KING COUNTY, WASHINGTON

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CE 413

GIS WATER RESOURCE

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King County

Introduction

This project will be focused on stream networks that pass through a USGS Gage for the location of King County, Washington. The goal is that the lengths of the flow lines will be measured to an outlet. A specific watershed has been chosen in King County even though there are many Watersheds in King County this one was chosen because it is connected to the main body of water next to the county. The tools that are going to be used are the Hydrologic tools in the ArcGIS Geoprocessing toolbox. This allowed to perform the following task filling sinks, flow direction, Flow accumulation, Drainage lines, Catchments, and Stream networks. In Figure 1. Represents where King County is located in the state of Washington.

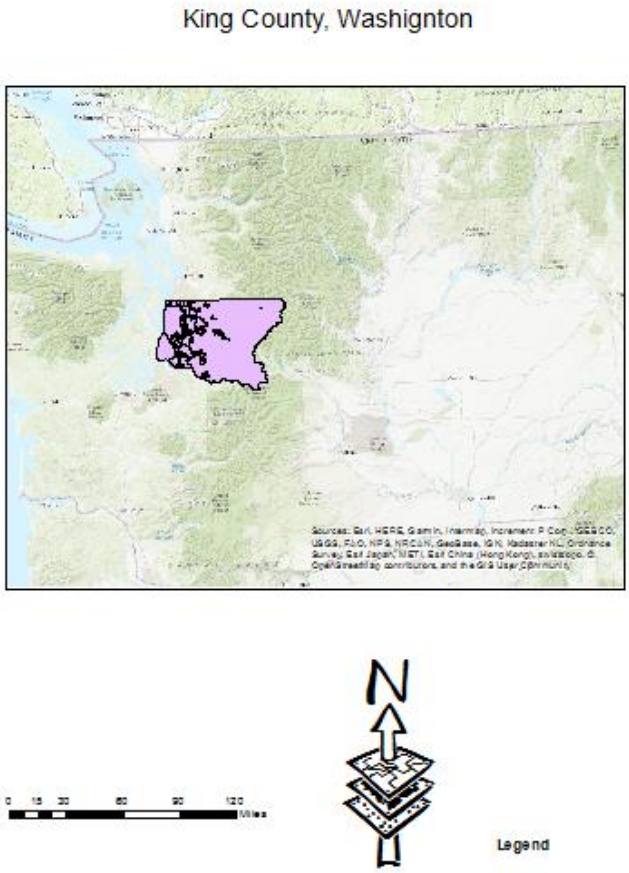

Figure 1. SeaTac Location

Project Overview

Project

This project is going to consist of the watershed in the area of King County that is going to be isolated from the other watersheds. The second thing is that the flow direction will be assigned from where it starts and where it will go to a certain point, this is known as the water outlet. The last thing that is going to be done is that with the flow lines and the outlet point, there will be a way to gather the lengths of the flow lines to the specific point.

Study Area

The location that is being analyzed is Sea Tac, Washington. It located in the Pacific-Northwest in Washington. It is located in-between Seattle and Tacoma. The watershed that is being analyzed is the watershed that connects the flow lines of the body of water next to the land. The topography of the land consist of mostly vegetation and towards the end it gets more into the urban area. Another interesting thing about the land is that there is mountains in the beginning of the watershed which creates steep slopes.

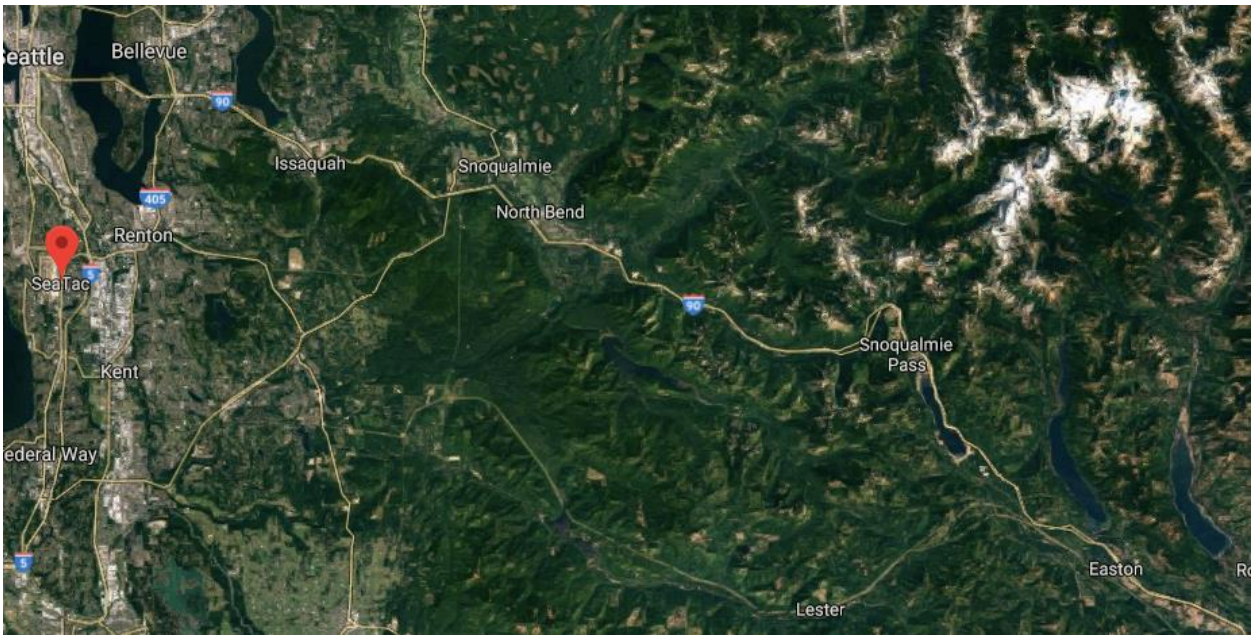

Figure 2. Topography

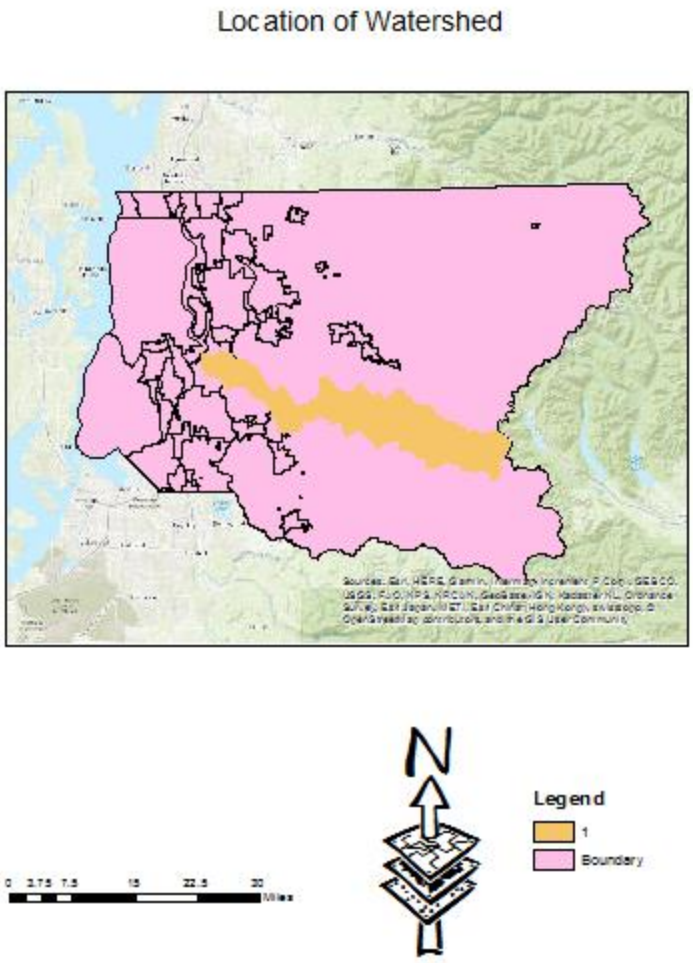

Figure 3. Location of Watershed

Methods

Data Acquisition

Table 1. Data

Data	Source
30-m DEM	Geospatial Data Gateway
Gages	King County GIS Open Data
Boundary	King County GIS Open Data
Watershed HUCs	Geospatial Data Gateway

Data

Table 2. Data Description

Item	Description
Drainage Line	• Projected coordinate system NAD_1983_Texas_Centric_Mapping_System_Albers • Projection Albers • Geographic Coordinate System GCS_North_American_1983
Gages	• Geographic Coordinate System GCS_WGS_1984

Processing

The DEM layer was obtained from Geospatial Data Gateway and the download elevation profiles of King county area came in as East and West DEM layers. The files that were obtained existed in 30 by 30 meters. The two DEM layers that was done was that they were merge together using the Function of Mosaic. This new File was named New DEM layer. After they merged together, what needed to be done was to clip the new DEM to the shape of King County boundary. Therefore the only data that is going to be looked at is the size of king county. Figure 4 shows the steps that were taken to combine the DEM layers and clipping it to the boundary of King County.

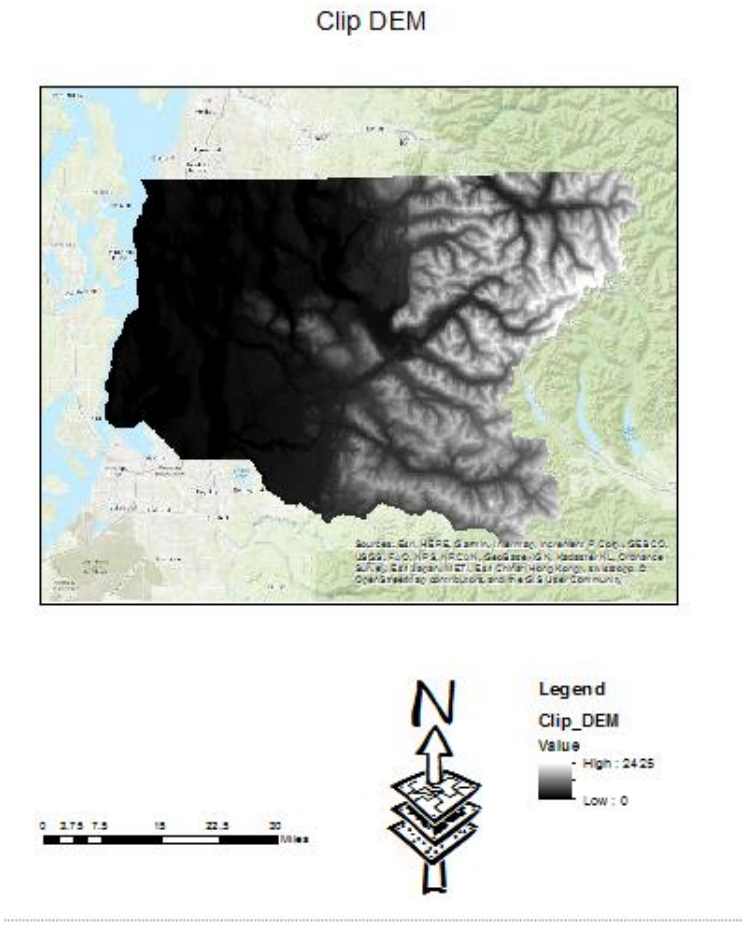

Figure 4. DEM Layer

After the DEM layers have been combined and clipped, the next steps was using the hydrology tools for the location. The first hydro tool is to fill in the sinks and what this tool does is that it fills any holes in the DEM so therefore the water can flow and not be trapped in a certain location. Then there is going to be a definition of the flow direction in respect to the steepest slope. This allows a person to visualize what direction is the steepest slope in a certain point. The third step of the hydro tools is the flow accumulation and this allows the user to see how much it has accumulated from one flow line to another. It represent the how much accumulation it has gathered based on the color of the certain raster. Figure 5. Represents the

flow accumulation of the previous flow lines that is by the outlet of the watershed that was chosen for this project.

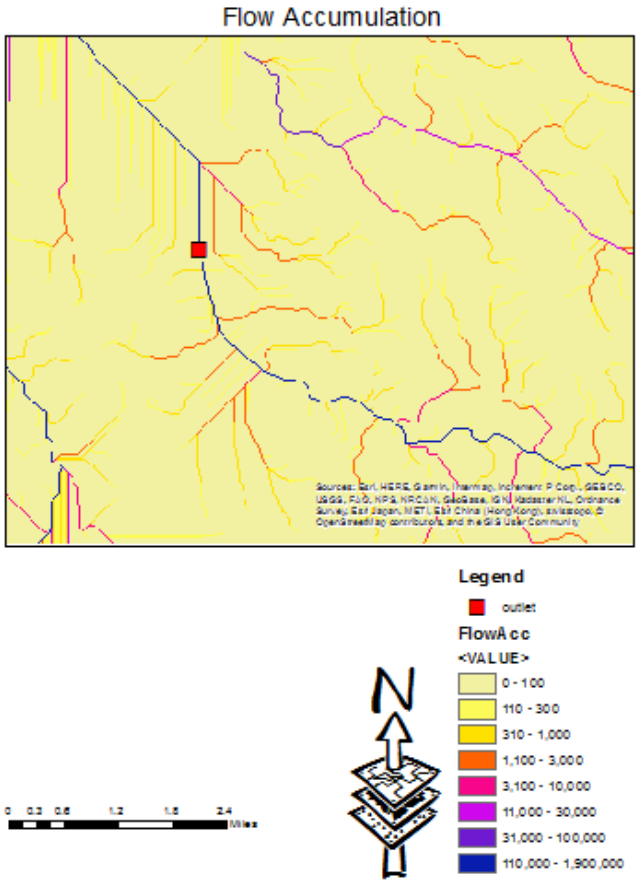

Figure 5. Flow Accumulation

Since there is a few watersheds in the area of King County, an assumption that is going to be made for this assignment is that a single Watershed is going to be isolated to simplify the purposes of the project. The location that was chosen was the watershed that connects east to west of king county and that runs to the main body of water. To be able to analyze this, there had to be an outlet at the end of the flow lines was made so there will be a point of discharge. Therefore having both an outlet point and the flow direction of the DEM layer can create a

water shed area that is wanted. Figure 6. Shows the watershed that was chosen for this location, the outlet point, and the drainage line from start to end.

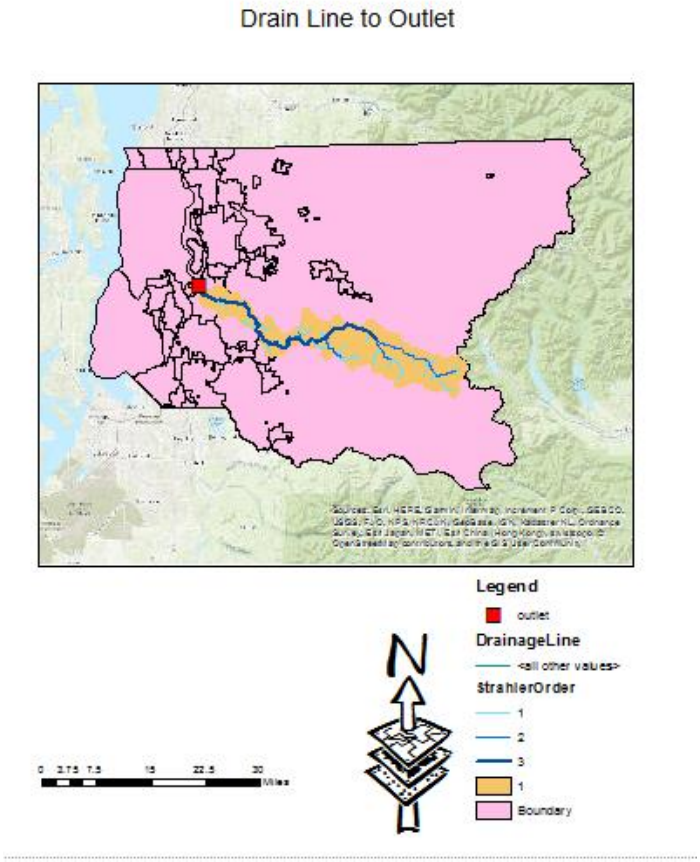

Figure 6. Drainage Line to Outlet

Having isolated the wanted watershed, the next step is to define the streams in respect to the gage. Using the Stream definition it can be defined as where how much fluids transfers in the respected gages. What this represents is stream delineation over the respected watershed. Figure 7. Represents the two areas that flow into the specific gage.

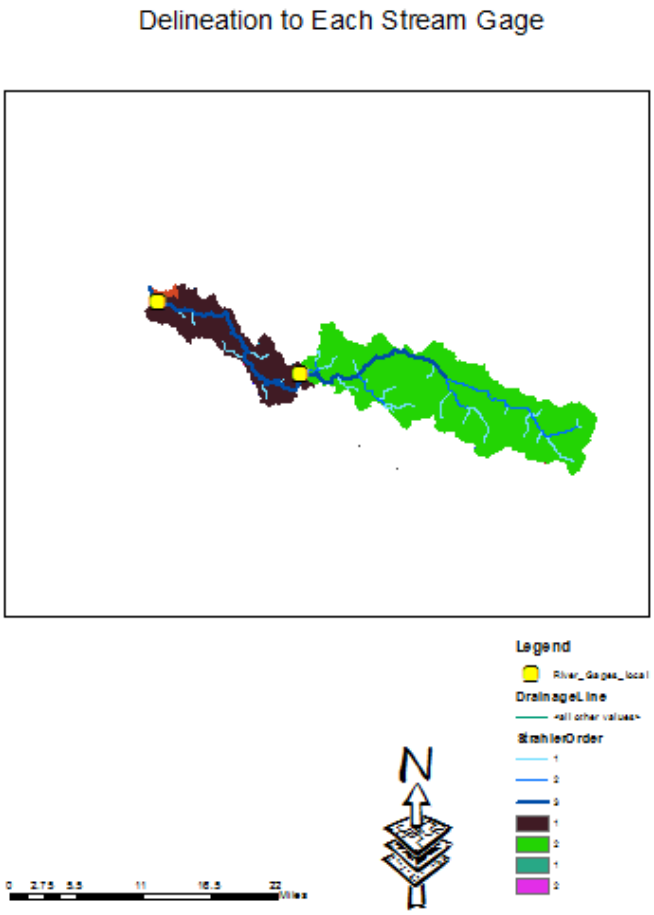

Figure 7. Delineation to Gage

A factor that was looked at was the catchments and this tells us is that the respected area of the drainage line respect to the area of the land. It is easier to visualize the separation of land through the flow line. The tool that was used to create this layer was the watershed layer. The information that was inputted was the flow direction layer and the stream link layer. Figure 8. Shows the catchments in respect the drainage lines that cross through the specific area.

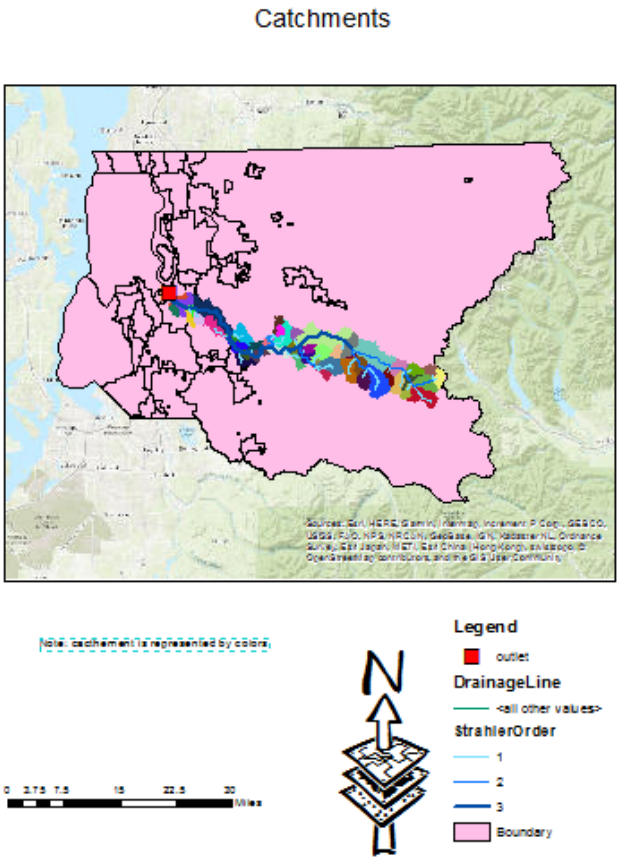

Figure 8. Catchment

Results and Discussion

The first result that was obtained was that with the stream definitions and the catchments there can be a representative of the flow of the water, which is represented by Figure 8. The stream of the waters are defined by both the darkness of the blue and the width of the stream. Having a low width and a lighter shade of color represents the start of the flow line. By the end the main flow line, it will be represented by a dark blue color and biggest width of the line. Therefore Figure 9, signifies the different catchments in the watershed. With the change in the catchment it represents a different segment of the flow lines.

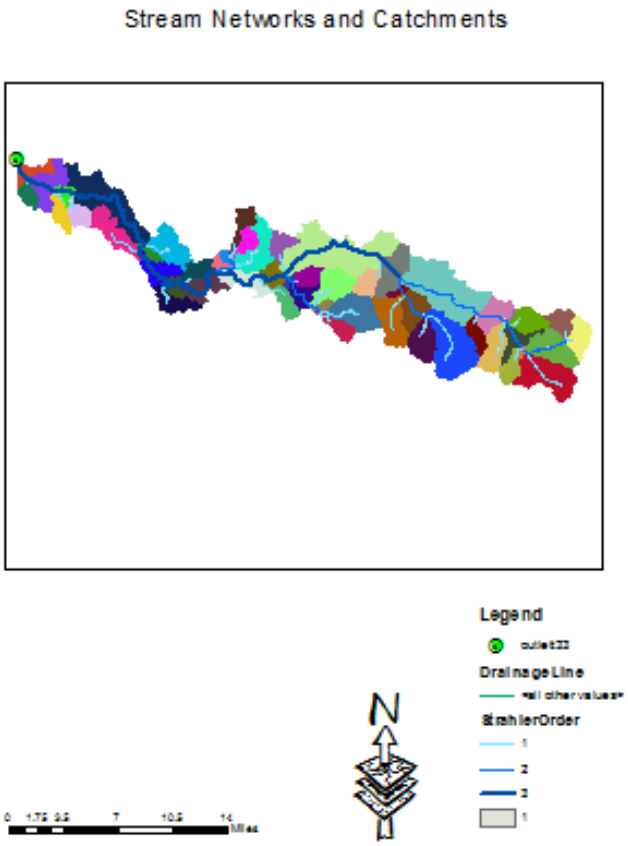

Figure 9. Stream Network

The next image is represented the direction of the flow and it shows that the flow runs from east to west. This is important because this way there can be a way to show the distances from individual points that can be important to the city. Figure 10 is the anaylsis that was made for the direction of the flow line.

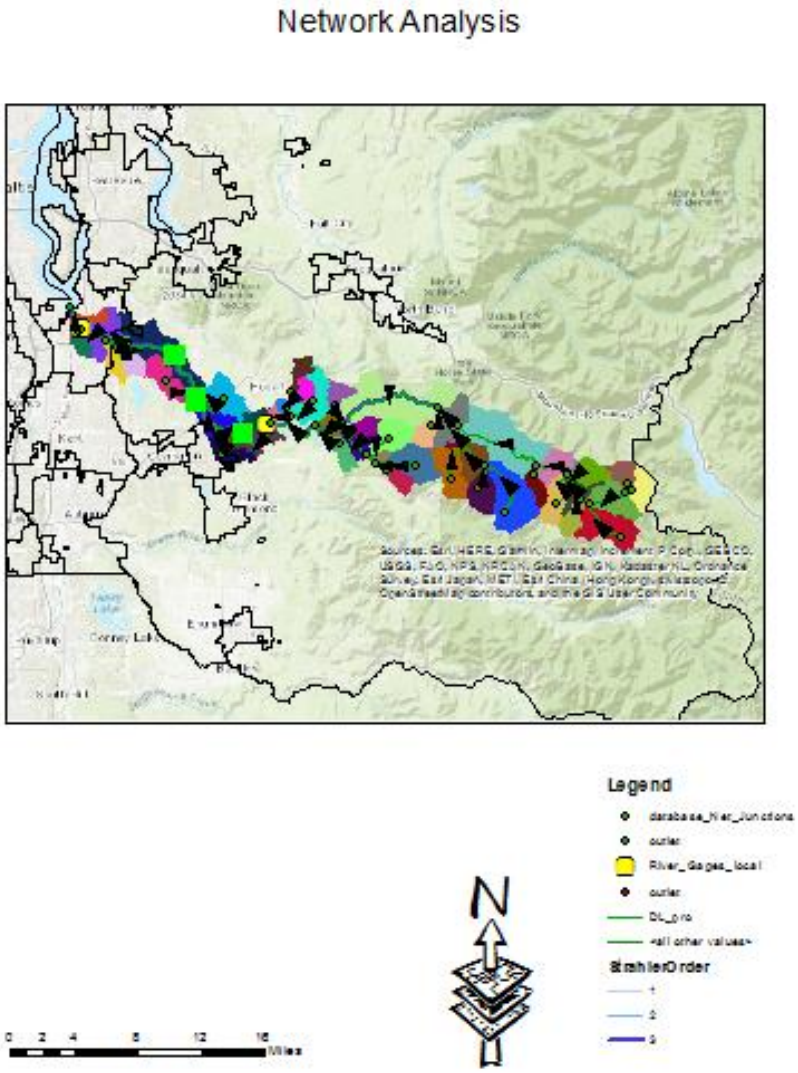

Figure 10. Network Analysis

Conclusions

The analysis that have been run for the particular site and the figure below and the final length is 88.7 kilometers. Some things to take away from this was that the projection that was used was Albers and that would give different lengths deepening on the projection. Something that could be done in the future is to analyze different water flows depending on the location and

therefore there can be an analysis of both the lengths of the rivers and also the how much water mass is coming through per location.

Table 3. Lengths Results

Reference	Length (m)
Longest length	88771.83
Closet gage to outlet	2613
Farthest gage to outlet	38550

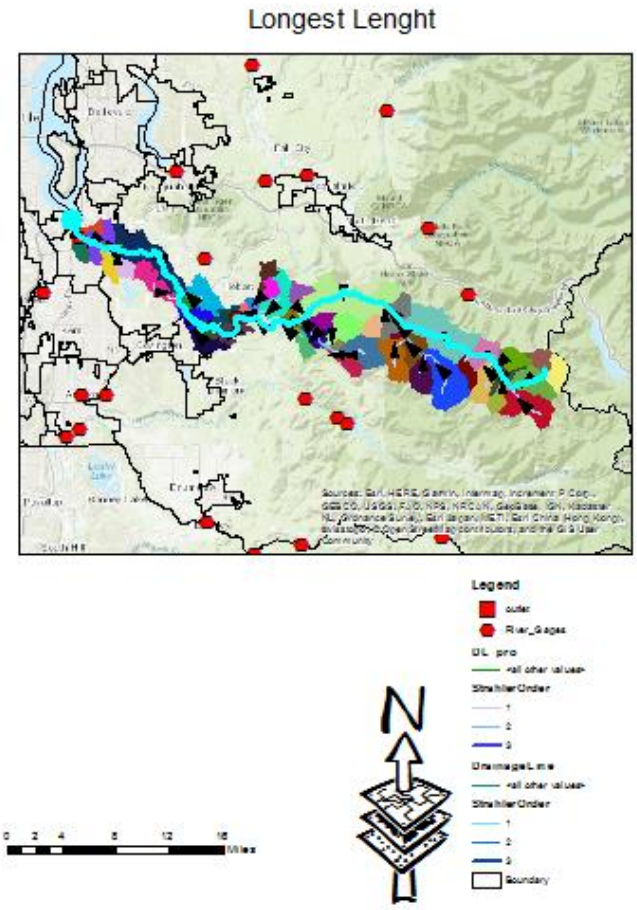

Figure 11. Longest Length

References

[1] GIS Open Data, “River Gages”, March 17, https://gis-kingcounty.opendata.arcgis.com/datasets/f675bcf993534f22935c34eda4c89742_2487

[2] Geospatial Data Gateway “King County, Washington” https://datagateway.nrcs.usda.gov/