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GEO 327G

GIS and GPS Applications in Earth Science

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Analysis of Texas lakes and reservoirs affected by and at risk to Giant Salvinia infestations

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Background and introduction:

Caddo Lake is ancient, being the only natural lake in Texas it's also made up of the world's largest bald cypress forest. Due to its age, the lake is home to many rare species like paddlefish, river otters, and wood ducks. Unfortunately, that beauty has been choked out to near extinction since the 2000s due to Giant Salvinia. Giant Salvinia is a floating freshwater fern from southern Brazil that multiplies rapidly across bodies of water. The floating plant carpets areas of open water prohibiting waterfowl from landing while also blocking sunlight and decreasing the oxygen concentration. Unfortunately Caddo Lake is not the only lake to have been affected by such a heinous plant, there are 14 other lakes in Texas battling this invasive species. The fern is predominantly transported between lakes and reservoirs through human traffic on boats and trailers resulting in Texas Parks and Wildlife to impose fines to individuals found with it on them. Even still, the risk of nearby lakes becoming infected is quite high.

Problem:

Which lakes and reservoirs in Texas are infected with Giant Salvinia, which are at risk, and which are at low to no risk. In order to accomplish this, I need to map which lakes contain giant salvinia to determine which are infected. From there I can estimate the risk using the proximity to infected reservoirs caused by connecting waterways, irregular flooding patterns and human/boat traffic.

Data Collection:

Texas reservoir and major river shapefiles were downloaded from the Texas Water Development Board:

<https://www.twdb.texas.gov/mapping/gisdata.asp>

Texas river shapefiles downloaded from Texas Commission on Environmental Quality:

<https://gis-tceq.opendata.arcgis.com/search?categories=water>

Information about which lakes contain giant salvinia:

<https://www.nbcdfw.com/news/local/invasive-giant-salvinia-eradicated-from-lake-fork-lake-athe-ns-texas-parksand-wildlife-department/217079/>

Information regarding Giant Salvinia

<https://tpwd.texas.gov/huntwild/wild/species/exotic/salvinia.phtml>

Texas State boundary shapefile was downloaded from Texas Department of Transportation system (TxDoT)

<https://gis-txdot.opendata.arcgis.com/>

Data Processing:

Known lakes infested with giant salvinia:

Brandy Branch Reservoir

Caddo Lake, Lake Conroe

B.A. Steinhagen Reservoir

Lake Livingston

Martin Creek Reservoir

Lake Murvaul

Lake Nacogdoches

Lake Naconiche

Lake O' the Pines

Lake Palestine

Sam Rayburn Reservoir

Sheldon Reservoir

Lake Striker

Lake Texana

Toledo Bend Reservoir

First, I loaded the shapefile representing the state boundaries of Texas from TxDoT into ArcMap to create a frame of reference. Then I imported the shapefiles containing the Texas reservoirs and river systems that I'll be using, resulting in a rough outline of the project (Figure 1).

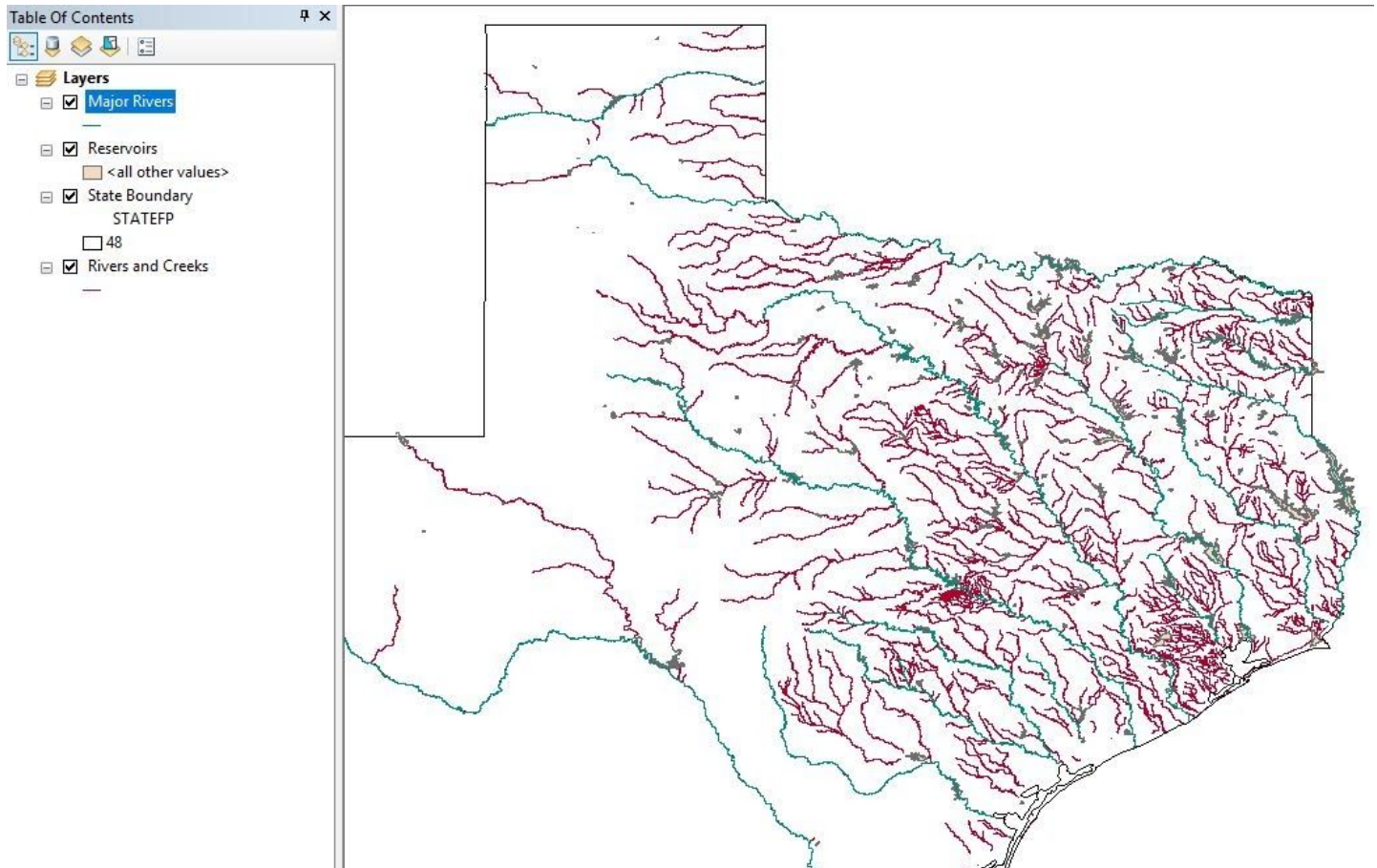


Figure 1: Combination of data into a rough draft

After, I went through and added a field to the attributes of the reservoirs data calling it “Risk” taking a text value (Figure 2). Then I turned on editing for the reservoir layer and selected each reservoir that has already been affected and changed the value of field “Risk” to “Infected”(Figure 3).

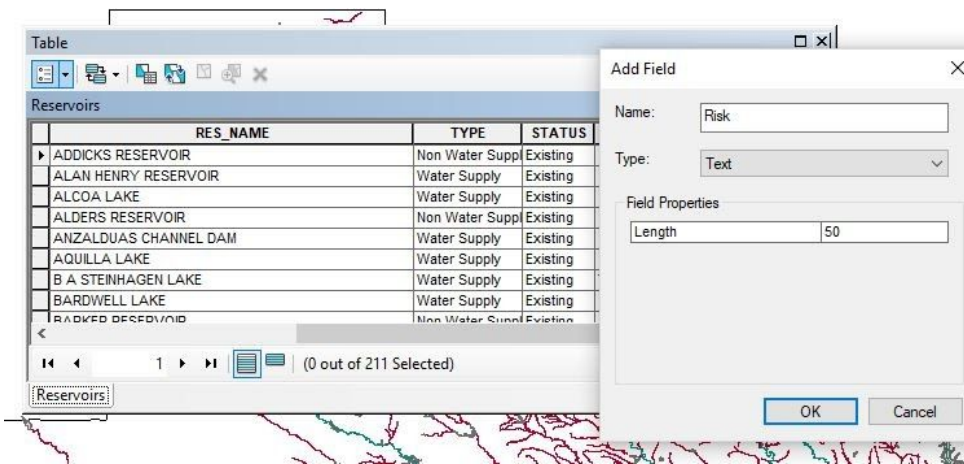


Figure 2: Creation of field “Risk”

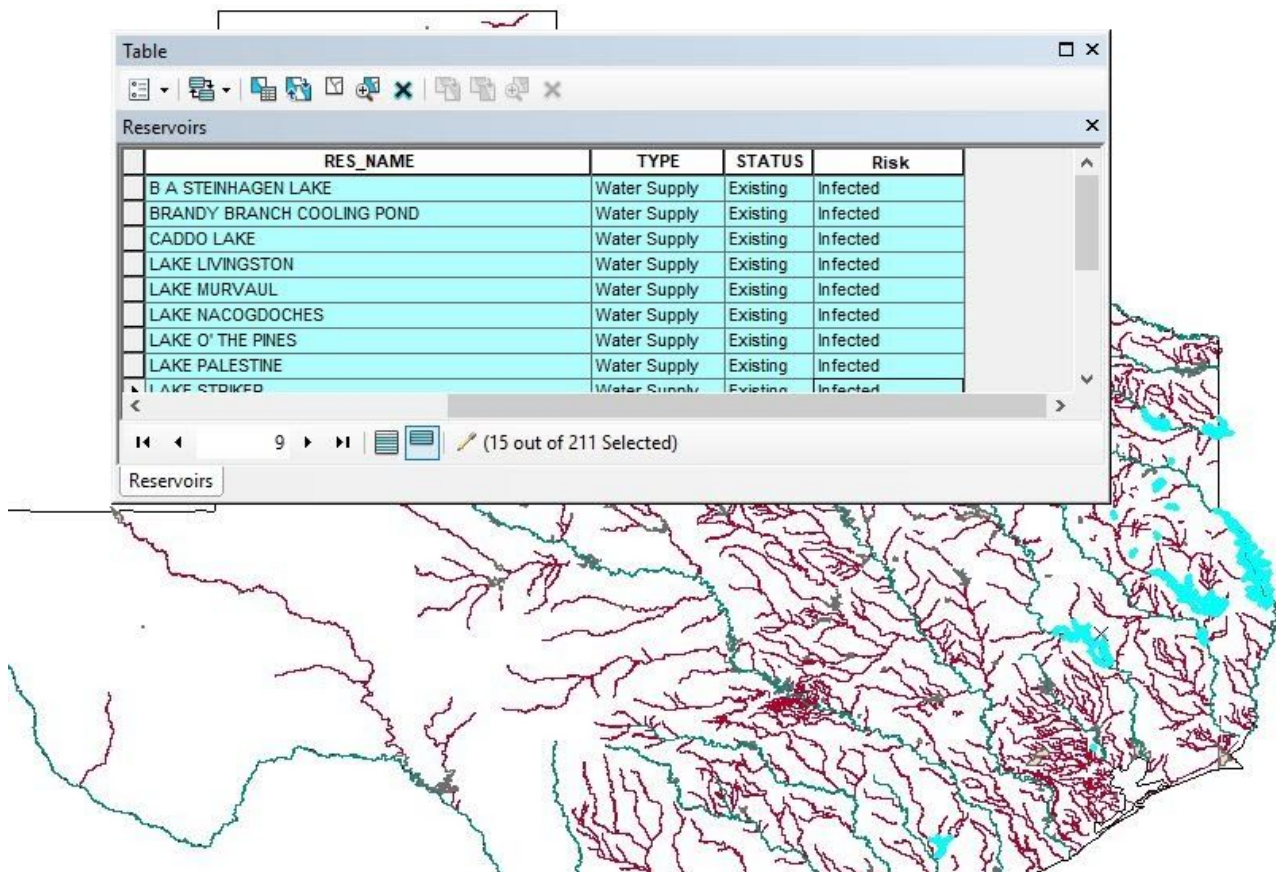


Figure 3: Selecting reservoirs and editing the attribute “Risk” to “Infected”

Since giant salvinia is transported through waterways, flooding events, and human traffic (boats, trailers, recreational watercraft) the at risk lakes and reservoirs can be estimated to be 30 miles away from infected reservoirs. To do this I selected the reservoirs that are infected and used the select by location tool to then select the reservoirs that are within 30 miles (Figure 4). These are the lakes and reservoirs to be considered at risk.

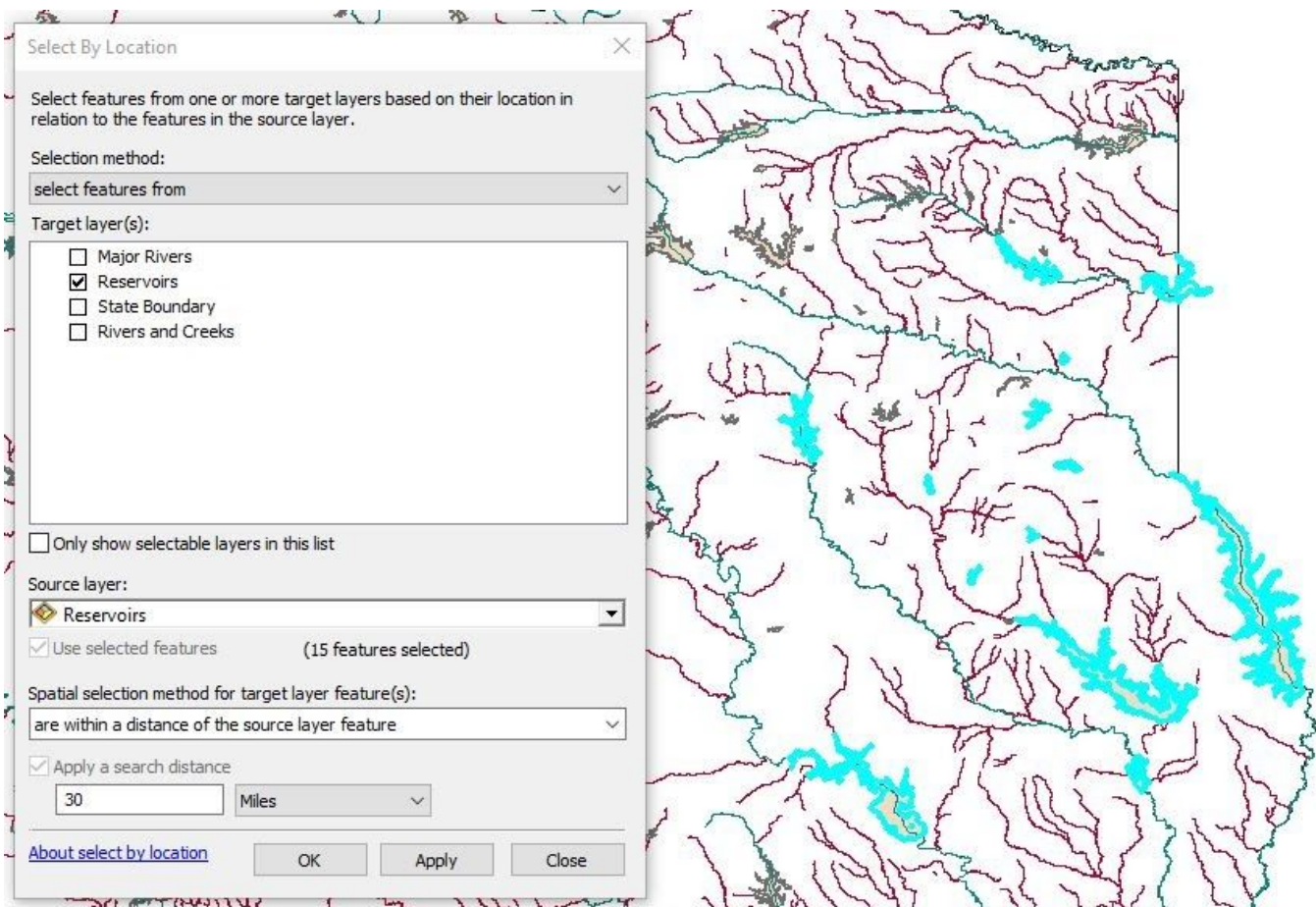


Figure 4: selecting surrounding reservoirs by location

After selecting all of the reservoirs within a 30 mile distance, I began editing the reservoir layer so that I could label the “Risk” field as “High Risk”. And then for those that did not get selected, I filled in the field with “No Risk”. (Figure 5)

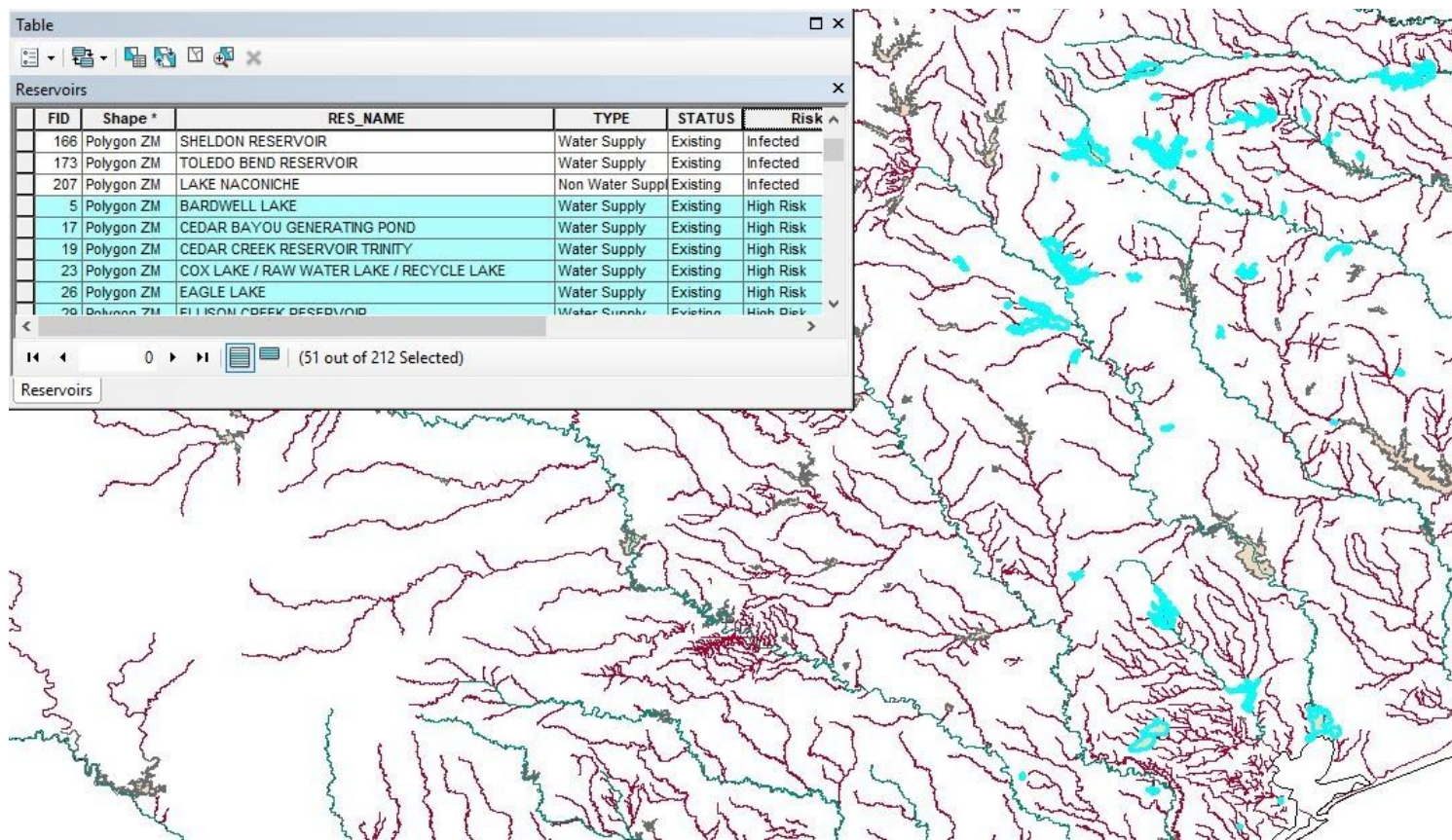


Figure 5: filling in the “Risk” field with “High Risk” for those that are within 30 miles of an infected reservoir

Once the “Risk” field was completely filled in, I could go in and create a copy of the selected features and put it into the table of contents. To do this I entered the attribute table and selected the items that were labeled as “Infected” under risk. Then right clicked on “Reservoirs”, hovered over “Selection”, and finally clicked “Create Layer From Selected Features” (Figure 6). I followed the same steps for “High Risk” and “No Risk” in order to categorize all of Texas’ Lakes and reservoirs into the three categories.

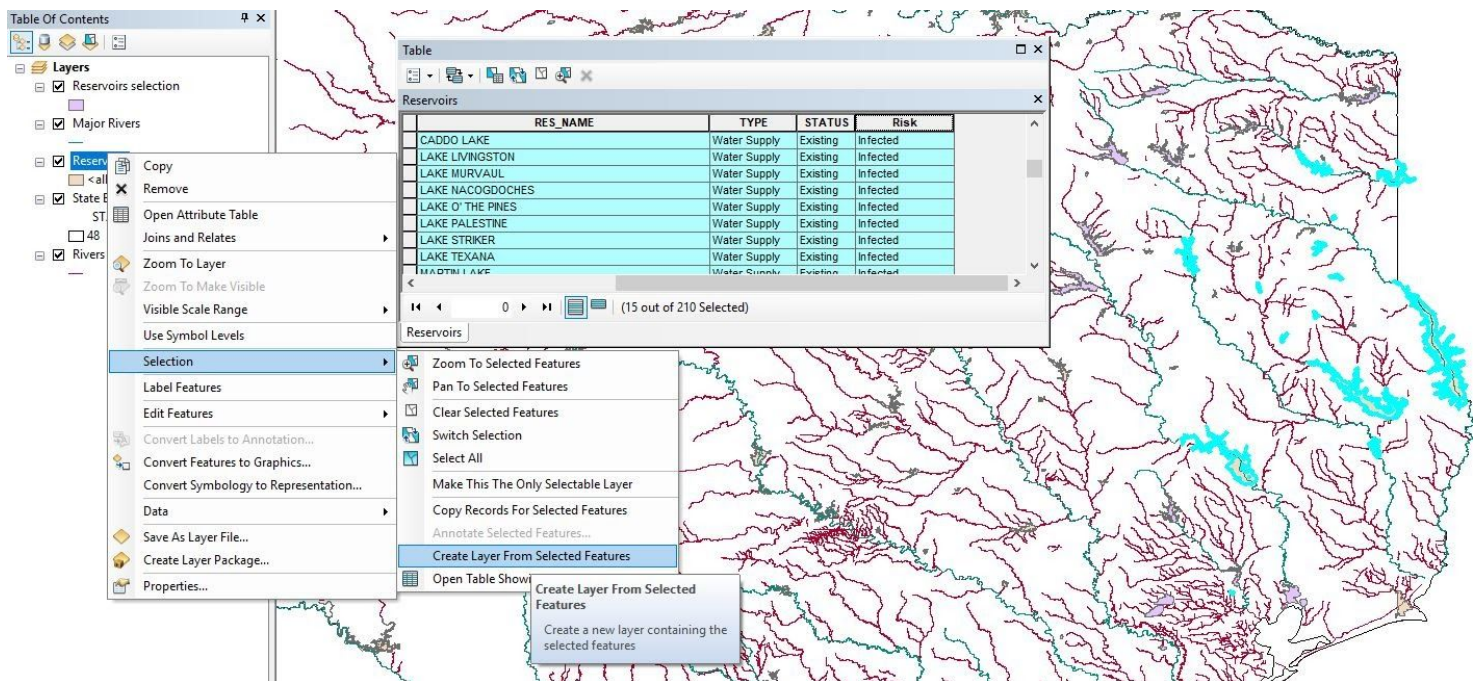


Figure 6: Create new layers for each category

Once I had my categorized reservoirs, rivers and creeks, and my Texas border, I could create the final maps in order to display the reservoirs and lakes that have been impacted or are at risk to a Giant Salvinia infestation (Figure 7 & Figure 8)

Final Product:

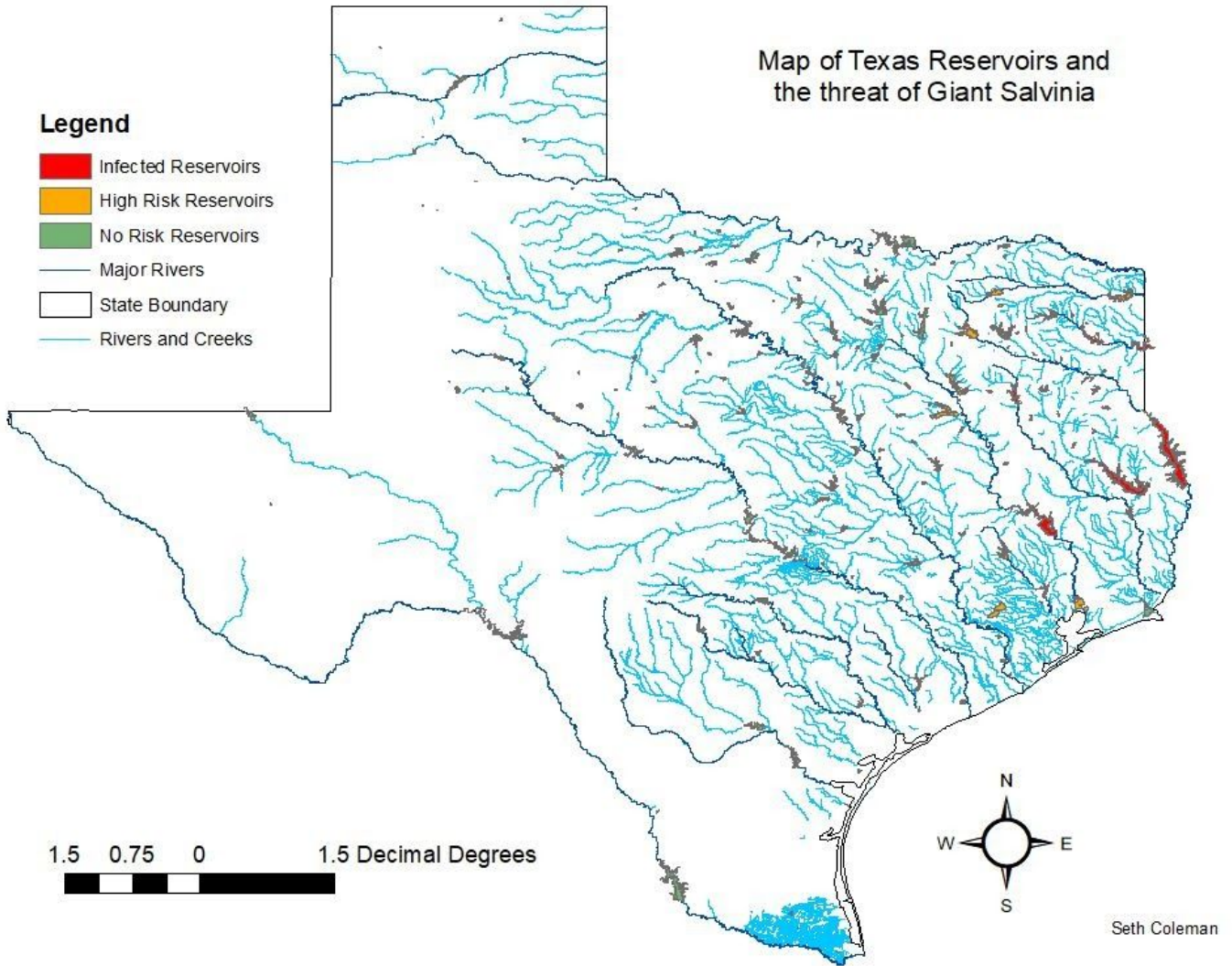


Figure 7: Final map of Texas (zoomed out)

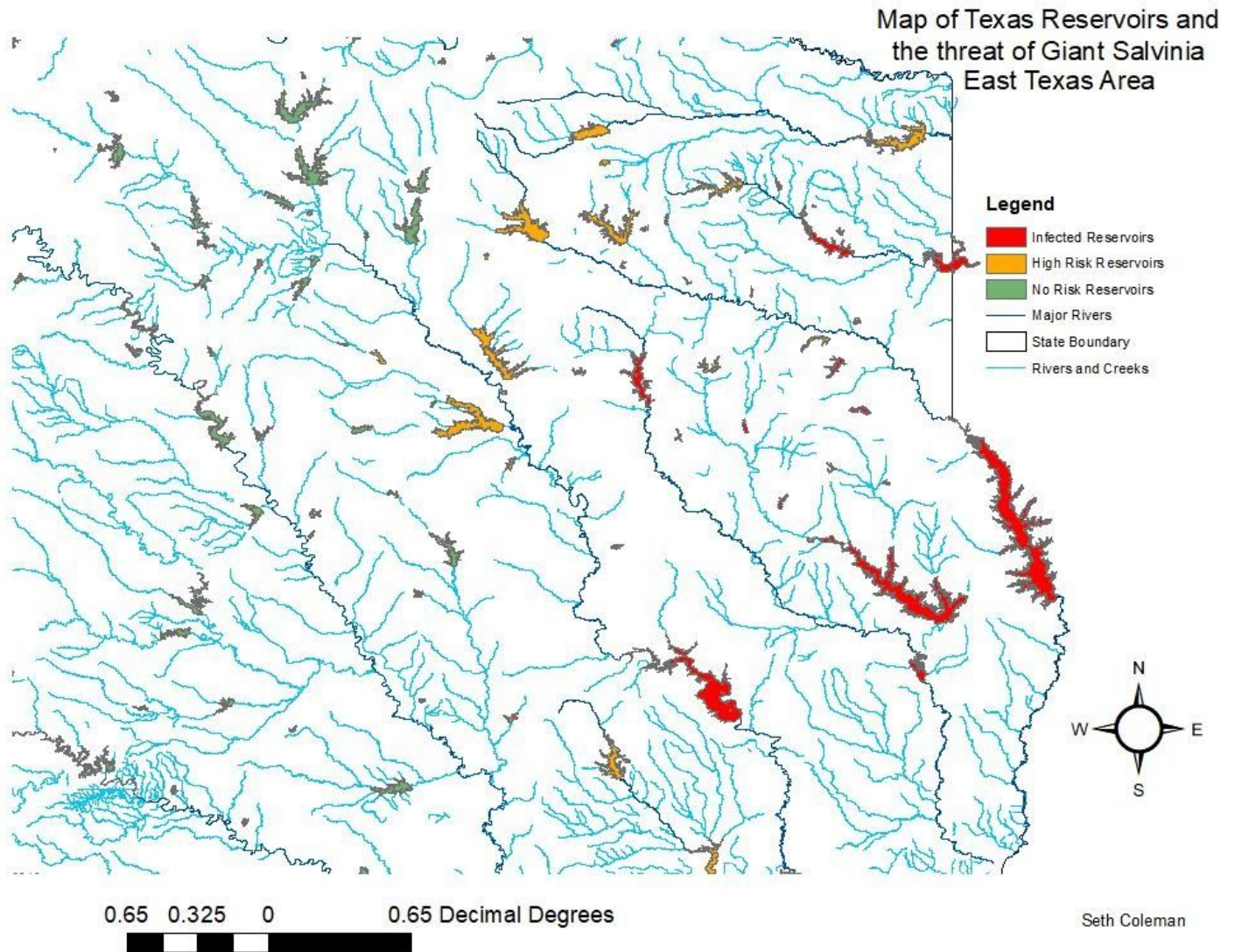


Figure 8: Final map of East Texas (zoomed in)

Conclusion

In conclusion there are 15 reservoirs in the state of Texas that have been infested with Giant Salvinia, 51 reservoirs that are at high risk of being exposed to the floating fern, and the rest of Texas' 144 reservoirs have low to no risk of Giant Salvinia showing up and reeking havoc. However, since the plant is still easily spread through boat traffic and flooding events, Texas Parks and Wildlife must continue their efforts to stop this foul weed from destroying more of Texas' beautiful lakes and reservoirs.