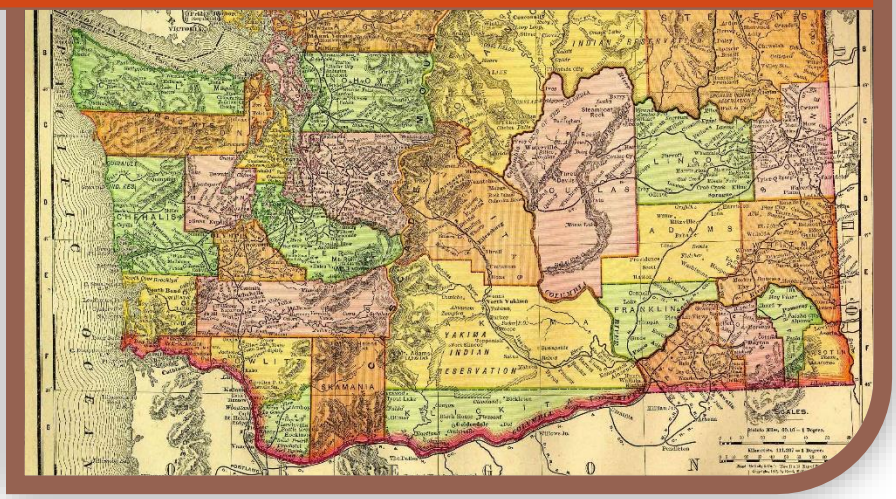
County Boundary Update Guidance



Abstract

This document is prepared by the Geospatial Program Office (GPO) and describes the process by which Washington State county boundaries are: set into statute, located on the ground, cartographically depicted and updated.

Office of the Chief Information Officer

www.ocio.wa.gov

January 6, 2016

Executive Summary

The explosion in geospatial technologies provides greater accuracy for more features at lower costs, however bringing existing statewide spatial data up to these standards is a challenge. The expectations of today's decision makers is that our data meets current standards, but the reality is that much of the original data is based on inadequate descriptions and measurement technologies no longer used. With today's limited budgets, no one level of government can bring the breath of geospatial products up to current standards, so coordination of data updates has become a necessity. However, the need to keep our geospatial representations reconciled with their underlying authoritative data remains paramount.

County Boundaries are defined by legal descriptions in article 36.04 of the Revised Code of Washington. They are described by both the Public Land Survey Grid (PLSS) corners and the physical features. These boundaries have been located on the ground through survey methods and depicted on maps since before statehood in 1889. Political changes and changes to physical features have resulted in court decisions that have modified the legal description of counties over time. Survey accuracy has improved with technological advances in survey equipment and satellite technology. Likewise advances in the geospatial sciences like Geographic Information Systems, digital orthophotography and LiDAR have allowed cartographic products to provide users much more detailed map products. All of these changes and technology improvements require continuous maintenance of representations of county boundaries.

RCW 58.22 established the Washington State Department of Natural Resources (DNR) as the responsible agency for establishing and maintaining a state base mapping system including the state cadaster which stores PLSS coordinates and associated data. This agency was an early adopter of GIS technologies and developed a statewide mapping system based on data collection technologies available at the time. Improvements to the mapping system are implemented through updates to underlying geospatial datasets driven by business functions and available resources. Technologies that did not exist when the first statewide GIS data were created now support positional accuracies that were either not possible or too expensive to implement during initial data creation.

Business requirements at the local level are driving spatial accuracy improvements through new spatial collection projects. These projects have produced a patchwork of geospatial datasets of differing accuracies across Washington State. While some of these improvements have been survey based, most are the results of geospatial technological advances that are non-survey based like ortho imagery, LiDAR, GPS Devices (mapping and consumer grade). While GIS does not contain legally binding representations, it does contain scale dependent, geospatial

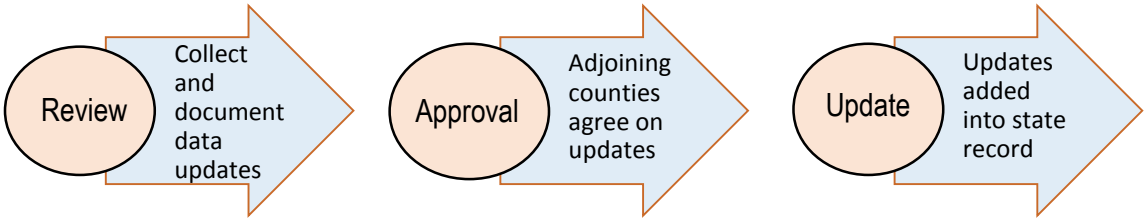
representations of boundaries based on the best available source. It has become the tool of choice for most practitioners of the cartographic sciences.

State business functions require the use of local government spatial data. Limited resources suggest that all levels of government coordinate their efforts to keep geospatial data maintained and available for business functions. Life-cycle updates to the State's geospatial datasets from local entities must be supported. Among the important datasets are those that depict jurisdictional or boundary representations.

This document describes four different methods for making changes to county boundaries—modified legal descriptions, improved survey monument coordinates, better cartographic depictions of survey monuments, and improved cartographic depictions of physical features. It also guides the user in the process of submitting changes to the Washington State cadaster, their inclusion into the State official county boundary layer and the publishing of these data in the state's Geospatial Portal. This document, the methodology it outlines and the data it describes are dynamic and ever changing. Without constant maintenance geospatial data rapidly depreciates.

The Process

County boundary data that are slated for update must go through a series of steps. While each type of method requires a different process, there are a set of generic steps. First the process used to create the data is documented and the proposed data must be an improvement over the existing data. The data then goes through an approval process where it is examined by the adjoining counties and if it is approved, a signed approval is created. The data and its documentation along with the approval is sent on to DNR for review and update. The updated data is then published and made available to the spatial data community.



The four sections discuss the different boundary change methodologies in detail. Examples are provided that illuminate the process and explain why updates to spatial data are needed.

Guidance and Recommendations

- The counties are the authority when it comes to their business interests.
- Access to improved geospatial data happens continually over time and needs to be reflected in state and local records.
- The state relies on counties to maintain and update county data and to provide updates to the state.

- The state should include local geospatial data of higher quality into their business systems for effective operation (population estimates, taxing rates, permitting requirements and licensing).
- Updates to geospatial representations of boundaries doesn't move or change their underlying surveys or legal descriptions.
- Actual surveyed and monumented PLSS corners control the demarcation of portions of boundaries in Washington.
- Department of Natural Resources (DNR) understands and acknowledges that their Cadastral database represents the best data available at the time of its creation and that more accurate survey points need to be included to improve the accuracy of the state's geospatial data and the representation of boundaries.
- The Counties and DNR will work through the Office of the Chief Information Officer's Geospatial Program Office to ensure that all data updates and announcements are disseminated.
- The counties will work through the Geographic Information Council (WAGIC) to ensure that all information regarding data updates and announcements are disseminated.

In order to geospatially align county boundaries we need to ensure that:

- ✓ Up-to-date survey points need to be shared to both state & county survey repositories;
- ✓ Acknowledge that the geospatial data is simply a representation of what's on the ground and not the legal records;
- ✓ Counties agree jointly on their adjacent boundaries;
- ✓ County boundaries are the baseline for much of the other spatial information we collect; and
- ✓ Data and maps need to be properly documented.

Table of Contents

Section 1: Process for Formally Changing County Boundaries in State Statue

Methodology: Legal Method.

Example: Court orders, joint actions of political bodies, etc.

County boundaries are set in state law and there are one of two ways to change or update these boundaries legally:

(1) Through court order; or
(2) *By the joint action of its county commissioners.*

Changes in county boundary need to be recorded with the WA Department of Natural Resources who has been given authority to record and track the state base maps. Below are a list of relevant state statues related to the mapping and depiction of county boundaries.

- RCW 36.04.400 **Survey of County Boundaries**. *"All common boundaries and common corners of counties not adequately marked by natural objects or lines, or by surveys lawfully made, must be definitely established by surveys jointly made by all the counties affected thereby, and approved by the board of county commissioners of such counties…."* http://apps.leg.wa.gov/rcw/
- RCW 36.04 **County Boundaries**. The legal designation for each county boundary is defined in law and outlined under this RCW. http://apps.leg.wa.gov/rcw/
- RCW 58.22 **State Base Mapping System.** The department of natural resources shall establish and maintain a state base mapping system.

Step-By-Step

Step 1: GIS County Boundary Data Review

- Compile updated records of survey, survey corners or other information that will help counties determine if more accurate data is available.
- Agree on the boundary representation and create updated GIS boundary file for review.

- GPS Data collection: Survey Grade GPS for coordinate control on legal land surveys or Resource Grade GPS should be used to replace less accurate boundaries in the GIS data when survey information is not available.
- County lines that fall along the Public Land Survey grid will need to be resolved with DNR and appropriate metadata will need to be provided if changes are requested.

Step 2: Submit Updates to County Commissioners for Approval and Adoption

- The County executive receives county boundary improvements and recommended changes.
- The work is reviewed and scheduled for Commissioners review and approval.
- If approved, then the County executive forwards the electronic records and supporting information to DNR for revision.
- The county notifies the Washington Geographic Information Council (WAGIC) of the resulting updates.

Step 3: Submit Approved Updates to DNR and to County GIS Data Steward

- DNR takes submitted County updates and examines packet and submittal to determine if there are any questions.
- The work is scheduled and the county is notified of the projected update.
- The electronic records are entered into the database.
- Once the Cadaster database is updated, then a new county boundary data set is created by DNR and submitted to OCIO.

Step 4: New County Data Published

- Once DNR submits the new county boundary data to OCIO, then the Geospatial Program Office will published it on the WA Geospatial Portal. This update process is on-going and driven by more accurate coordinate data.

The OCIO notifies the Geospatial community of the county boundary update via the Geographic Information Technology Committee and the Washington Geographic Information Committee List Serve.

Section 2: Changes to Survey Coordinate Data in the DNR Cadastral Database

Methodology: Survey Method

Example: *#1: Re-habitation of existing section corner through GPS based or traditional surveying equipment/ methods.*
#2: Extraction and reconstruction of PLSS corners through historical review of recorded survey documents.
#3: Land Survey records filed with government office (US BLM, WA DNR, County Auditor, etc.).

The original GIS county boundary layer created by the state, and represented in the Department of Natural Resources (DNR) Cadastral data base, was never intended to replace the legal description of the States county boundaries. It was created as a graphical depiction of those boundaries and was based on the best available data at the time of its initial creation.

A map, whether digital or paper is not the same as a property corner location, or a survey monument. Survey coordinates of monuments change over time because of a variety of reasons: better models of the earth, datum shifts, coordinate densifications based on new subdivisions, corrections and other phenomena that occur along legal boundaries.

Any updates to these data can be made at any time, as new and better coordinate information is made available. This process is relatively easy and simply means more accurate coordinate points are submitted to DNR for inclusion into the state's cadastral database.

Once this information is in incorporated, then an announcement will be made to the survey and GIS user community. It is important that both communities sign up for inclusion on the list servers that disseminate this information.

- ✓ The Surveying community should consider signing up to the Surveyors List Serve at …. Survey Advisory Board http://listserv.wa.gov/cgi-bin/wa?A0=DNR-SURVEY-ADVISORY-BOARD
- ✓ The GIS users community should join the *WAGIC Listserv to stay informed*

http://listserv.wa.gov/cgi-bin/wa?A0=WAGIC

What follows are some general steps that a county should use to assure that any improved coordinate points are submitted for inclusion into the states cadastral database.

This example shows how the DNR Land Survey Section, cadaster data editor regularly updates surveyed corner positions with new and more accurate coordinates as part of their core work. The priority of where to make these updates is necessarily driven by DNR business and relative location to DNR managed lands. DNR captures corner data in their Cadaster Point layer, in

general only corner positions originally set by GLO or BLM surveyors and DNR parcel corner positions are recorded. The DNR cadaster is ***not*** intended to be an inventory of all possible known parcel corners.

When opportunities arise to improve corner positions outside of the core DNR work areas including along county boundaries; funding and staff time availability allow DNR to work with data providers to include the improved data. One example of a relatively large scale GIS corner position improvement project came by way of Grant County:

Grant County had knowledge of an effort by the U.S. Bureau of Reclamation (USBR) where they partnered with a private land survey firm to accurately locate many of the original USBR survey corner monuments from the Columbia Basin Project. Grant County contacted DNR and provided complete project documentation as listed in figure 2-1

- A copy of e-mail correspondence between you and me regarding the coordinates.
- One dvd, containing the digital coordinate products. They were created by Rogers Surveying, Inc. Please see the file named "Final Report.doc" for further information.
- One spiral bound packet titled "USBR by Rogers Surveying, Inc. For Cadastral Wireframe Grant & Adams Counties April, 2000." This packet represents some of the digital data referenced above, prefaced with a "Project Report" that appears to be the same content as the "Final Report" on the dvd.
- One spiral bound packet titled "Columbia Basin Project WSDOT Geographic Services Bureau of Reclamation Rogers Surveying". This packet contains the WSDOT monuments referenced by the Rogers Surveying group in the "Final Report."
- One 3-ring binder titled "GIS Station Data Bureau of Reclamation Ephrata Field Office Ephrata, Washington." This packet contains the field notes (station data sheets) for the township corners surveyed using GPS units.

DNR analyzed the data, found it acceptable to update the cadaster and used the project as "fill in" work that took over a year of "a little here, a little there" effort. The end result is nearly eight thousand improved corner positions in cadaster. See figure 2-2

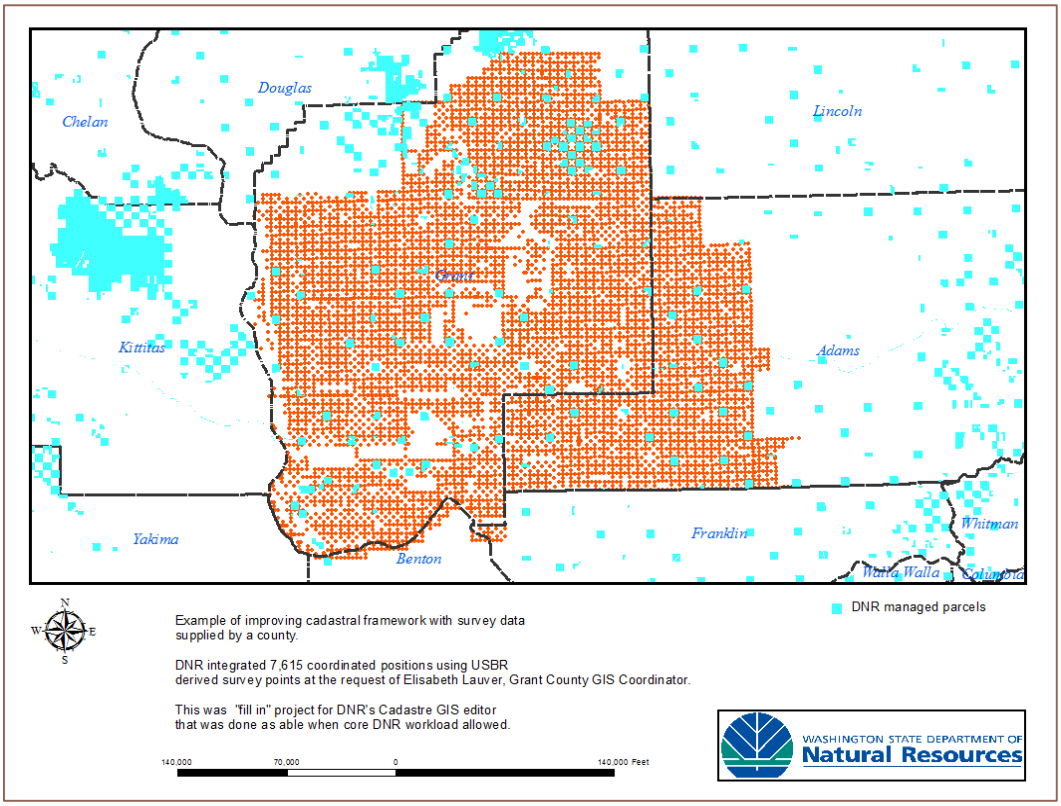


Figure 2-1. Improved corner positions per USBR/Grant County

Another much smaller example of a county providing data to improve GIS corner positions comes from Columbia County: Columbia County contacted DNR inquiring about whether DNR would be willing to use their data to improve corner positions in the cadaster including some positions along the boundary with neighboring Counties.

Columbia County

- Researched recorded survey documents for coordinate data;
- Converted all of the coordinates to Washington State Plane NAD 83 HARN;
- Provided a geodatabase of their corner positions; and
- Provided references to the source data for each point.

DNR will very likely accept the Columbia County information and assimilate it into the cadaster, but since their process was to start from scanned and or paper copies of recorded documents DNR will do a thorough QA/QC of their data to ensure that any potential data entry errors from paper to digital are eliminated. This more manual, hands on approach is only feasible with fairly small data sets.

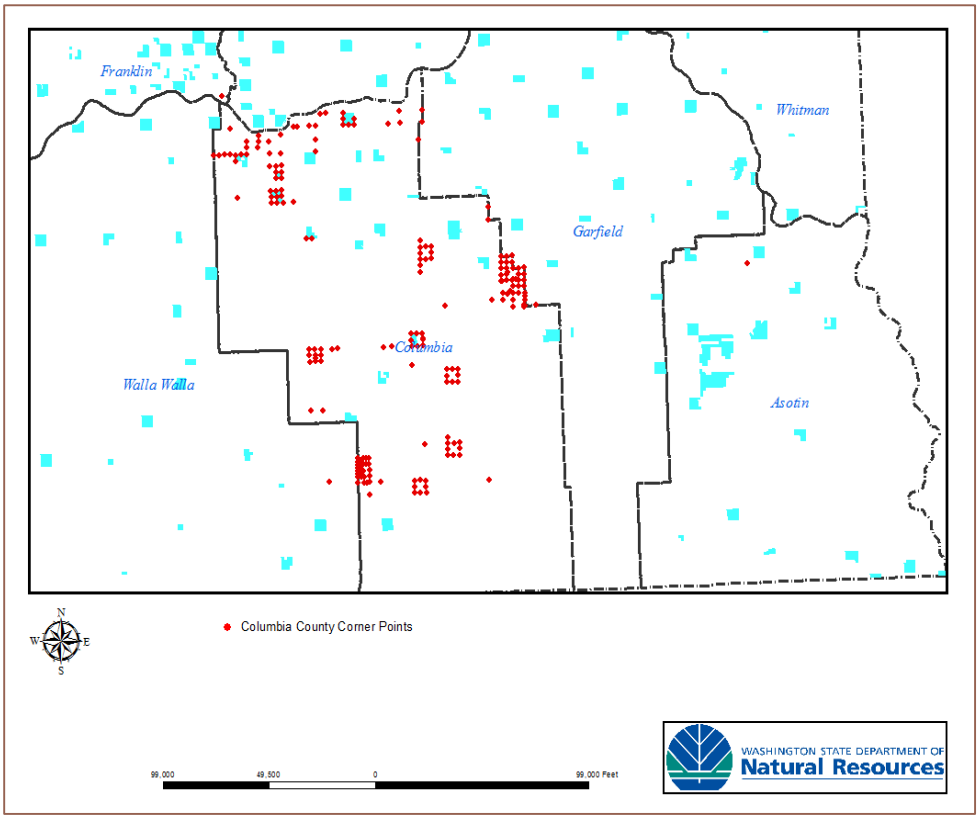


Figure 2-2. Accepted position corners

Step-By-Step

Step 1: County Boundary Data Review

- Compile updated survey corners or other information that will help the counties determine if more accurate data is available from other sources like the BLM, counties, tribes, cities and others.
- Agree on the boundary representation and create updated GIS boundary file for review.
- GPS Data collection: Geodetic GPS for coordinate control on legal land surveys or Resource Grade GPS should be used to replace less accurate boundaries and survey points in the GIS data.
- County lines that fall along the Public Land Survey grid will need to be resolved with DNR and appropriate metadata will need to be provided if changes are requested along these lines.

Step 2: Submit Updates to County for Approval

- The County boundary authorizing body receives updated county boundary maps.
- The work is reviewed and approved or sent back for further analysis.
- If approved, then the County authorizing entity, as defined by the county, forwards the electronic records and supporting information to DNR for revision

- The county notifies its county departments of the updated county boundary data for inclusion into its business processes.

Step 3: Submit Approved Updates to DNR and to County GIS Steward

- DNR takes submitted County updates and examines packet and submittal to determine if there are any questions.
- The work is scheduled and the county is notified of the projected update.
- The electronic records are entered into the database.
- Once the Cadastral database is updated, then a new county boundary data set is created by DNR and submitted to OCIO.

Step 4: New County Data Published

- Once DNR submits the new county boundary data to OCIO, then the Geospatial Program Office will published it on the WA Geospatial Portal. This update process is on-going and driven by more accurate coordinate data.

The OCIO notifies the Geospatial community of the county boundary update via the Geographic Information Technology Committee and the Washington Geographic Information Committee List Serve.

Section 3: Changes to Mapped Representation of PLSS Monuments on County Boundaries

Methodology: Non-legal binding methodologies for improving PLSS data within a GIS database

Examples: *#1: Heads-up digitizing of Paneled Section Corners from Ortho Imagery Flights.*
#2: Heads-up digitizing of physical features roadways, etc. via ortho-imagery that align with County Boundaries.
#3: Use of LIDAR Derived products like 2 foot contours for documentation of County Boundaries.
#4: Extraction and reconstruction of PLSS corners through historical review of parcel and plat and recorded survey documents.

The authority to change and update a counties GIS data mapped representation of its county boundaries resides within the administrative authority of each county. This allows the GIS practitioners to define the methodology used to update its depiction and to rely on the "best" available source of data for those updates. Sometimes these improvements are based on Survey (GPS, CORS, Ground based LiDAR, etc.), but more commonly from digital orthophotography, LiDAR and LiDAR derived products like DEMs and 2 foot contours.

In order to improve sharing of GIS data between different levels of government, county boundary changes should be recorded at the state level. This requires these changes are agreed to by adjoining counties. It is also recommended that the updated boundaries be adopted by each counties' GIS Manager to ensure the updated depictions are properly distributed across the county departments. In order to ensure proper coordination and distribution across state and local entities, the Washington Geographic Information Council and the Office of the CIO's Geospatial Program Office (GPO) should be notified as well.

Notification Mechanism	**Coordination & Distribution**	**Announcements**
County	County GIS Managers	WAGIC
State	DNR	OCIO

Example: An example of this process occurred along the county boundary between Kitsap and Pierce Counties. Examination of the State's Cadastral database, displayed in figure 3.1, shows that no PLSS points exist long the Kitsap/Pierce County boundary (no green triangles). Pierce County had PLSS points calculated for creation of their parcel layer but it was recognized that the accuracy, while the best data available at the time was not very accurate. At a later date,

Kitsap initiated a survey that included much of the Kitsap/Pierce county boundary for a county public works project (see figure 3.2). During the coordination of identifying agreement points between the counties, Kitsap made their survey information available to Pierce County. Pierce County made use of this information and adjusted their parcel and roads layers based on this information. However, these survey data have never been submitted to DNR for inclusion into the Washington State Cadastral database (see figure 3.3). When this work is submitted the state's County Boundary layer will be updated to reflect these changes. With a maintained boundary that is coincident between agencies, data sharing costs among the Counties and State are greatly reduced.

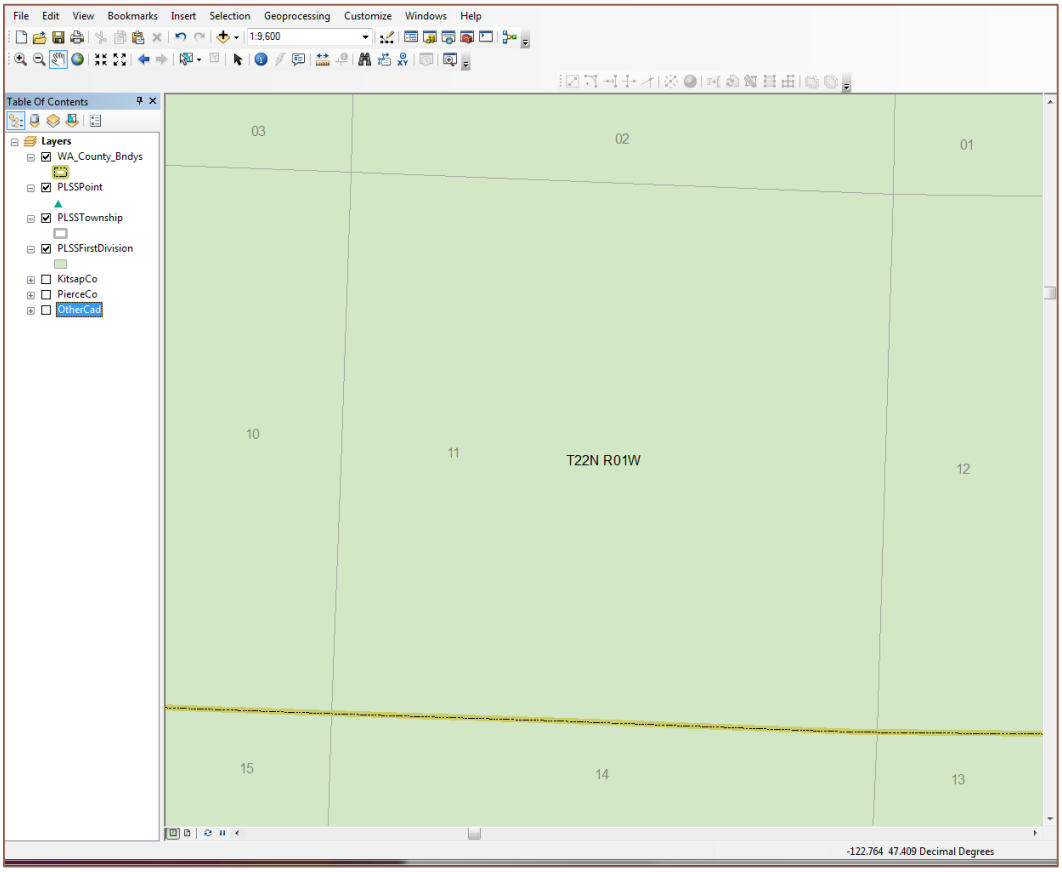


Figure 3.1. Section 11, Township 22 N, Range 1 W. This figure shows State cadastral databases First Subdivision layer and Public Land Survey System Point layer along with the DNR County Boundary Layer (yellow line). Note that no PLSS Points exist along Pierce/Kitsap County boundary.

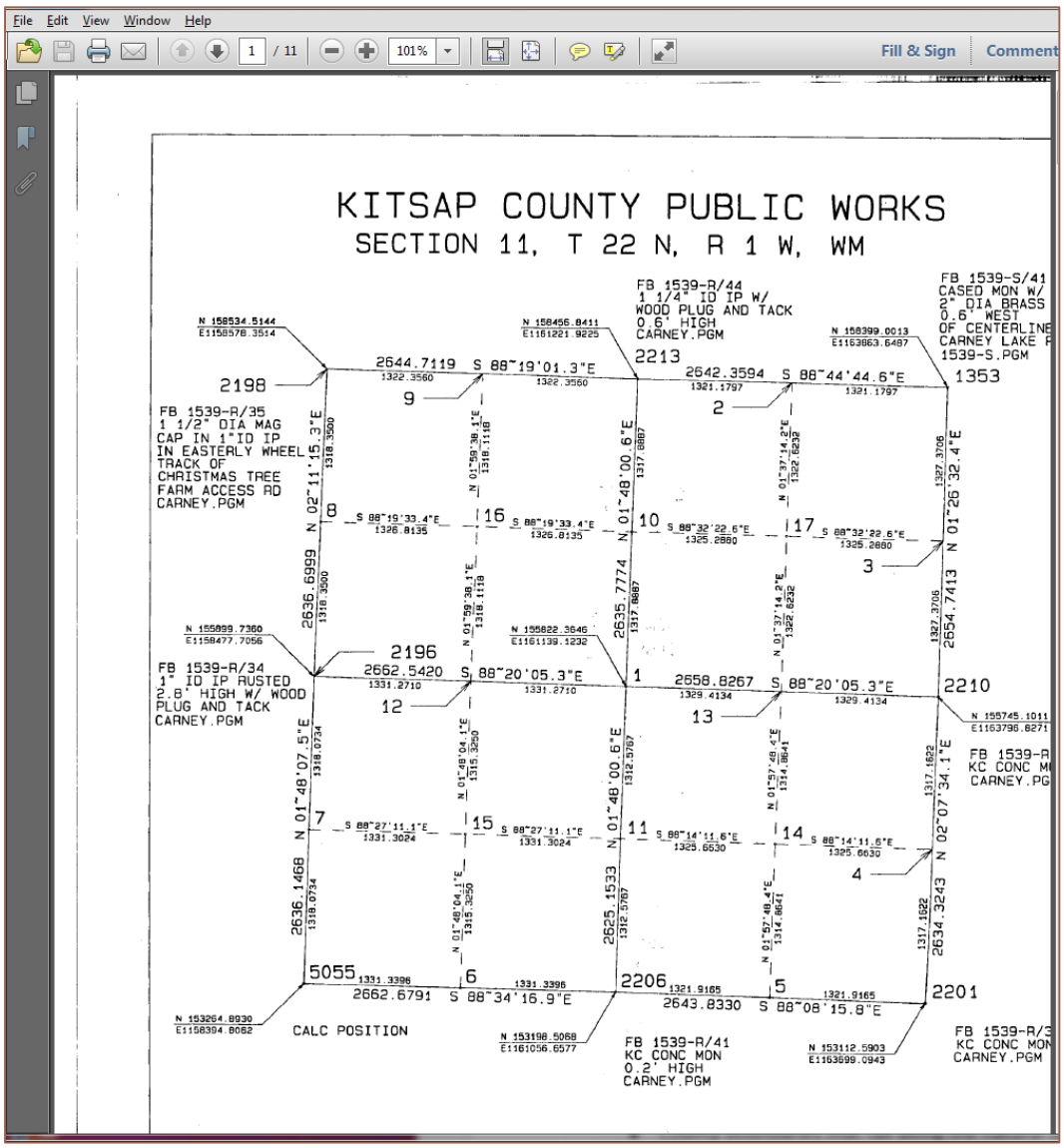


Figure 3.2. This graphic displays some of the documentation that Kitsap County obtained with surveying many of the sections along the Kitsap/Pierce County boundary. This data improved the accuracy of the section corner information along with derived layers like the County boundary layer.

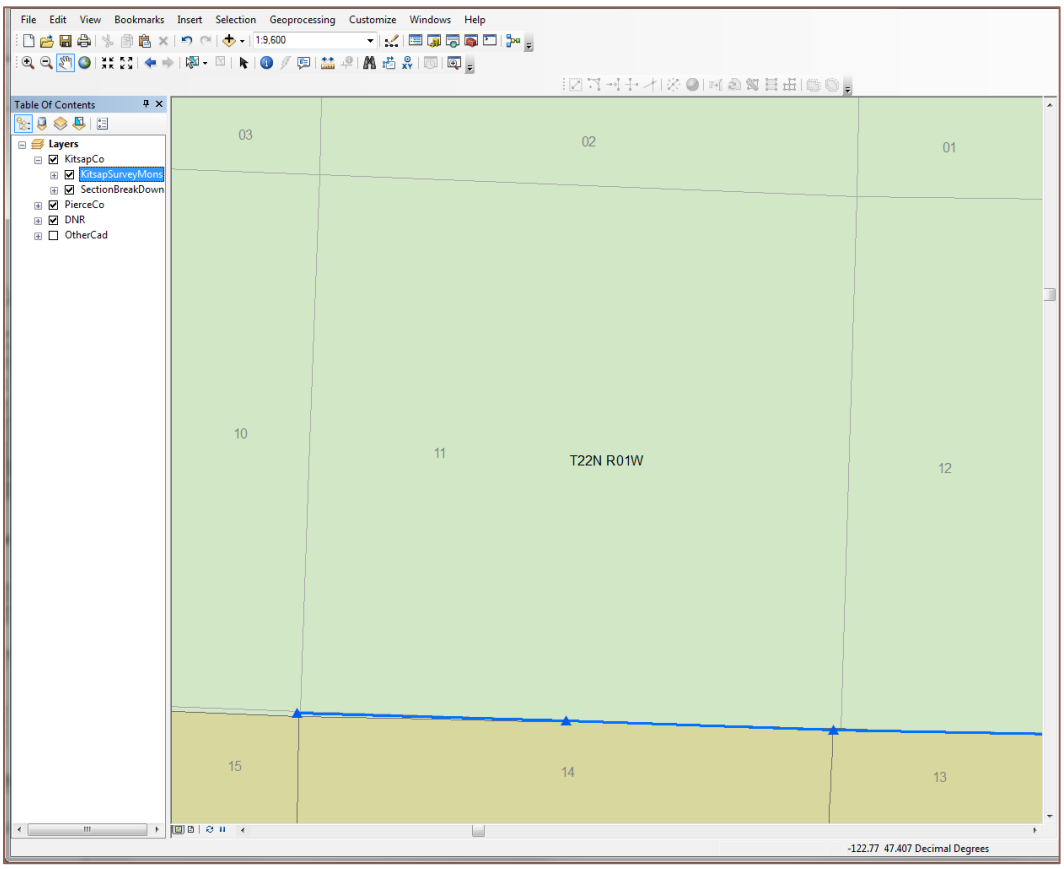


Figure 3.3. This map shows the alinement of Kitsap County Survey (blue lines and triangles), Pierce County first subdivision layer (based) and DNR's first subdivision layer (light green). Note the vertical and horizontal alignment conflicts. These will be eliminated when Kitsap County submits their survey for inclusion into the State Cadastral Database and the state updates its County Boundary layer.

Step-By-Step

Step 1: County Boundary Data Review

- Compile any updated records of survey, survey corners or other information that will help the counties determine if more accurate data is available.
- Agree on the boundary representation and create an updated GIS boundary file for review.
- County lines that fall along the Public Land Survey grid will need to be resolved with DNR and appropriate metadata will need to be provided if changes are requested in these areas.
- County boundaries that fall along the natural landscape should be updated using the process outlined in Section 4.

Step 2: Submit Updates to County for Approval

- The County boundary authorizing body receives updated county boundary maps.
- The work is reviewed and approved or sent back for further analysis.
- If approved, then the County authorizing entity, as defined by the county, forwards the electronic records and supporting information to DNR for revision

- The county notifies its county departments of the updated county boundary data for inclusion into its business processes.

Step 3: Submit Approved Updates to DNR and to County GIS Data Steward

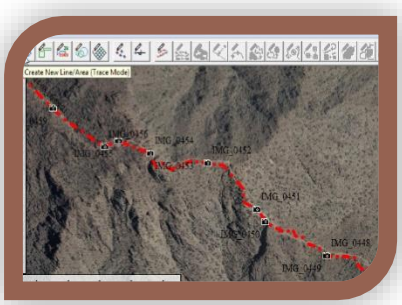
- DNR takes submitted County updates and examines packet and submittal to determine if there are any questions.
- The work is scheduled and the county is notified of the projected update.
- The electronic records are entered into the database.
- Once the Cadastral database is updated, then a new county boundary data set is created by DNR and submitted to OCIO.

Step 4: New County Data Published

- Once DNR submits the new county boundary data to OCIO, then the Geospatial Program Office will published it on the WA Geospatial Portal. This update process is on-going and driven by more accurate coordinate data.
- The OCIO notifies the Geospatial community of the county boundary update via the Geographic Information Technology Committee and the Washington Geographic Information Committee List Serve.

Section 4: Updating County Boundaries Along Non-Public Land Survey Boundaries

Methodology: Non-legal binding methodologies for improving non-PLSS survey boundaries within a GIS database (rivers, mountain crests, etc.)



Example: *#1: Heads-up digitizing of river-channels from Ortho Imagery Flights.*
#2: Heads-up digitizing of physical mountain ranges lines via ortho-imagery that align with County Boundaries.
#3: Use of LIDAR derived products like 2 foot contours lines to delineate physical mountain ranges lines that align with County Boundaries.

Many segments of county boundary descriptions are based on physical features such as mountain range crests or the main channel of rivers and streams. Few of these features have been accurately surveyed so boundary depictions are based on other cartographic data such as contours or digital elevation models. In the past 20 years other digital data sources such as digital orthophotography and LiDAR have improved the accuracy of cartographic depictions of these features. Following is an example that illuminates how these improvements need to be incorporated in order to ensure Washington State's official GIS layers are based on the best available data.

This example shows how using LiDAR can improve the accuracy of a single location where 4 county boundaries meet. The descriptions of this location are defined as:

King County (RCW 36.04.170 excerpt)
...; thence upstream along the middle of the main channel of the Greenwater river to the forks of the Greenwater river and Meadow creek; thence upstream along the middle of the main channel of Meadow creek to the summit of the Cascade mountains, at a point known as Naches Pass, said point lying in the southwest quarter of section thirty-five, township nineteen north, range eleven east, Willamette Meridian;...

Kittitas County (RCW 36.04.190 excerpt)
...; and thence northerly along the main channel of the Naches river to the summit of the Cascade mountains, or to the eastern boundary of King county;…

Pierce County (RCW 36.04.270 excerpt)

...Nisqually river; thence following the main channel of said river to its head; thence due east to the summit of the Cascade mountains; thence northerly along the summit to the head of the Green Water;

Yakima County (RCW 36.04.390 excerpt)
...; thence along the southern boundary of Kittitas county to the summit of the Cascade Mountains; thence southerly to the southeast corner of Lewis County;

Reading the excerpts of these four legal descriptions it is difficult to determine that they all refer to the same point, Naches Pass. While no survey monument is located at Naches Pass on the "crest of the Cascades", a GIS depiction of the location can be determined from digital elevation models such as USGS 10 meter DEM or 20 foot contours derived from these elevation models. Twenty foot contours have been available on the 7.5 minute quadrangle map series produced by the USGS for over 50 years. The USGS has made their DEM and contour data available digitally for over 30 years and they were the source of WA DNR's County Boundary layer for descriptions based on elevation. See Figure 4-1.

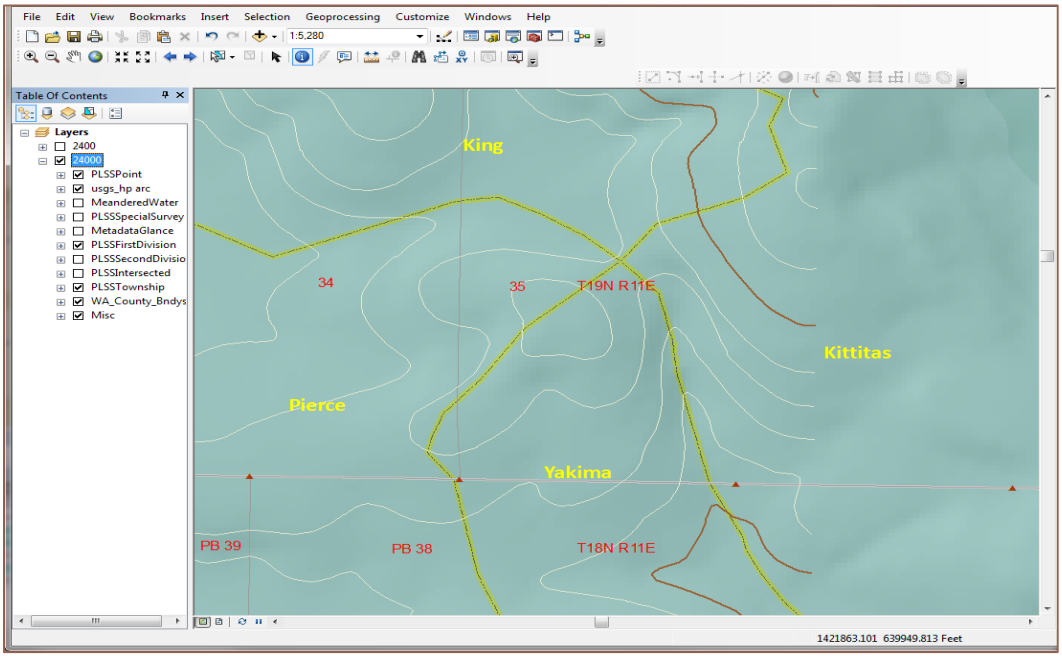


Figure 4- 1. Yellow lines are existing WA DNR County boundary lines. Background shaded relief is 10m USGS DEM. 20 foot contours are from USGS DLG. Note that County boundaries for King, Pierce, Kittitas and Yakima meet near Naches Pass.

With the availability of light detection and ranging (LiDAR), collection of elevation based data has vastly improved for a fraction of the cost. This allowed Pierce County along with the USGS to commission a countywide LiDAR collection project that produced a 3 foot resolution DEM. This product allow for the generation of 2 foot contours. The engineering community have found this DEM accurate enough to use for preliminary engineering projects and planners have

found that regulatory features derived from this data produce fewer false positives than those based on previous technologies.

Below, Figure 4-2 and 4-3 show how LiDAR derived products can highlight improved accuracies achievable from their use in creating new GIS boundaries.

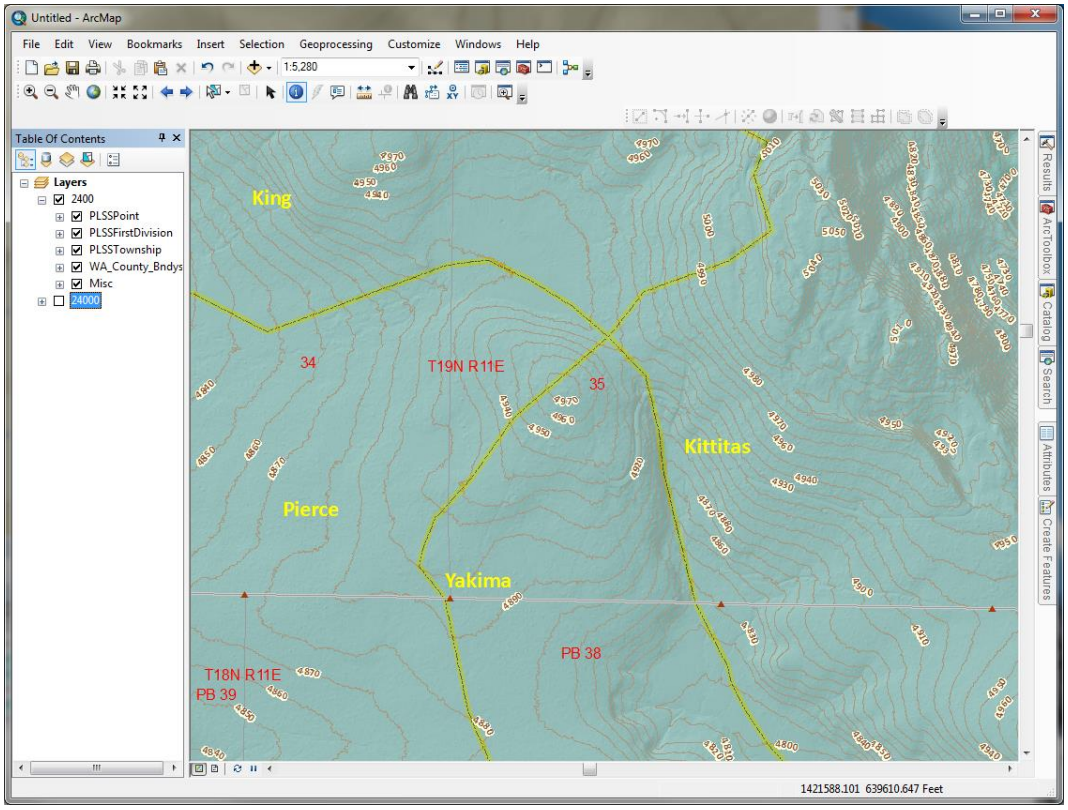


Figure 4-2. *Yellow lines are existing WA DNR County boundary lines. Background shaded relief is 3ft Pierce County LiDAR DEM. 10 foot contours were derived from 3ft Pierce County LiDAR DEM. Note that County boundaries for King, Pierce, Kittitas and Yakima meet west of Naches Pass.*

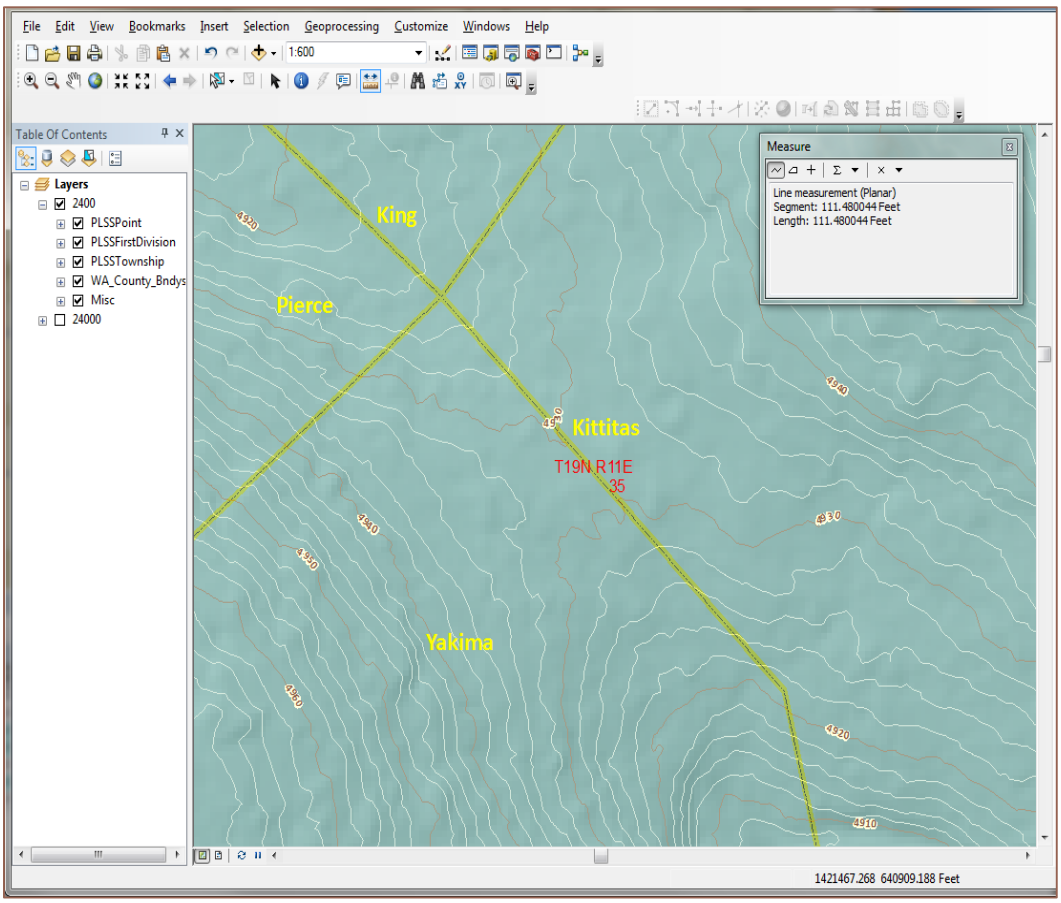


Figure 4 – 3. *Yellow lines are existing WA DNR County boundary lines. Background shaded relief is 3 foot Pierce County LiDAR DEM. 2 foot contours were derived from 3ft Pierce County LiDAR DEM. Note that DNR county boundaries for King, Pierce, Kittitas and Yakima meet approximately 100 feet west of Naches Pass.*

Data accuracy between Washington state counties varies significantly. This can be mitigated by adoption of a hierarchy of data collection methodologies where more accurate methodologies take precedence over less accurate methodologies. Realizing it is cost prohibitive to collect all monuments with the highest accuracy, the survey community has followed a monument hierarchy where by higher accuracy coordinates take precedence over lower order coordinates. This requires that each feature collected includes documentation as to the methodology used to derive the feature. While surveys are legally binding, thus requiring significant documentation, GIS depictions are based on the best available data at a point in time and thus require less rigorous documentation. The documentation must include a statement of the methodology and source data used to create the depiction as-well-as the date of the source, the boundary creation date and an estimate of the accuracy of the boundary. The adoption of a GIS accuracy hierarchy will allow for the agency accepting the proposed change to determine whether the submittal is an improvement over the existing depiction and thus moved into the cue for inclusion into the official statewide, boundary layer.

Step-By-Step

Step 1: County GIS Boundary Data Review

- Work with all adjacent county GIS, IT Managers and land surveyors to see if the existing county boundary is correct and meets the needs of all adjoining counties. All counties must agree to any and all boundary ambiguity changes.
- Compile updated boundary information that will be used to determine the more accurate boundary line.
- County boundaries that fall along the natural landscapes should be updated with only more accurate information than what is presently used to represent the boundaries.
- Agree on the boundary representation and create an updated GIS boundary file for review.

Step 2: Submit Updates to County for Adoption

- The County authority, as defined by the county, receives county boundary improvements and recommended changes.
- The work is reviewed and approved.
- If approved, then the electronic records and supporting information is forwarded to DNR for inclusion into the Cadastral database.

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- DNR takes submitted County updates and examines packet and submittal to determine if there are any questions.
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Step 4: New County Data Published

- Once DNR submits the new county boundary data to OCIO, then the Geospatial Program Office will publish it on the WA Geospatial Portal. This update process is on-going and driven by more accurate coordinate data.

The OCIO notifies the Geospatial community of the county boundary update via the Geographic Information Technology Committee and the Washington Geographic Information Committee List Serve.

Acknowledgements

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