust Lands	2	
Coastal and Marine		
Shoreline	2	
Elevation		
Nearshore and Estuarine Bathymetry	1	
Geodetic Control		
geodetic control points	0	
other survey control	1	
Imagery		
.5-meter DOQs	2	
1-meter DOQs	2	
30-meter DOQs	2	
DRGs	3	
Reference		
county boundaries - WA, CA, ID, NV	1	
Transportation		
bridges	3	
heliports	3	
lighthouses	3	
ports	3	
railroads	3	
road centerlines	3	
VOR	3	

Conclusions

Using a spreadsheet to collect responses was a familiar and efficient way to gather responses to the 5 questions examined in Table 1. I used data validation to decrease the amount of time required for interpretation of the responses, but also included two free text fields to capture reference data sets/elements and to capture notes and explanation. I was concerned that FIT leads and team members may have some trouble identifying the number of levels most elements are from geodetic control, as did. I was also concerned that more work was needed to define what it means to be “directly referenced to” geodetic control. For example while answering Q1 and Q2, I was stumped by the question, is a data element that is projected into the standard projection, which is tied to the Oregon geodetic network via the datum, directly or indirectly referencing the geodetic control element?

Another issue that may arise from implementation of proposal 2 is that a large number of data elements may not directly reference geodetic control, and there may be no information about how far from geodetic control these elements lie. This situation would make it quite difficult to determine the tier to which these elements belong.

Many data elements are interrelated and distinguishing the lineage[8] of reference data used to develop and update elements can be challenging when the tier classification scheme relies on distance from a geodetic element. It may be best to use a hybrid approach to the tiering of elements. For data elements that are in tiers 1 and 2, we may be okay going with “levels away from geodetic control”, but for higher tier elements such as climate and vegetation distribution, criteria such as the tier 4 criteria described in Box 1 may be more useful.

The results of these efforts as documented in Box 1 could be used to develop a dichotomous key as proposed in proposal 1. I initially ruled out proposal 1 because of the extensive amount of work required to develop the questions that would populate a dichotomous key. In the future, Box 1 could be used to create a dichotomous key as proposed above.

There are certainly other issues that will arise when working to applying the foundational data tiering concept to the Oregon Framework. Additional discussions about criteria are likely[9] and improved descriptions of the tiers may be useful for communicating about the program.

[8] Lineage here refers to how close or far from geodetic control a data element is.

[9] For example, what is the best tier for national and state boundaries? Should these be in tier 3 as they are ideally constructed by generalizing local scale data?