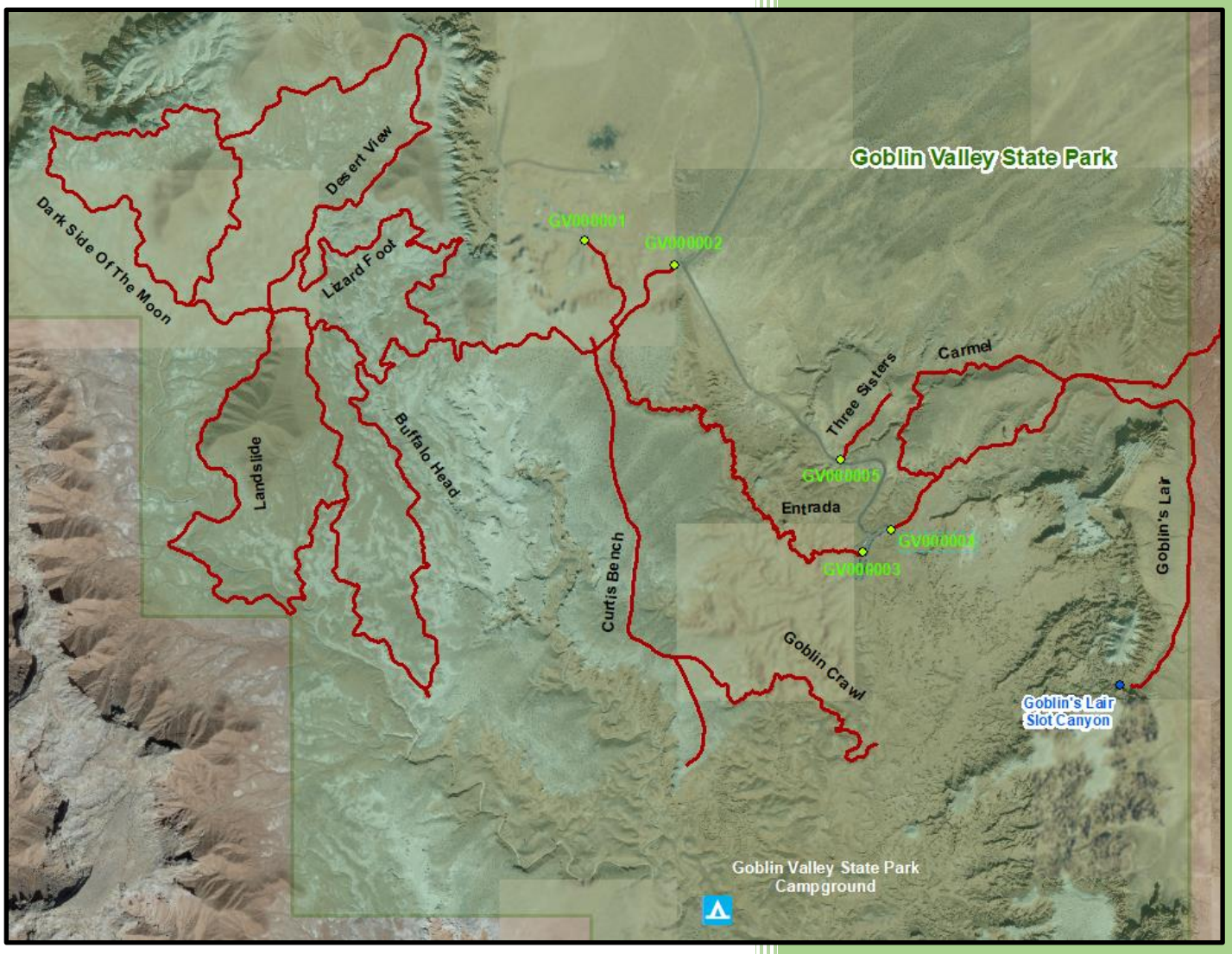
Utah Recreation Database



Erik Neemann

Spatial Data Design - GEOG 6150

Final Project

4 December 2017

1. Introduction

This report presents a statewide recreation database for Utah. The database gathers many recreational datasets in one place for Utahns to explore and use to plan out trips or activities. A variety of data related to hiking, camping, skiing, canyoneering, swimming/boating, golfing, and parks/wilderness are included. The data are associated through relationship classes (where appropriate), to help query and make sense of inherent connections. Some example queries the database helps to answer include:

- What trailhead(s) leads to Goblin Valley's Dark Side of the Moon trail?

- How many ski lifts are in the ski resort containing "Chips Run?"

- What boat ramps provide access to Lake Powell?

With a wide variety of functionality, users are able to use the database to find the necessary trailhead for their desired hiking route or determine what runs and lifts are available to them at a ski resort. Users can also determine what boat ramps provide access to a specific lake or river, identify which campgrounds in Washington County have more than 50 campsites, and see what Utah peaks are higher than 13,000 feet above sea level.

2. Integrity Constraints

The next few paragraphs outline the integrity constraints that describe "business rules" of the database and how different datasets are related to each other.

The state is subdivided into counties. Counties each have attributes for a unique FIPS code, Area, Name, and Population. Utah contains BLM Land, Forest/Wilderness Areas, and Parks. BLM Land has attributes for ID, Area, and County. Forest/Wilderness Areas have ID, Name, Agency, Type, and Area attributes. Parks have attributes for ID, Name, Type, and Area. Parks contain subtypes for Local, State, and National Parks. Each park must fit into one and only one of these categories. The Local Park subtype has attributes for County and City.

Utah contains Ski Resorts with ID, Name, Area, Runs, and Lifts attributes. Ski Resorts contain at least one Ski Lift and Ski Run; all Ski Lifts must belong to a Ski Resort. Ski Lifts have attributes of ID, Lift_Name, Length, Type, Capacity, Base_Elevation, Top_Elevation, and Resort. Ski Runs have ID, Name, Length, Difficulty, and Resort attributes. The state also contain Cross Country Ski Trails, with attributes of ID, Name, XC_Area, and Length.

The state contains many Trailheads with attributes for ID, Name, and Use. Trailheads can initiate one or many Trail Segments and Trail Routes. Trail Segments connect and compose Trail Routes. Many Trail Segments and Routes can also connect to many Trailheads. Similarly, many Trail Routes can be composed of many Trail Segments and Trail Segments can belong to many Trail Routes. Trail Routes and Segments each have ID, Name, Length, and Use. Trail Segments also have a Surface Type attribute.

Utah also contains Golf Courses with attributes for ID, Name, Area, Type, Holes, Par, City, and County. The state contain Campgrounds with ID, Name, Phone, Season, Amenities,

Town_Name, Elev_ft, Num_Sites, Latitude, and Longitude attributes. Lakes and Rivers are also in the state. Lakes have attributes for ID, GNIS_Name, Area, and Elevation. Rivers have ID, GNIS_Name, and Length attributes. Boat Ramps are adjacent to Lakes and Rivers and have attributes for ID, Name, Agency, Vessels, and Water_body. Boat ramps must be adjacent to one and only one Lake or River, but Lakes and Rivers can have 0, 1, or many Boat Ramps.

The state contains many Highest Peaks with attributes of ID, Name, Elevation, Rank, and County. Many Slot Canyons are also present in Utah. Slot Canyons have ID, Name, Length, Rating, Rappels, and Long_Rappel attributes.

3. Conceptual Model Description

A conceptual Entity-Relationship diagram was created based on the integrity constraints mentioned above. In this diagram, each dataset is represented by a rectangular entity, and the relationships between entities are represented by diamonds. The ovals depict attributes belonging to each of the entities. Most of the relationships are one-to-many, meaning one entity connects to many other entities through the relationship (e.g., one ski resort contains many ski runs and ski lifts). The exception to this is the many-to-many relationships between trailheads, trail segments, and trail routes (e.g., several trailheads can initiate one route and several routes can begin at one trailhead).

The double lines connecting some entities to a relationship indicates that the specific entity is required to participate in the relationship. For example a ski lift must be within a ski resort, and a boat ramp must be adjacent to a river or lake. The third mandatory participation constraint is for the disjoint subtype of parks. This means that parks must either be local, state, or national parks, but they can only be in one of those three categories. Finally, among the attributes of each entity, the underlined attribute is the unique identifier for the entity that links allows it to be linked to other entities through the relationships.

4. Relational Model Description

The conceptual Entity-Relationship diagram was translated into a logical Relational Model diagram. In this process, primary and foreign keys were specified for each relation (entity) and many-to-many relationships were connected through the creation of an additional relation. Further, domains where added for each attribute, to include data type and length constraints. Three many-to-many relationships exist in the Utah Recreation Database, so relations were added for each. An “Initiation” relation was added between both Trailheads and Trail Routes and between Trailheads and Trail Segments. A “Connection” relation was also added between Trail Segments and Trail Routes. For the Boat Ramp relation, the “Water_body” attribute is used as the foreign key to both the Lake and River relations to connect Boat Ramps to appropriate water bodies. Finally, the Park supertype relation is linked to the “Local_Park,” “State_Park,” and “National_Park” subtype relations, where each park ID is both a foreign key and primary key.

5. Physical Model Description

a. To translate the logical relational model into a physical model, a geodatabase was created and populated in ArcCatalog. A feature class was imported or created for each dataset and relationship classes were created to link feature classes together, where appropriate. Several of the relationship classes were simple, one-to-many relationships placing the feature within the state. However, a few required more careful design. The many-to-many relationships among trailheads, trail segments, and trail routes were created by selecting appropriate features and adding them to the associated relationship class's table. Additionally, boat ramps were linked to their adjacent rivers and lakes through relationship classes and ski lifts and ski runs were connected to their parent ski resorts. In its completed form, the geodatabase provides a coherency to the data that enables additional functionality as described below.
b. After putting the recreation database together, new functions are now available that weren't possible when the datasets were disparate. This can be demonstrated by answering the questions in the introduction. In ArcMap, the trailheads leading to Goblin Valley's "Dark Side of the Moon" trail can be identified by selecting the trail and finding its associated trailheads by clicking on the "TH_to_Routes" relationship class. By selecting "Chip's Run" from the ski runs dataset and clicking on the "SkiResort_SkiRuns" relationship class, Snowbird is identified as the resort. Snowbird's attributes note that it contains 11 ski lifts. Lastly, Lake Powell's boat ramps can be found by selecting the lake and using the "Lakes_BoatRamps" relationship class. All of these functions, and many more, can now be executed quickly and easily to interrogate the database to meet a user's needs.

6. Future Directions

While this database ended up relatively complete, there are several improvements that could be made in the future. Most of the datasets were gathered from open sources (listed below), resulting in inconsistent or minimal attributes. For example, it would be informative to have starting elevation, ending elevation, and vertical gain data for the ski runs, trail routes, etc. Additional attribute improvements or geometry changes would also lead to a better overall dataset (e.g., slot canyons represented as line segments). In some cases, the data were trimmed into subsets to make it more manageable (only ski runs in Snowbird were used, trail segments/routes were clipped to the San Rafael Swell/Goblin Valley region), so including more complete data would provide a better product. Finally, adding datasets for more recreation options would also produce a more comprehensive database (rock climbing locations, whitewater rafting/kayaking areas, etc.).

7. Data sources

Each dataset was adapted or retrieved from the following sources:

Utah Automated Geographic Reference Center (2017). Boundary data overview. Retrieved November 6, 2017 from https://gis.utah.gov/data/boundaries/.

Utah Automated Geographic Reference Center (2017). Recreation overview. Retrieved November 6, 2017 from https://gis.utah.gov/data/recreation/.

Utah Automated Geographic Reference Center (2017). Water data services overview. Retrieved November 8, 2017 from https://gis.utah.gov/data/water/

Bogley Outdoor Community (2017). Thread: The Super Amazing Canyoneering Map. Retrieved 6 November, 2017 from http://www.bogley.com/forum/showthread.php?62130-The-Super-Amazing-Canyoneering-Map.

USCampgrounds.info (2017). The most comprehensive guide to Federal, State, Provincial, and Local campgrounds. Retrieved 6 November, 2017 from http://www.uscampgrounds.info/POI/SouthwestCamp.csv.

Skimap.org (2017). Snowbird ski and summer resort. Retrieved 6 November, 2017 from https://skimap.org/SkiAreas/view/226.

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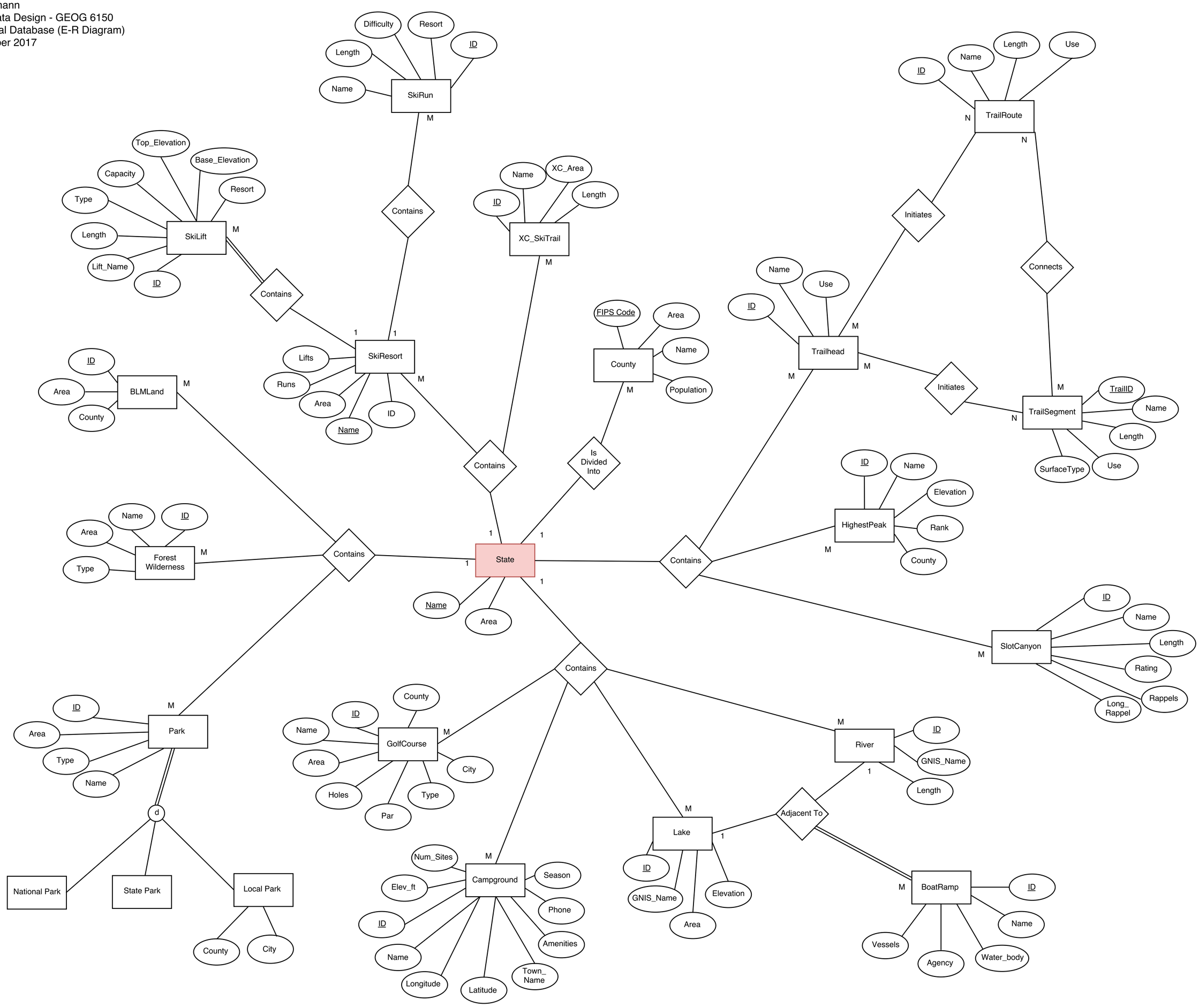
Spatial Data Design - GEOG 6150
Conceptual Database (E-R Diagram)
4 December 2017



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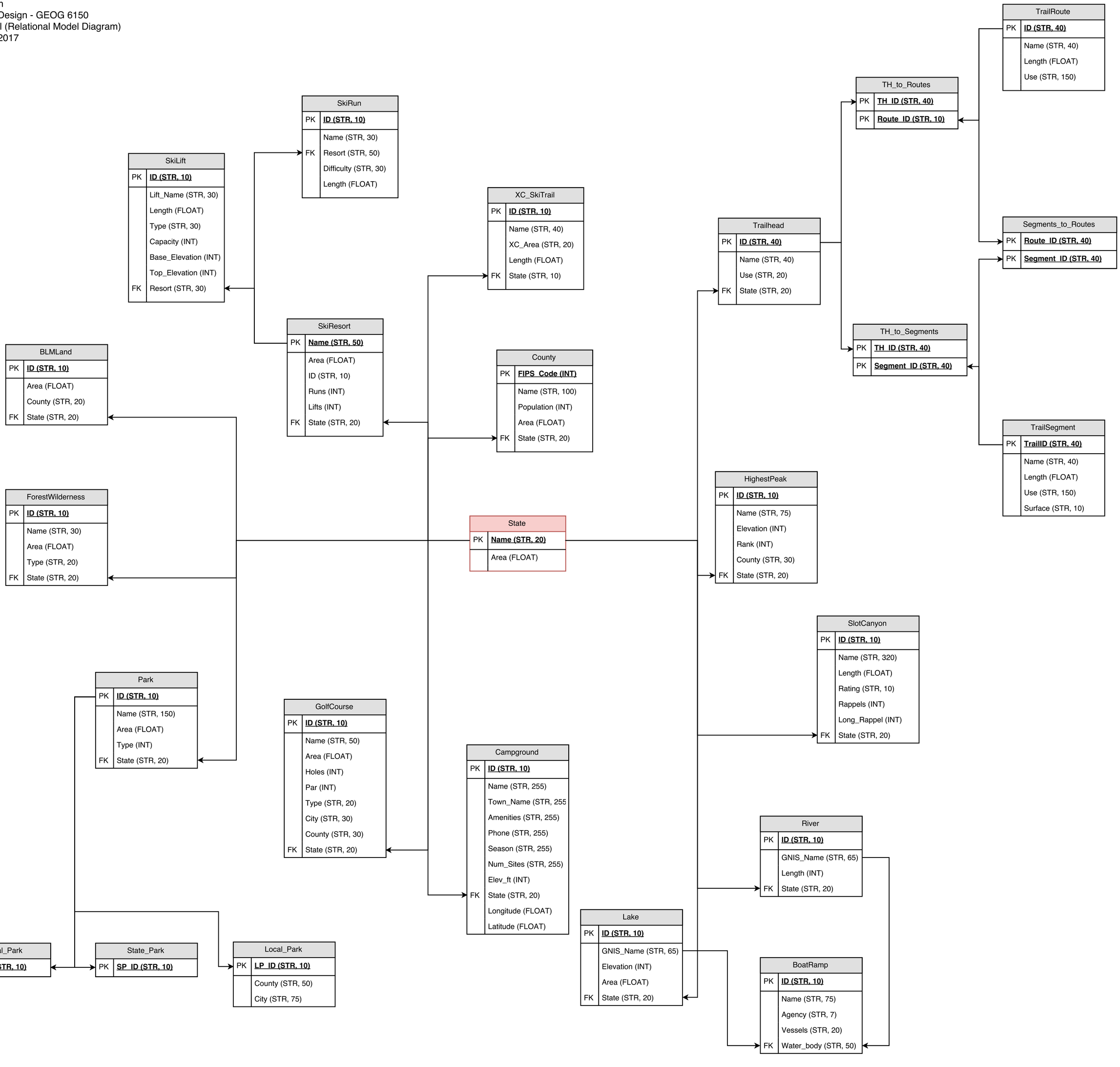
Logical Model (Relational Model Diagram)
4 December 2017



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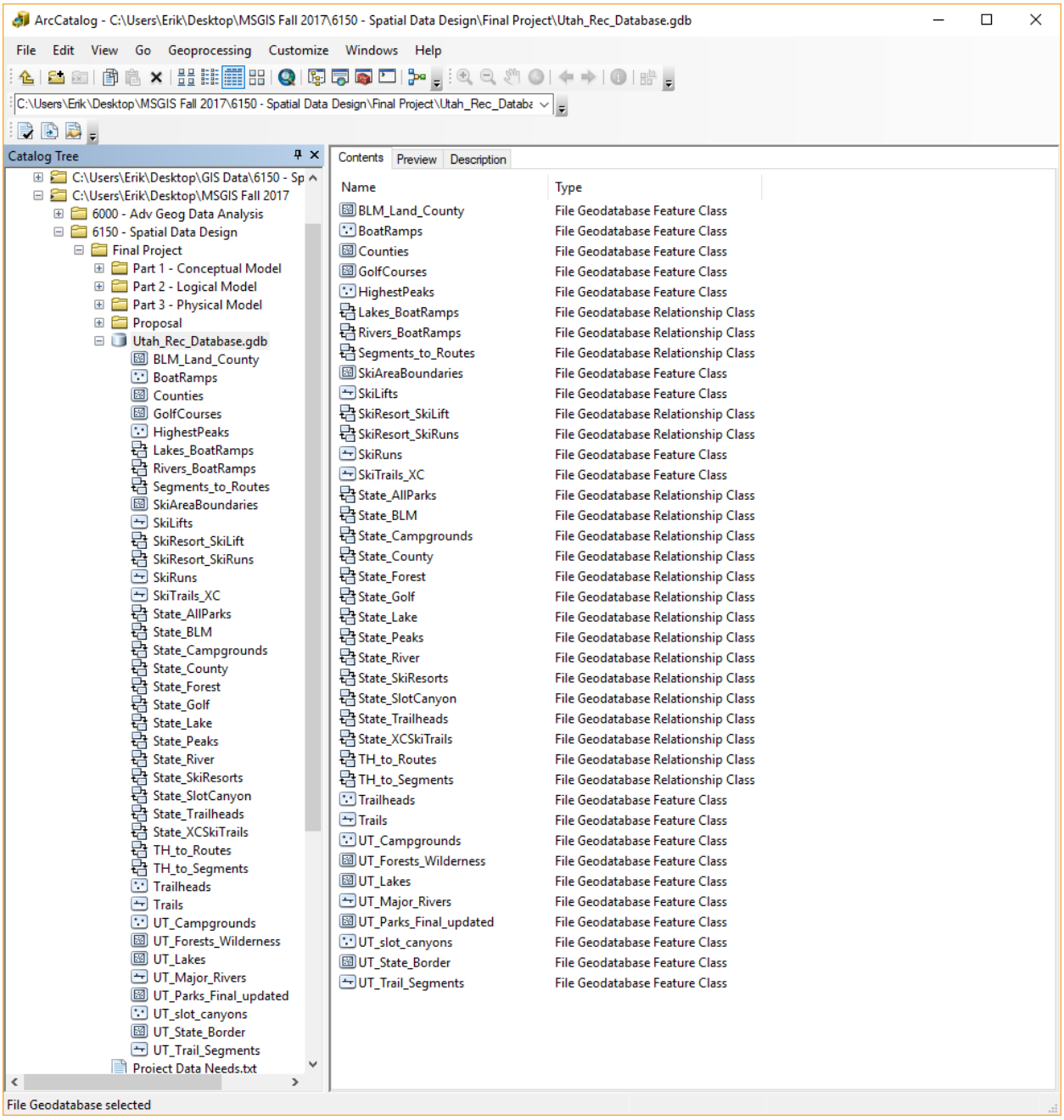
Physical Model

4 December 2017

Physical Model

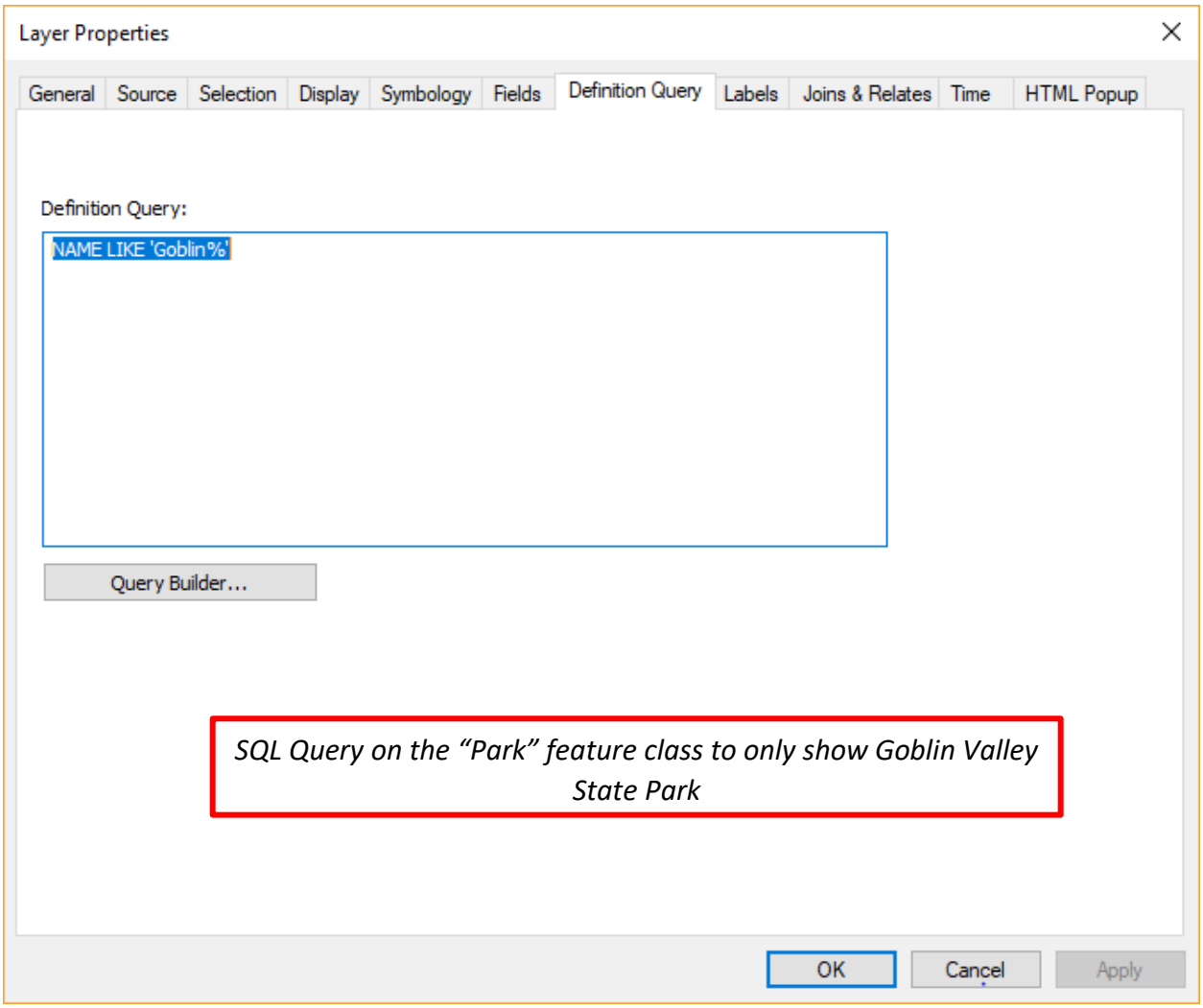


Functionality and Query Demonstrations

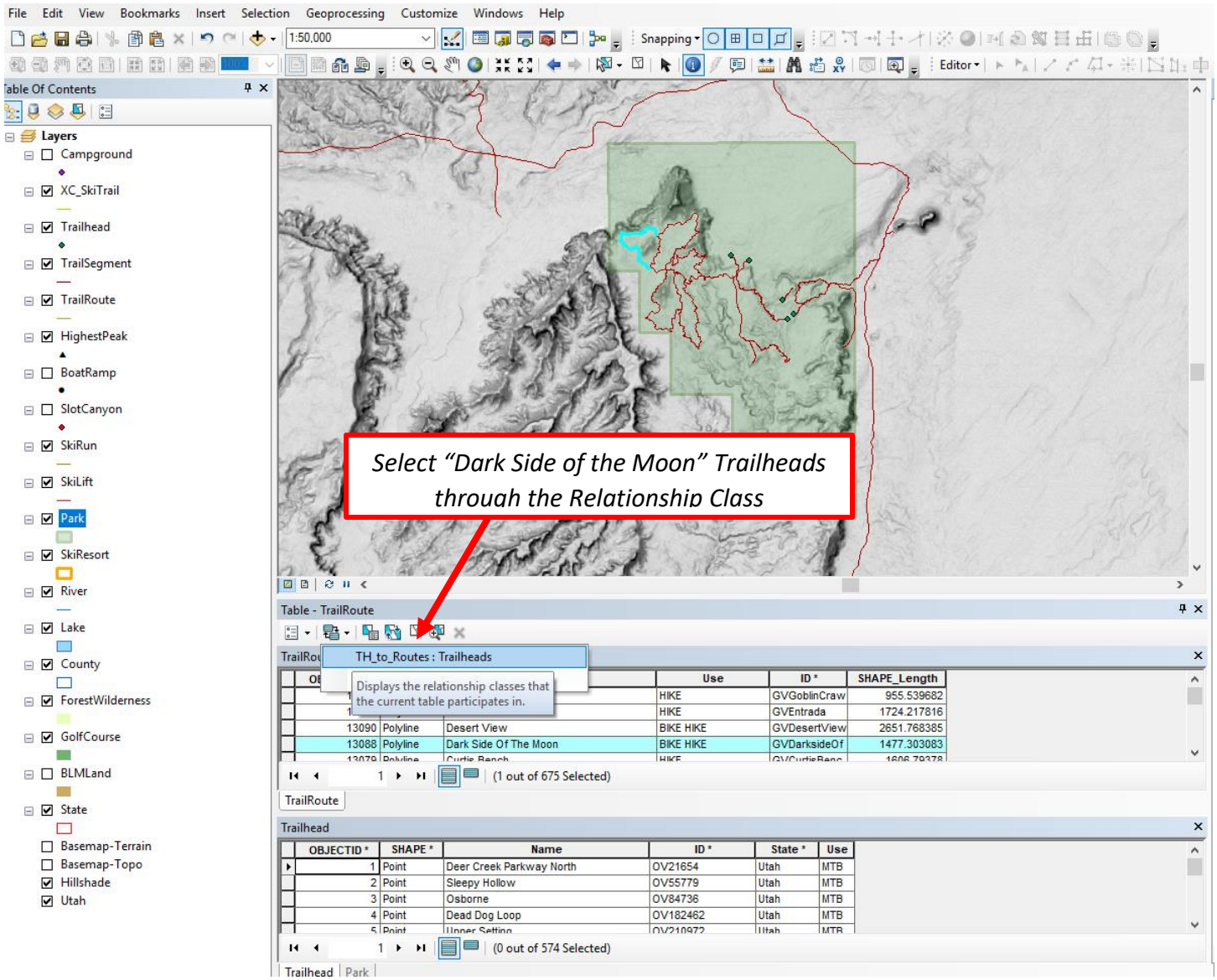
Query One

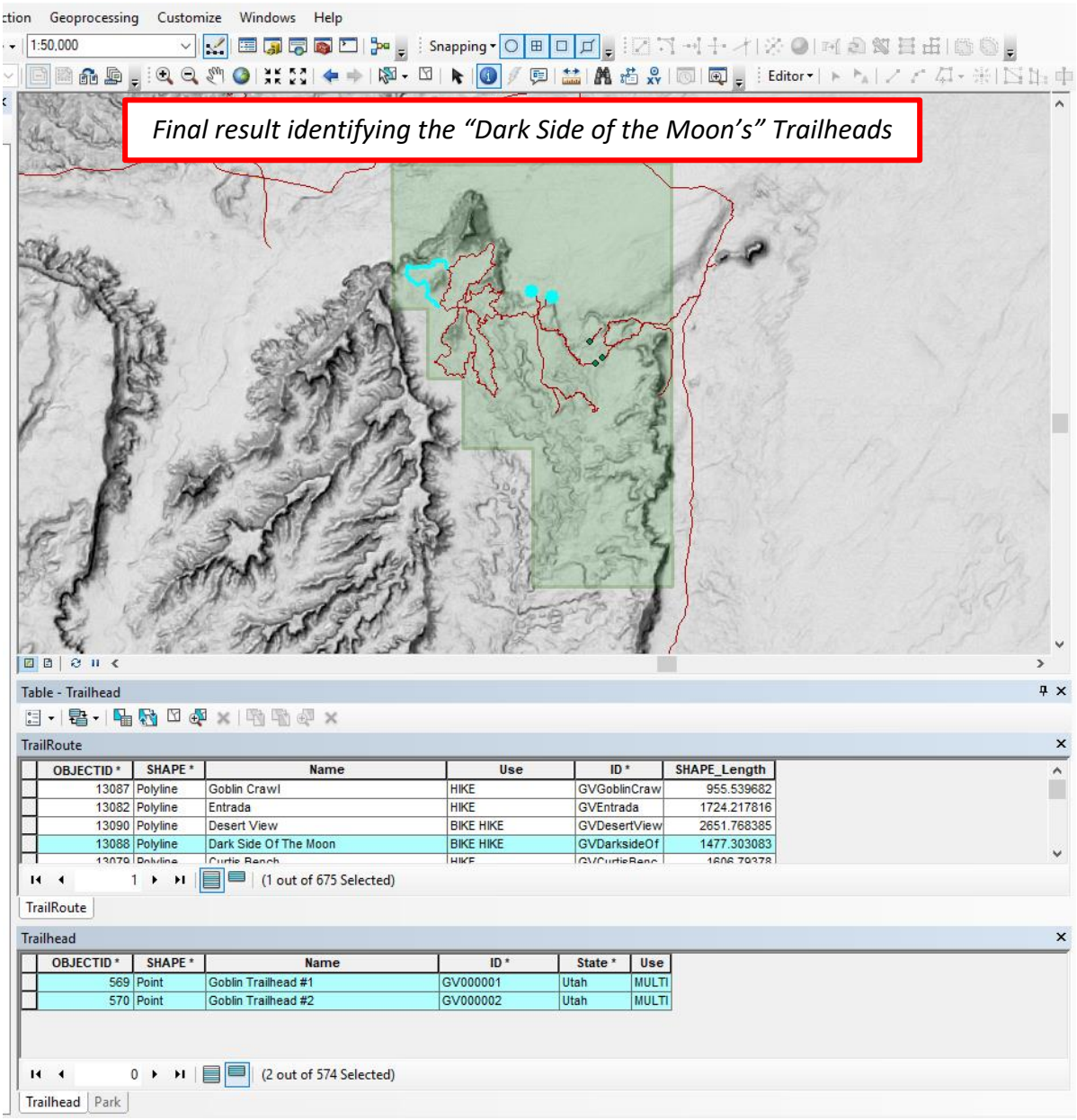
Which trailhead(s) lead to Goblin Valley's "Dark Side of the Moon" trail?

- To answer this query and SQL definition query is used so only Goblin Valley State Park is visible. Then the "Dark Side of the Moon" trail was selected and appropriate trailheads were identified by using the "TH_to_Routes" relationship class.



SQL Query on the "Park" feature class to only show Goblin Valley State Park

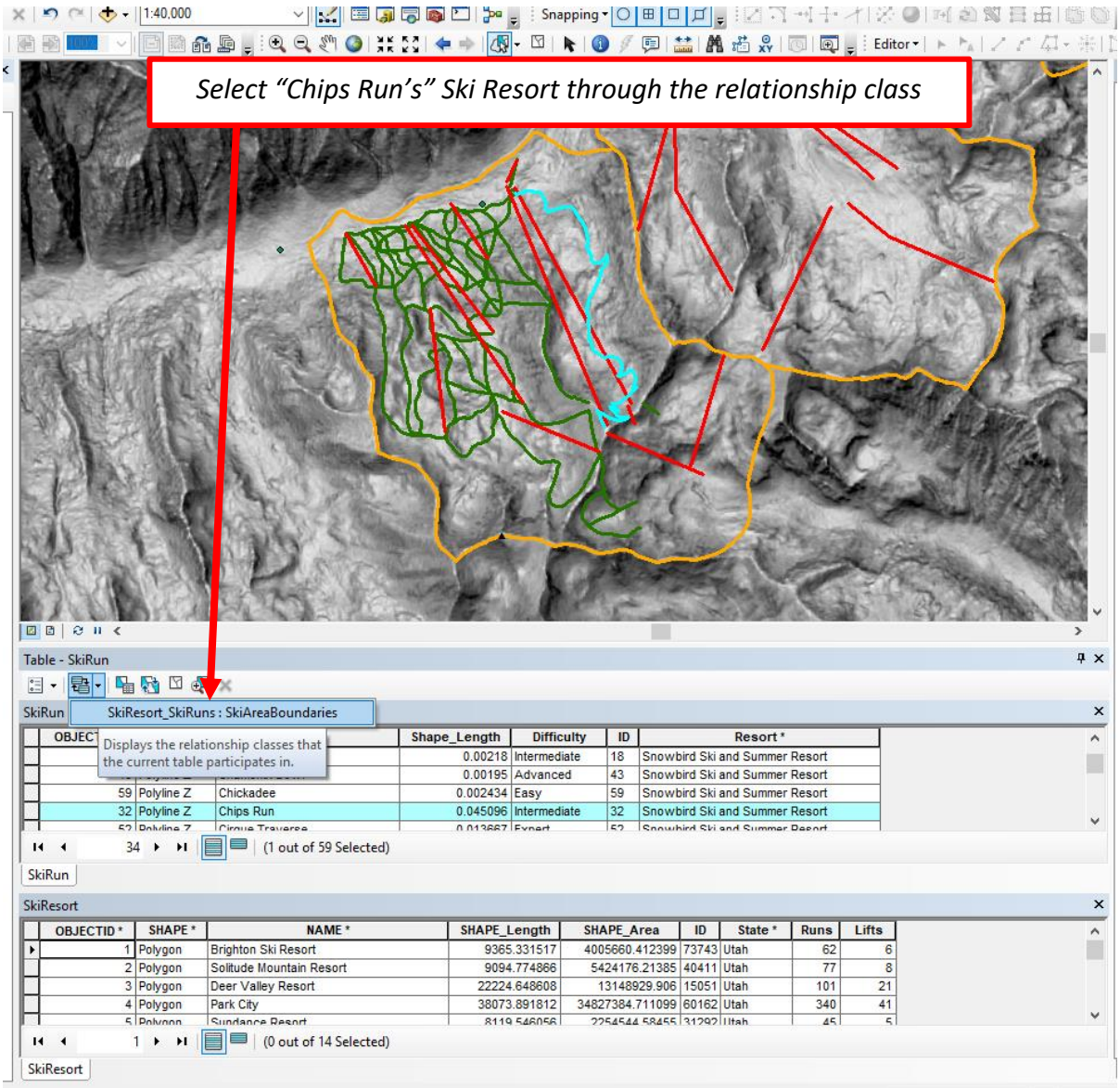

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help
1:50,000
Snapping
Editor
Table Of Contents
Layers
Campground
XC_SkiTrail
Trailhead
TrailSegment
TrailRoute
HighestPeak
BoatRamp
SlotCanyon
SkiRun
SkiLift
Park
SkiResort
River
Lake
County
ForestWilderness
GolfCourse
BLMLand
State
Basemap-Terrain
Basemap-Topo
Hillshade
Utah
Select "Dark Side of the Moon" Trailheads through the Relationship Class
Table - TrailRoute
TH_to_Routes : Trailheads
Displays the relationship classes that the current table participates in.
Use
ID *
SHAPE_Length
HIKE GVGoblinCraw 955.539682
HIKE GVEntrada 1724.217816
13090 Polyline Desert View BIKE HIKE GVDesertView 2651.768385
13088 Polyline Dark Side Of The Moon BIKE HIKE GVDarksideOf 1477.303083
(1 out of 675 Selected)
TrailRoute
Trailhead
OBJECTID *
SHAPE *
Name
ID *
State *
Use
1 Point Deer Creek Parkway North OV21654 Utah MTB
2 Point Sleepy Hollow OV55779 Utah MTB
3 Point Osborne OV84736 Utah MTB
4 Point Dead Dog Loop OV182462 Utah MTB
(0 out of 574 Selected)
Trailhead
Park

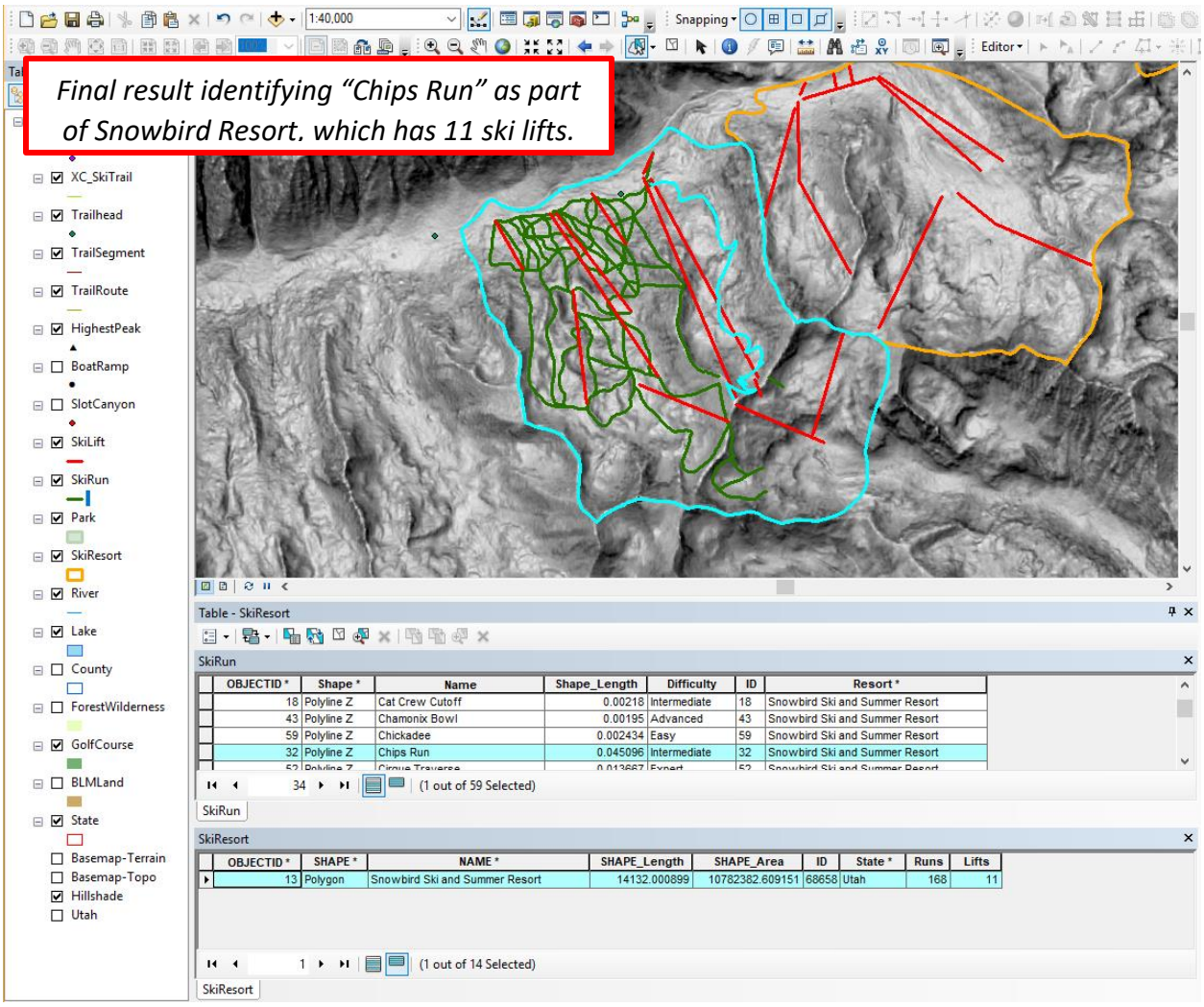

ction Geoprocessing Customize Windows Help
1:50,000
Snapping
Editor
Final result identifying the “Dark Side of the Moon’s” Trailheads
Table - Trailhead
TrailRoute
OBJECTID * SHAPE * Name Use ID * SHAPE_Length
13087 Polyline Goblin Crawl HIKE GVGoblinCraw 955.539682
13082 Polyline Entrada HIKE GVEntrada 1724.217816
13090 Polyline Desert View BIKE HIKE GVDesertView 2651.768385
13088 Polyline Dark Side Of The Moon BIKE HIKE GVDarksideOf 1477.303083
(1 out of 675 Selected)
TrailRoute
Trailhead
OBJECTID * SHAPE * Name ID * State * Use
569 Point Goblin Trailhead #1 GV000001 Utah MULTI
570 Point Goblin Trailhead #2 GV000002 Utah MULTI
(2 out of 574 Selected)
Trailhead Park

Query Two

How many ski lifts are in the ski resort containing “Chips Run?”

- To answer this question, the “Chips Run” trail was selected and the appropriate Ski Resort was identified using the “SkiResort_SkiRuns” relationship class. The “Lifts” attribute shows there are 11 ski lifts at Snowbird Resort.

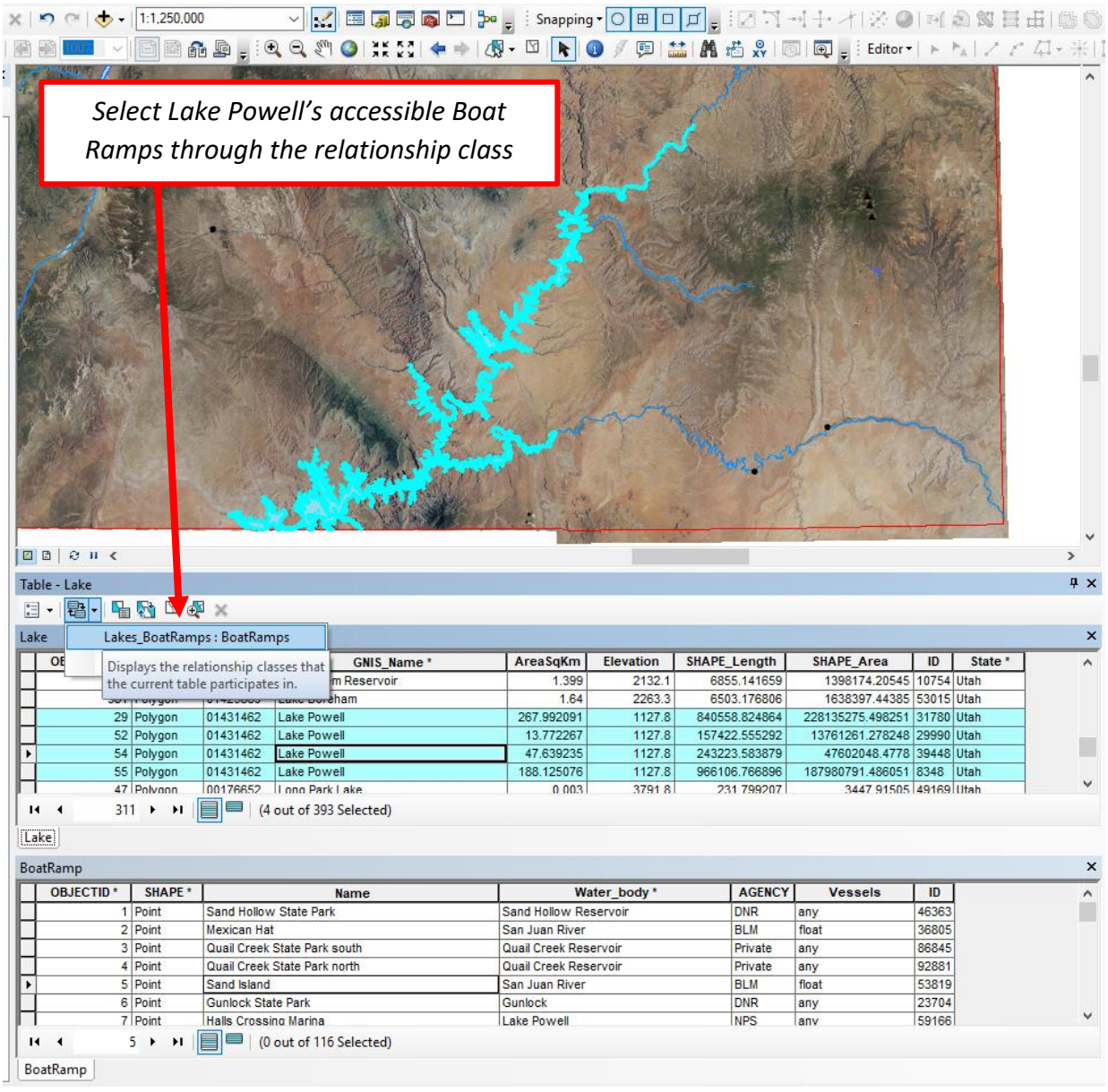


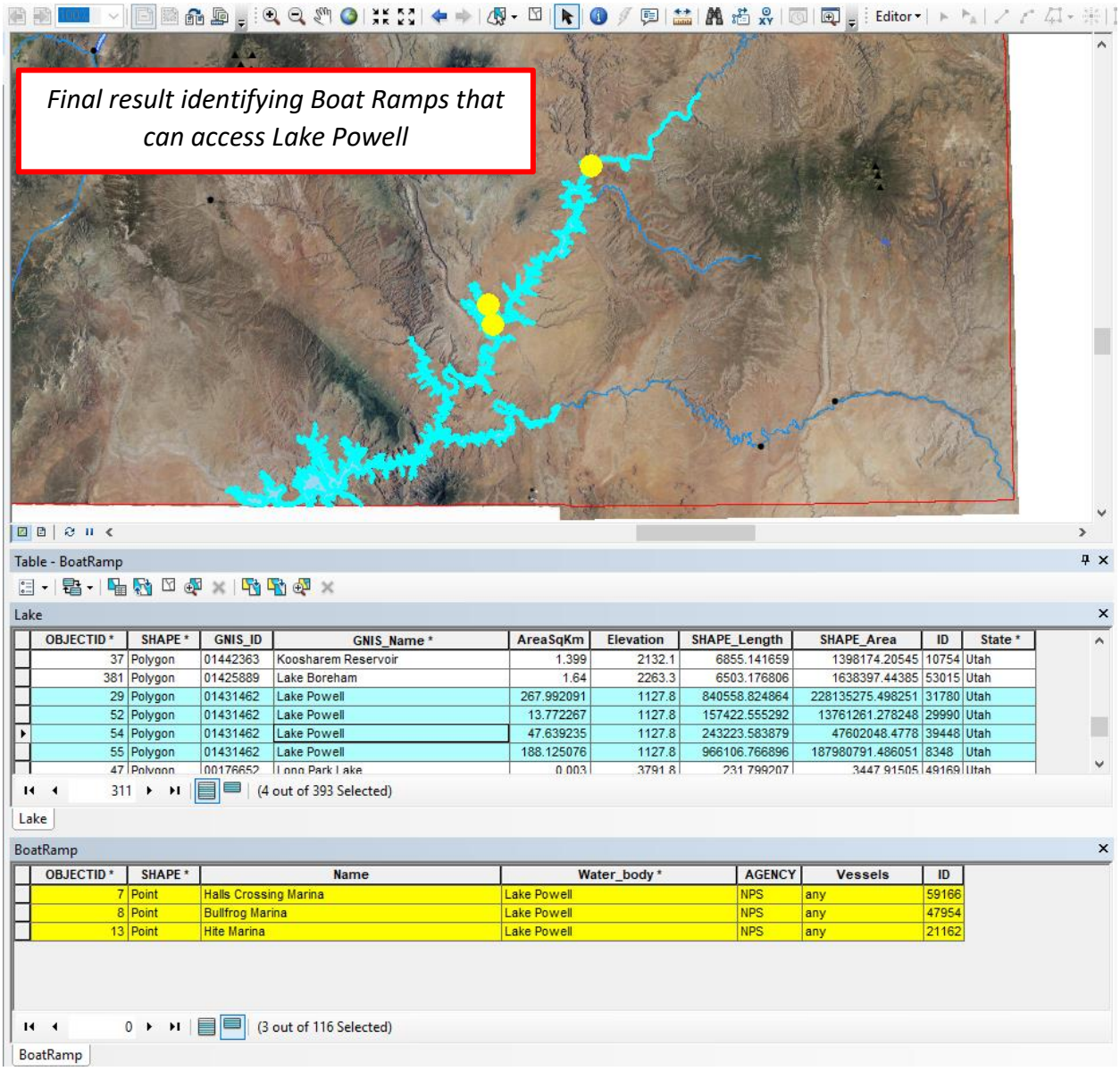

Final result identifying “Chips Run” as part of Snowbird Resort, which has 11 ski lifts.
XC_SkiTrail
Trailhead
TrailSegment
TrailRoute
HighestPeak
BoatRamp
SlotCanyon
SkiLift
SkiRun
Park
SkiResort
River
Lake
County
ForestWilderness
GolfCourse
BLMLand
State
Basemap-Terrain
Basemap-Topo
Hillshade
Utah
Table - SkiResort
SkiRun
OBJECTID * | Shape * | Name | Shape_Length | Difficulty | ID | Resort *
18 | Polyline Z | Cat Crew Cutoff | 0.00218 | Intermediate | 18 | Snowbird Ski and Summer Resort
43 | Polyline Z | Chamonix Bowl | 0.00195 | Advanced | 43 | Snowbird Ski and Summer Resort
59 | Polyline Z | Chickadee | 0.002434 | Easy | 59 | Snowbird Ski and Summer Resort
32 | Polyline Z | Chips Run | 0.045096 | Intermediate | 32 | Snowbird Ski and Summer Resort
(1 out of 59 Selected)
SkiRun
SkiResort
OBJECTID * | SHAPE * | NAME * | SHAPE_Length | SHAPE_Area | ID | State * | Runs | Lifts
13 | Polygon | Snowbird Ski and Summer Resort | 14132.000899 | 10782382.609151 | 68658 | Utah | 168 | 11
(1 out of 14 Selected)
SkiResort

Query Three

What Boat Ramps provide access to Lake Powell?

- To answer this question, Lake Powell was selected and the appropriate Boat Ramps were identified using the “Lakes_BoatRamps” relationship class.




Final result identifying Boat Ramps that can access Lake Powell
Editor
Table - BoatRamp
Lake
OBJECTID * | SHAPE * | GNIS_ID | GNIS_Name * | AreaSqKm | Elevation | SHAPE_Length | SHAPE_Area | ID | State *
37 | Polygon | 01442363 | Koosharem Reservoir | 1.399 | 2132.1 | 6855.141659 | 1398174.20545 | 10754 | Utah
381 | Polygon | 01425889 | Lake Boreham | 1.64 | 2263.3 | 6503.176806 | 1638397.44385 | 53015 | Utah
29 | Polygon | 01431462 | Lake Powell | 267.992091 | 1127.8 | 840558.824864 | 228135275.498251 | 31780 | Utah
52 | Polygon | 01431462 | Lake Powell | 13.772267 | 1127.8 | 157422.555292 | 13761261.278248 | 29990 | Utah
54 | Polygon | 01431462 | Lake Powell | 47.639235 | 1127.8 | 243223.583879 | 47602048.4778 | 39448 | Utah
55 | Polygon | 01431462 | Lake Powell | 188.125076 | 1127.8 | 966106.766896 | 187980791.486051 | 8348 | Utah
47 | Polygon | 00176652 | Long Park Lake | 0.003 | 3791.8 | 231.799207 | 3447.91505 | 49169 | Utah
311
(4 out of 393 Selected)
Lake
BoatRamp
OBJECTID * | SHAPE * | Name | Water_body * | AGENCY | Vessels | ID
7 | Point | Halls Crossing Marina | Lake Powell | NPS | any | 59166
8 | Point | Bullfrog Marina | Lake Powell | NPS | any | 47954
13 | Point | Hite Marina | Lake Powell | NPS | any | 21162
0
(3 out of 116 Selected)
BoatRamp