Zion National Park

An Atlas of Natural Landforms and Terrain - Workflow Diagram

Planning

Title

Zion National Park
An Atlas of Natural Landforms and Terrain

Themes

- Landforms, elevation, terrain

Colours & Fonts

Potential colour palette

#efa288	#edbe9d
#a76451	#a04f32
#894530	#42353e
#3b3e35	#36540c
#5c671b	#aaab08
#698cac	#d9e5f5

Fonts (tbd)

Avenir LT Std

Other planning

Research:

- Park information and history
- Notable and popular land forms
- Notable peaks
- Geological processes
- Experiment with 1 m DEM for custom basemap
- Other research (TBD)

Data Acquisition

Data Sources

- Jill, USGS, ArcGIS Hub, ArcGIS Online, Utah Geospatial Resource Center (DEM)

Data Familiarization

Required Datasets

- AOI Clipping Boundary
- Utah Contours
- Zion National Park - Boundary
- Zion National Park - Points of Interest (POIs)
- Zion NationalPark - Buildings
- Zion National Park - Roads
- Zion National Park - Trails
- Zion National Park - Parking Areas
- USA Geographic Names Information System - Summits and Peaks
- National Hydrography Dataset (NHD) - Flowline Watercourses
- National Hydrography Dataset (NHD) - Hydrography Area
- National Hydrography Dataset (NHD) - Waterbodies
- National Gazetteer - Populated Places
- National Transportation - Road Segments
- National Administrative Boundary - State or Territory

Optional Datasets (5)

- 1 m Utah Digital Elevation Model
- National Administrative Boundary - County Boundary
- National Administrative Boundary - Native American Areas
- Utah - Structures
- Custom contours extracted from DEM

Data Verification

- Verify data projection
- Extent and coverage
- Attribute completeness
- Resolution consistency

Data Experimentation and Base Map Feasibility in ArcGIS Pro

- Assign map projection:
  NAD 1983 StatePlane Utah South FIPS 4303 EPSG: 32144
- Import 330 DEM tiles representing Zion National Park
  from: https://gis.utah.gov/products/sgid/elevation/lidar/
- Create new mosaic dataset
- Add rasters to mosaic dataset
- Add DEM raster to map
- Create hill shade and slope layers
- Generate contours at 20 m and 50 m for testing
- Apply primary symbology (stretch) and color ramps to all raster layers
- Confirm usability

- Export DEM, hill shade, slope raster images and contour vectors

Project Setup

Project Structure

- Create the necessary project folders and subfolders

Move Data

- Move original, downloaded data to appropriate locations

ArcGIS Project

- Create ArcGIS Pro Project

Data Preparation

Map CRS

Change project projection to:
NAD 1983 StatePlane Utah South FIPS 4303 (EPSG: 32144)

Reference Scale

Set Reference scale to 1:40,000

Add Verified Datasets to ArcGIS Pro

- Add raw data through folder connection
- Drag all verified layers to map
- Confirm data layers load correctly and cover Zion National Park
- Save project

Check Coordinate Systems

- Check the spatial reference (CRS) for all data layers
- Identify non-matching layers
- Identify layers not matching project CRS (EPSG: 32144)

Reproject Non-Matching Layers

- Reproject all applicable data layers to:
  NAD 1983 StatePlane Utah South FIPS 4303 (EPSG: 32144)
- Apply *Project* or *Project Raster* tools as appropriate
- Save reprojected outputs to .gdb
- Maintain consistent naming conventions
- Confirm reprojection success and alignment

Create Feature Datasets / Data Classes

- Logical thematic organization and drawing order in contents panel
- Create new feature classes as needed
- Establish standardized attribute fields
- Assign field aliases for readability
- Maintain consistent naming conventions

Clip / Extract Study Area

- Use Zion National Park Boundary as mask polygon
- Extract relevant features from national/statewide datasets
- Limit datasets to Zion extent only
- Export clipped feature classes to .gdb
- Verify geometry and attributes after clipping
- Maintain consistent naming conventions

Clean Attribute Tables

- Standardize field names, capitalization, and data types
- Remove redundant, empty, or irrelevant fields
- Check for null values and correct attribute inconsistencies
- Validate field domains and aliases
- Ensure field values align across datasets (e.g., standardized category names)
- Maintain consistent naming conventions

Verify Alignment / Save

- Overlay all layers to confirm spatial alignment
- Check for projection mismatches or geometry errors
- Validate topology (no gaps, overlaps, or slivers where inappropriate)
- Save and backup project

Data Processing and Geoprocessing

Merge Features

- Combine related or adjacent features into a single dataset
- Use batch processing if merging multiple feature classes of the same type.
- Perform merges before topology validation to confirm final extents.

Joins and Relates

- Join non-spatial attribute tables to spatial layers to enrich data
- Ensure the join key field is consistent across both tables
- Apply joins only after geometry is finalized to avoid lost relationships when geometry changes.

Dissolve

- Aggregate features based on shared attributes to simplify boundaries
- Produces cleaner geometry for topology and generalization.

Validate Topology #1

- Validate and repair geometric relationships.
- Conduct after merge and dissolve operations, but prior to generalization.

Generalization

- Use various generalization techniques (simplify, smooth, aggregate polygons, etc.) to improve map legibility, aesthetics and performance.
- Conduct after merge and dissolve operations, but prior to generalization.

Validate Topology #2

- Re-validate and repair geometric relationships after generalization as applicable.
- Confirm no new overlaps, slivers or broken geometry. Ensure final alignment with park boundaries

Erase

- Remove unwanted data outside of the Zion National Park boundary as applicable.

Manual Data Edits

- Perform manual data edits as necessary

Graphical Conflicts

- Address symbol and label overlap as applicable

Map Production and Design

Apply Symbology

- Symbolize all feature layers based on feature type
- Use consistent color palettes and layer hierarchies.
- Ensure classification and color logic support legibility at 1:40,000 scale.
- Ensure hierarchy of importance

Establish Visual Hierarchy

- Control which features draw attention first through contrast, size, color, and saturation.
- Order visual layers logically
- Adjust line widths and color saturation to separate visual levels
- Use drop shadows, masks, or subtle outlines where necessary to reinforce figure-ground separation

Create Label Classes

- Symbolize all feature layers based on feature type
- Use appropriate placement properties and techniques

Convert to Annotation

- Once label placement is finalized, convert labels to annotation (optional) for enhanced control

Graphical Refinement

- Adjust placement of key labels manually for balance and clarity
- Create leader lines where necessary
- Ensure text hierarchy follows map design conventions

Quality Check

- Review all text for spelling, capitalization, and consistency.
- Check for label collisions, occluded text, or ambiguous associations.
- Perform zoom-level test at reference scale (1:40,000) to assess visibility and legibility

Map Series and Layout

Create Grid Index Features

- Generate 1:40,000 grid defining individual atlas plate boundaries
- Use Zion National Park boundary as the clipping extent
- Coordinate system – NAD 1983 StatePlane Utah South FIPS 4303 (EPSG 32144)
- Add plate identifiers to grid cells
- Confirm park coverage

Create Keymap

- Scale: ~1:500,000 to 1:1,000,000 (student choice).
- Coordinate system – NAD 1983 StatePlane Utah South FIPS 4303 (EPSG 32144)
- Include Zion National Park boundary and grid index overlay
- Label all grid cells with page/plate designators
- Add simple scale bar, representative fraction (RF), and north arrow.
- Highly generalized
- Place keymap on non-plate page

Layout and Map Series

- Page Size: 10" width × 12" height, Portrait orientation, single sided
- Typehold: Top/Bottom/Right: 0.25"; Left: 0.50". *No content should be in this area!*
- Plate Neatline (live map area): 8.75" × 9"
- Confirm coordinate system – NAD 1983 StatePlane Utah South FIPS 4303 (EPSG 32144)
- Map surround dimensions: Top, right, left: 0.25", bottom: 2.25"
- Add grid with Eastings and Northings, and optional graticule
- Map series consists of 20 plates with 0% overlap
- Add page numbers as dynamic text field
- Add and configure locator inset map (in map area or margin)

Plate Marginalia

- Map surround dimensions: Top, right, left: 0.25", bottom: 2.25"
- Plate title, subtitle as appropriate
- North Arrow
- Plate scale: 1:40,000, with graphic scale bar and representative fraction

Create Non-Plate Layouts

- Organization TBD, but to include the following elements:
- Map title and subtitle
- Park Introductory Narrative
- Legend
- Table of contents
- Table of pages (optional)
- Key map and grid index diagram
- Additional relative map information
- Logos (COGS, Esri, NPS, USGS, Data.gov
- Additional relative map information
- Student Credit and date
- Citations (APA 7th edition)
- Student disclaimer and copyright statement

Quality Check

- Confirm everything looks and feels right. Double check spelling etc.

Draft Review and Finalization

Export for Draft Proof

- Export in PDF format
- Review all components for aesthetic quality and technical correctness:
- Repeat as necessary

Add Front and Back Cover Art

- Add front and back cover art designed in Martha's class class

Export Final Product

- Export atlas in PDF format with all pages in chronological order. Upload to project deliverables on Brightspace

Purpose of the Workflow Assignment Milestone

- The purpose of this assignment milestone is to design a clear, organized GIS workflow diagram that illustrates the sequential stages of planning, data acquisition, data preparation, geoprocessing, and map production for the CRTY1012 Assignment 1: Park Atlas.
- This milestone demonstrates an understanding of GIS workflows in ArcGIS Pro and how individual stages connect logically and technically to design an atlas from conception to completion.
- Workflow by Alex Hordal, Nov 2nd, 2025