

UNBC GIS

Regional District Topology Errors

A Fly in the Jello

Ashley Elliott and Morganne Barthel
4/1/2012

1. Introduction

Purpose and Intent:

The purpose of this project was to correct problem areas with the current Zoning Bylaw 833 from the Regional District of Fraser-Fort-George (RDFFG). The problem areas were identified and given to us by Amanda Spendiff, 9-1-1 CAD/RMS Technician for the RDFFG who suggested this project during a guest-lecture.

The original intention of this project was to create topologies as team so that the rules were consistent, and then divide the problem areas identified by Amanda Spendiff between the two of us. There would then be edited separately followed by individual analyses within our assigned problem areas. Unfortunately, as we will indicate in the following report, the topologies, analysis, and editing were so time consuming that we did not have enough time to complete separate analyses. Instead, we determined alternative approaches to solving the problems between the parcels layer and the ZoningBylaw833 layer together.

Background Information:

At the beginning of this project, we were given two layers: ZoningBylaw833 and zoning_problem_areas. ZoningBylaw833 contained the errors which we had to find and correct because they did not coordinate properly with the parcels layer we downloaded from the RDFFG website. We were given zoning_problem_areas as a starting point which we could work within and expand from depending on our time frame for this project. After several attempts at creating topologies we tested alternative approaches: snap to feature using ArcView 3, and a fly in the jello approach using ArcMap. Although the corrections we have made are not perfect, they provide a better starting point for the Regional District to begin editing their Zoning Bylaw layer.

2. Study Area and Data Source

The Regional District of Fraser-Fort George (RDFFG) covers approximately 52,000 square kilometers in central and eastern British Columbia. The RDFFG serves

approximately 100,000 people within four municipalities and seven electoral areas which include:

- (1) The City of Prince George,
- (2) The District of Mackenzie,
- (3) The Village of Valemount,
- (4) The Village of McBride, and
- (5) Electoral Areas A, C, D, E, F, G, and H.

Data was collected through the Regional District's website and Amanda Spendiff. Data collected from the RDFFG, provided by Amanda Spendiff, included parcels, zoning bylaw 833, and identified "problem areas" (see Figure 1.) The data was sent in BC Albers which enables the RDFFG to work within one map sheet as it covers a large area.

Parcel data was used as the dominant layer because it was retrieved from the Integrated Cadastral Information Society (ICIS) whereas the ZoningBylaw833 was done at the Regional District within the GIS department.

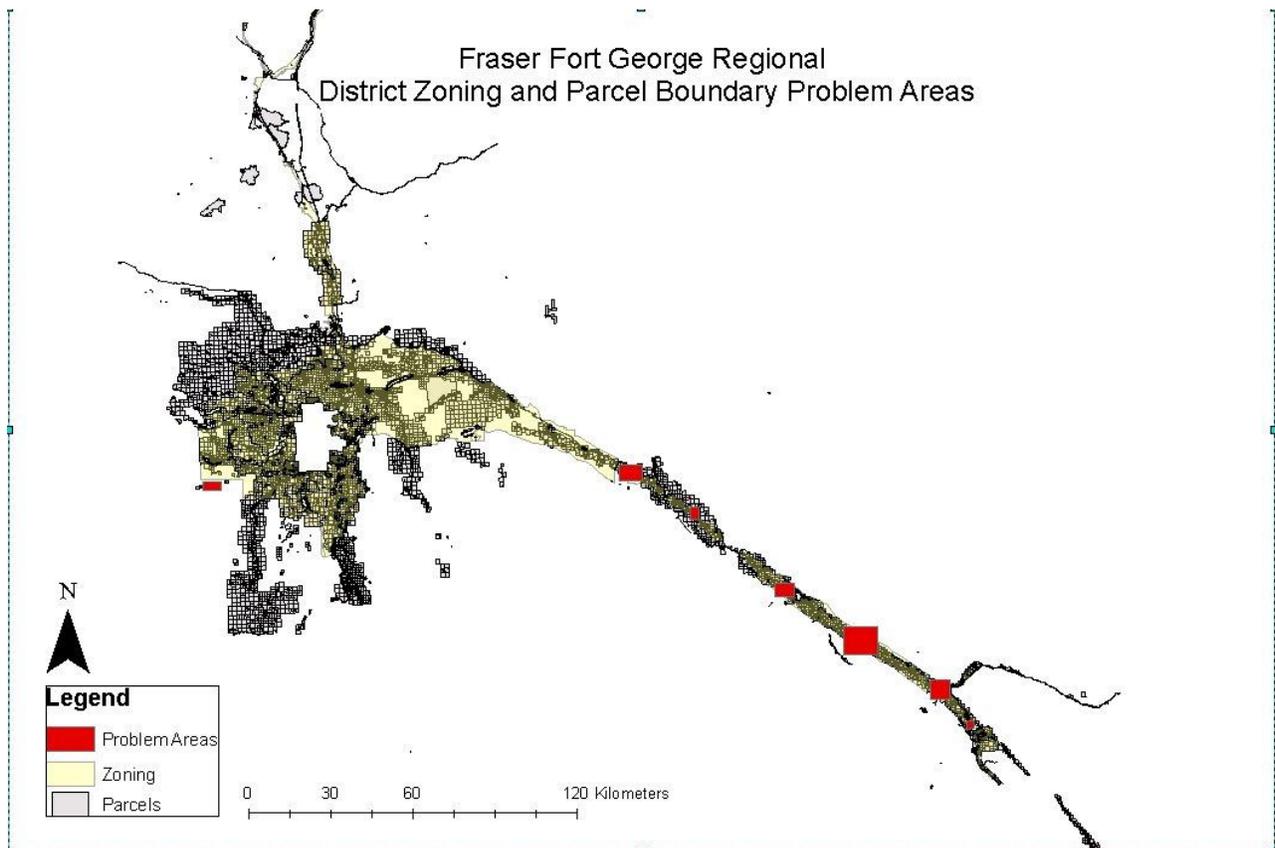


Figure 1: Fraser Fort George Regional District Zoning and Parcel Boundary Problem Areas

3. Topology Rules and Analysis

During a preliminary meeting with Amanda Spendiff and Roger Wheate, we were requested to create geodatabases and a topology which would identify errors indicated by red points, lines, or polygons.

TOPOLOGY ATTEMPTS 1 - 6

Topology: Attempt 1 (2 hours)

Our first step was to create a geodatabase and a new topology with the following rules: (1) ZoningBylaw833 must not have gaps, (2) Parcels must be covered by ZoningBylaw833, (3) Parcels Area boundary must be covered by ZoningBylaw833 (see figure 2.).

We then imported this topology into ArcMap and utilized the ESRI helpdesk to understand the topology editor toolbar. We utilized the topology editor to modify the ZoningBylaw833 to match the parcel borders but none of the errors were corrected when we validated the section that we had edited.

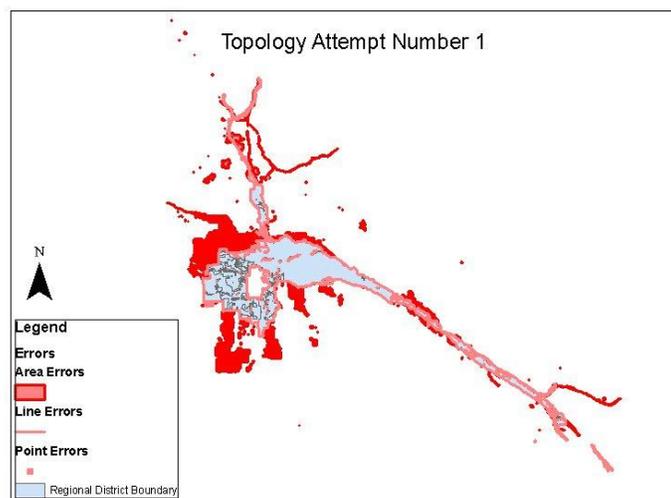


Figure 2: Topology Attempt #1

Topology: Attempt 2 – after edits

In an attempt to visualize the progress we had made with our edits, we generated another topology using the same rules as attempt 1. If we had made progress we would see a reduced amount of red points, lines, and polygons that would justify the corrections done to the first topology. Unfortunately, what we realized was that the amount of red in problems areas remained unchanged plus additional errors were caused by the editing process (see Figure 3.)

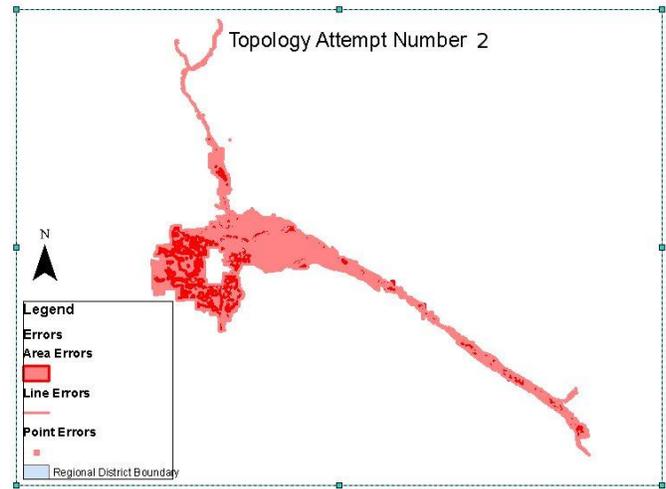


Figure 3: Topology Attempt #2

Topology: Attempt 3 (4 Hours)

We started over and created a new geodatabase and a new topology with the following rules:
 (1) Zoning_problem_areas must not have gaps, and (2) ZoningBylaw833 must not have gaps. This new topology was imported into ArcMap (see Figure 4.), after four hours of editing and no progress to account for, we e-mailed Amanda Spendiff questioning the validity of our rules. We were provided with a recommended set of rules to try for our next attempt.

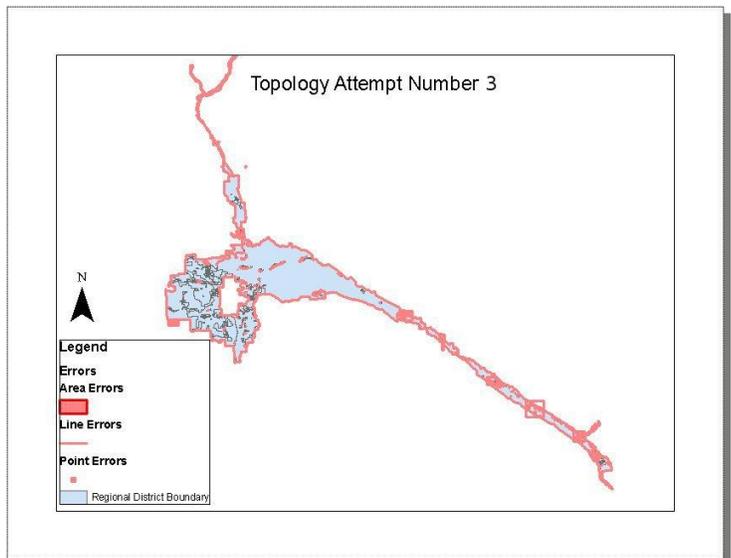


Figure 4: Topology Attempt #3

Topology: Attempt 4

(2 Hours)

After receiving a new set of rules to use from Amanda Spendiff, we generated a new geodatabase as our fourth attempt. The new set of rules given to us were:

- (1) ZoningBylaw833 must not have gaps,
- (2) ZoningBylaw833 must not overlap, and
- (3)

ZoningBylaw833 area boundary must be covered by parcels. This topology was then loaded into ArcMap (see Figure 5). We then used

the topology editor and the editor toolbar extension to modify the ZoningBylaw833 to match the parcel borders. Using the validate tool, we were unable to see the progress in areas we had worked on and instead had created more errors with our corrections.

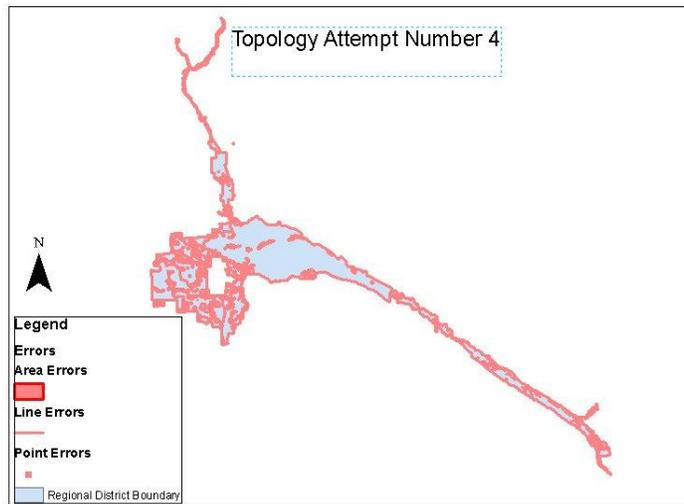


Figure 5: Topology attempt #4

Topology: Attempt 5

(3 Hours)

For our fifth attempt, we clipped ZoningBylaw833 to zoning_problem_areas which meant that we would only be correcting the zoning within the designated problem areas to avoid increasing the amount of errors elsewhere. We used the same rules from the previous attempt (see figure 6).

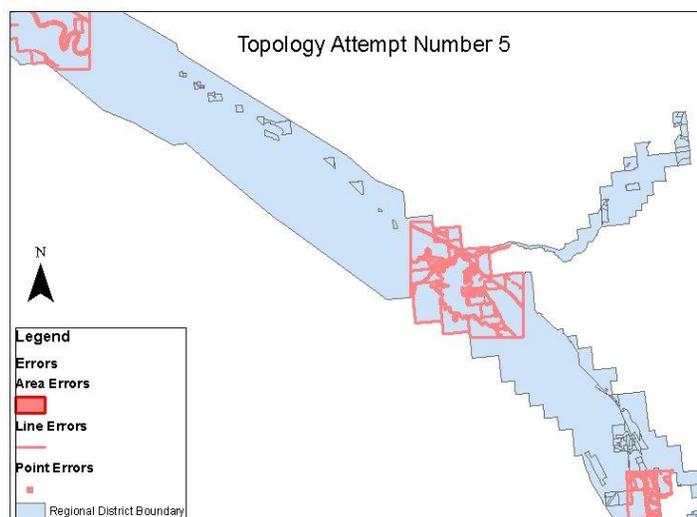


Figure 6: Topology Attempt #5

Chris Turner, Teaching Assistant and PhD student at UNBC, gave us a brief background on topology and suggested two tools we could use to help our situation: auto-correct or manual editing. Chris gave us the pros and cons of using each tool stating that the auto-correct can create more errors in other areas so we decided to continue with manual editing. We then used the topology editor and the editor toolbar extension to modify the ZoningBylaw_clip to match the parcel borders. We realized that many of the errors were within the Zoning_clip layer and that this was causing unrelated errors when attempting to overlay with parcel boundary layer.

Topology: Attempt 6 (1 hour)

For our sixth attempt, we generated a new topology using only the ZoningBylaw833 layer. This topology focused only the zoning layers to try and correct gaps and overlaps so that when overlaid with parcels, there would only be errors if the two did not align correctly.

The rules we applied to the new Zoning_clip topology were: (1) Zoning_clip must not have gaps, and (2) Zoning_clip must not overlap (see Figure 7).

This topology was then imported into ArcMap where the topology toolbar & editor toolbar extensions were utilized to edit the errors and validate our corrections. After editing the zoning_clip topology, we realized we were not making any progress and decided our best course of action would be to find an alternative method to eliminate the errors between the parcel boundary layer and the zoning layer.

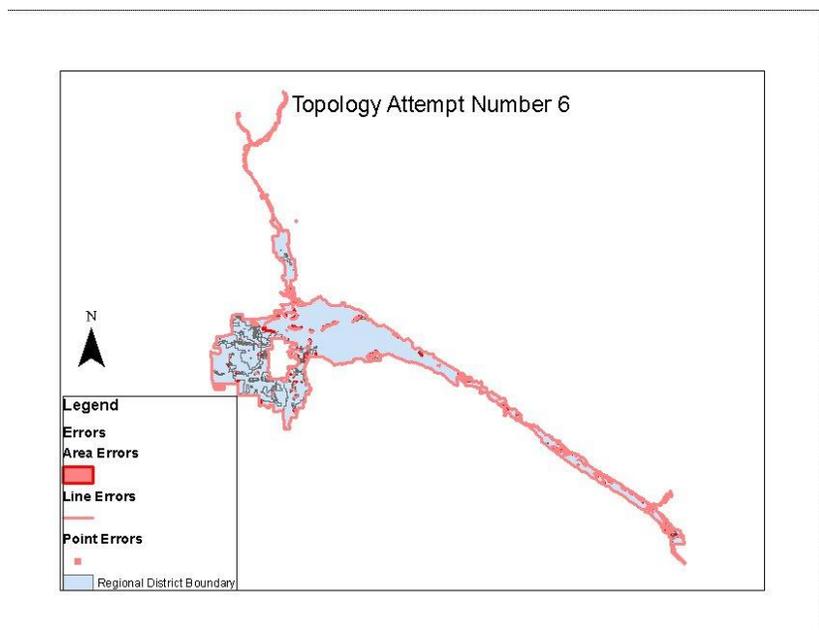


Figure 7: Topology Attempt #6

4. Errors

The errors that we first encountered when we overlaid the original ZoningBylaw833 layer and the parcels layer were: the boundaries were not aligned, rivers and roads were zoned as polygons, and there were multiple vertices stacked on top of one another in addition to slivers located throughout the ZoningBylaw833 layer (see figure 8). After recognizing that the amount topology errors, as discussed above, could not be corrected in the allotted amount of time we had to complete this project, we tried two alternative approaches for editing the zoning boundary errors.

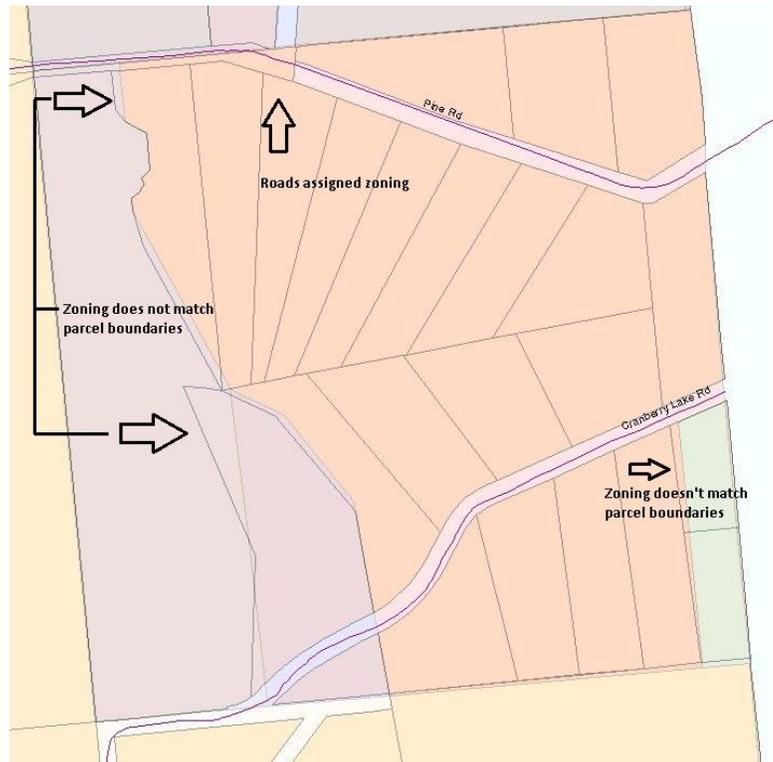


Figure 8: ZoningBylaw833 layer errors after overlaying with parcels

5. Alternative Data Management Methods and Analysis

Approach 1: ARCVIEW 3 (2 hours)

We loaded our layers into ARCVIEW 3 to utilize the snap to feature tool that is not available in ArcMap to clean the ZoningBylaw833 layer. Our first attempt was to create another copy of the ZoningBylaw833 file so that we could overlay them and snap the zoning boundaries to the proper zoning polygons. This proved futile so we loaded the parcel boundary and attempted to snap the zoning polygon boundaries to the parcel boundaries. This created additional errors and raised concerns regarding the accuracy of these edits.

We decided to try an alternative approach using the centroids of the parcel polygons in ArcMap known as the 'fly the in the jello' method.

Approach 2: ARCMAP (2 hours)**A Fly in the Jello:**

The alternative approach that we used to solve the problem expressed by Amanda Spendiff was completely different than the approach she suggested during our preliminary meeting. Our first step was to clip the parcels layer to the ZoningBylaw833 layer. From here, we utilized the 'feature to point' tool from the ArcToolbox to calculate the centroids of the parcels_clip layer. We then conducted a spatial join to assign the attributes from the parcels to the centroids, and then conducted another spatial join to join the attributes from the zoning_clip layer to the parcel centroids which produced the file parcels2.

Once we had assigned the entire parcel and zoning information to the centroids, we joined the tables of the centroids and the original parcel attribute table. Our next step was to dissolve the parcel boundaries, which gave us the new zoning layer with an attribute table that contained all the parcel attributes and the zoning attributes. Once this was completed, our zoning layer matched the parcel boundaries and eliminated the original problems between the parcels and zoning that were identified by Amanda Spendiff.

This alternative approach did correct many of the problems between the two layers that Amanda Spendiff had identified. The approach also created some errors that would be less time consuming to fix. For example, some parcels were divided by a road so when the centroid was assigned, it was located within the middle of the road. When the zoning table was joined, it automatically zoned the entire road (see Figure 9).



Figure 9: Errors resulting from the 'fly in the jello' approach

6. Results

The results of this alternative approach were positive because we fixed many of the errors, and it was significantly more time efficient than the topology approach. This may be an approach worth suggesting to the Regional District as it would significantly reduce the number errors that require editing using the topology approach.

7. Future Work and Recommendations

In the future, we suggest starting with a centralized location and working outwards rather than beginning with problems areas which are dispersed throughout the Regional District. Starting with a centralized location and working outwards allows for the errors which are created by corrections to be recognized and addressed in a sequential manner. Additional corrections, for example to the errors created using the 'fly in the jello' approach, would need to be made before presenting this information to the Regional District.

8. References

Regional District of Fraser-Fort George (2011). Original data can be accessed at:

<http://www.rdffg.bc.ca/>

Personal Communication:

Amanda Spendiff, 9-1-1 CAD/RMS Technician at the RDFFG and
alumni of UNBC, March - April 2012

Chris Turner, Lab Instructor and PHD student - UNBC, March - April 2012

Ping Bai, Senior Lab Instructor - UNBC, March - April 2012

Roger Wheate, Professor - UNBC, March - April 2012

Scott Emmons, Senior Lab Instructor - UNBC, March - April 2012

9. Acknowledgements

We would like to thank Amanda Spendiff and Roger Wheate for setting up a meeting to initiate the project. We would also like to thank Chris Turner, Scott Emmons, Ping Bai, and Roger Wheate for working with us on various programs, teaching us background information on topologies, and brainstorming alternative approaches to the project.