

CREATING AND USING CUSTOM, UTM REFERENCED GRIDS

Quick Map Updates and Grid Regeneration



June 2023

Southern African Wildlife College

Prepared by students of Sir Sanford Fleming College
in partial fulfilment of academic requirements

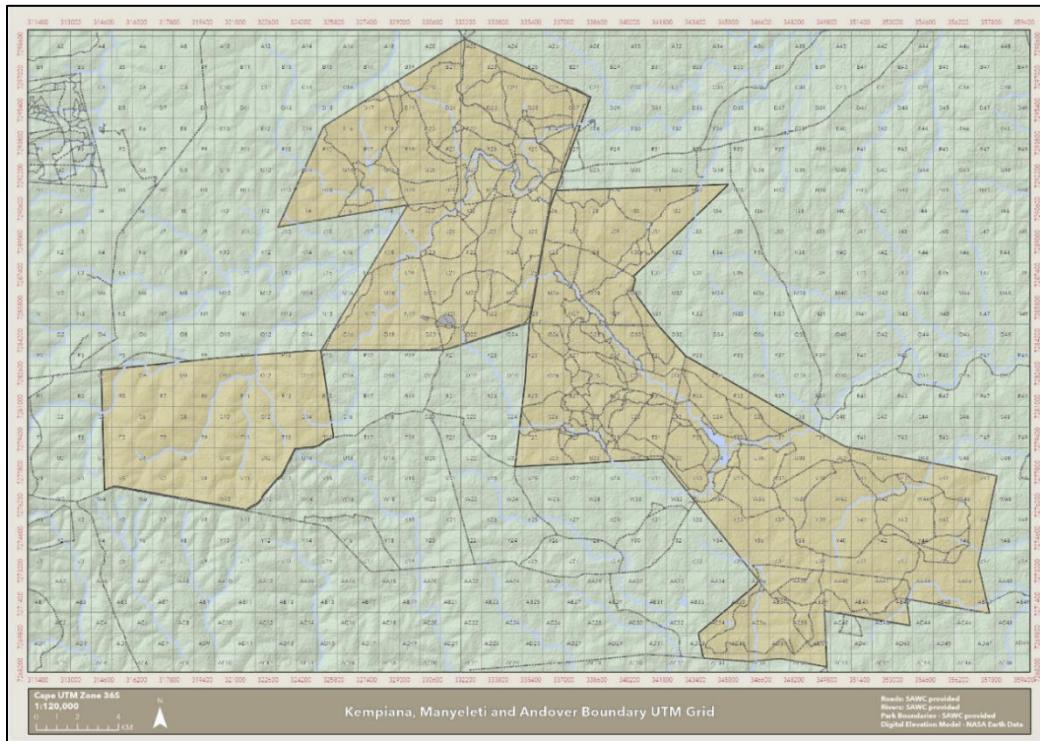


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Introduction

A Universal Transverse Mercator (UTM) referenced grid code solution has been developed for Southern African Wildlife College (SAWC) which applies a unique naming code system to UTM referenced 1km x 1km UTM grids. The UTM grids are universal, but the unique name code labels allow for easier communication for those not familiar with reading UTM coordinates.



This is a sample for reference, not to scale.

Use cases:

- Referencing grid zones on an offline map (printed or PDF) or an online solution (e.g. Field Maps) to quickly communicate location and coordinate incident responses.

Instruction overview:

These instructions will cover:

- General data information.
- Making updates to the SAWC UTM Reference Grid Code Maps using the provided ArcGIS Project file and layout (no edits to the extent of the reference grids themselves).
- Creating a new UTM referenced grid for new map park boundaries.

General data overview

The UTM Grid Maps have been created in PDF form for quick reference, and have also been added to the [SAWC ArcGIS Online](#) (AGOL), and a standalone web map for [Field Maps](#). This reference grid can be added to other online projects as desired. One grid system has been created so that the same grid naming system is used for all three study areas, without creating conflicts.

There are four individual files that support the UTM Grid Maps.

Abbreviated from the project metadata sheet provided by the Fleming team.

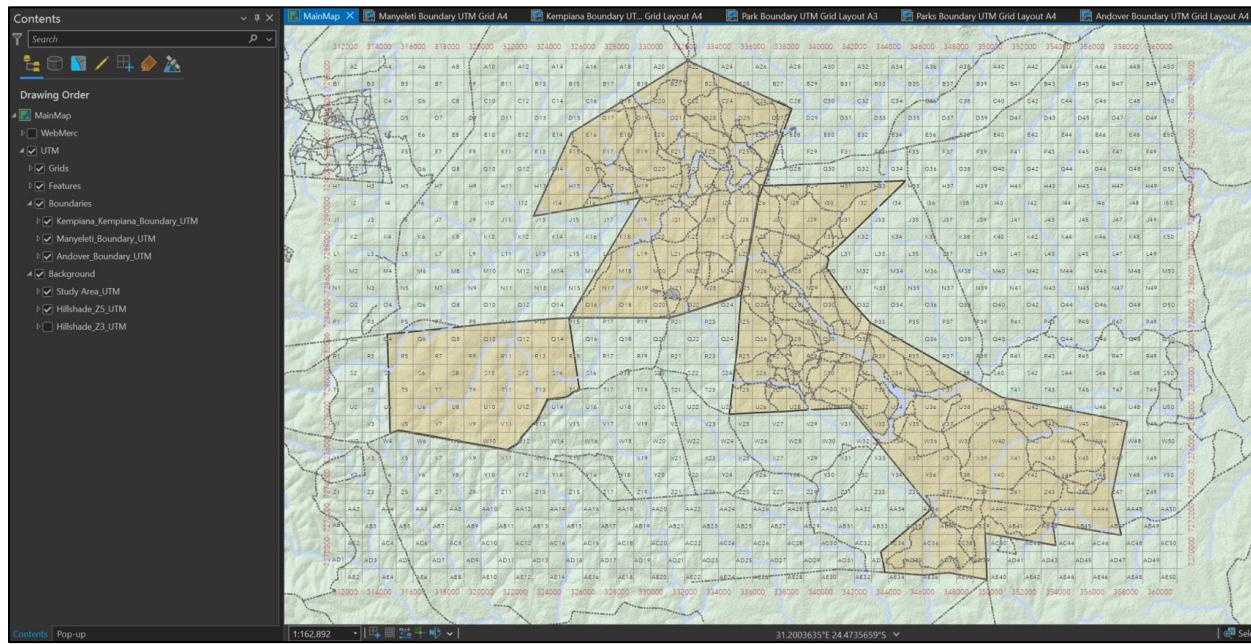
Common Layer Name	Comments
Park Alpha Numeric Labels (Full) Reprojected	Alpha numeric codes specific to SAWC use. Symbology should be off; labels should be on.
Park Alpha Numeric Labels (Minimal) Reprojected	Alpha numeric codes specific to SAWC use. Every other grid is deleted to allow for more space and better performance at smaller scale. Symbology should be off; labels should be on.
UTM Grid Lines Reprojected	Lines representing UTM sections (UTM Zone 36S), at 1000m x 1000m grids. Reprojected from UTM to Web Mercator; this may cause some distortion in online environment.
UTM Grid Annotation Reprojected	Labels for the actual relevant Cape UTM Zone 36S grid numbers.

Note: All labels include 'reprojected' in the title, because the UTM grid map references a projected coordinate system (Cape UTM Zone 36S). In the PDF maps, the data remains in UTM. For inclusion in online use cases, the data is reprojected to Web Auxiliary Mercator before upload to ArcGIS Online. This can cause the appearance of distortion, particularly at smaller scales.

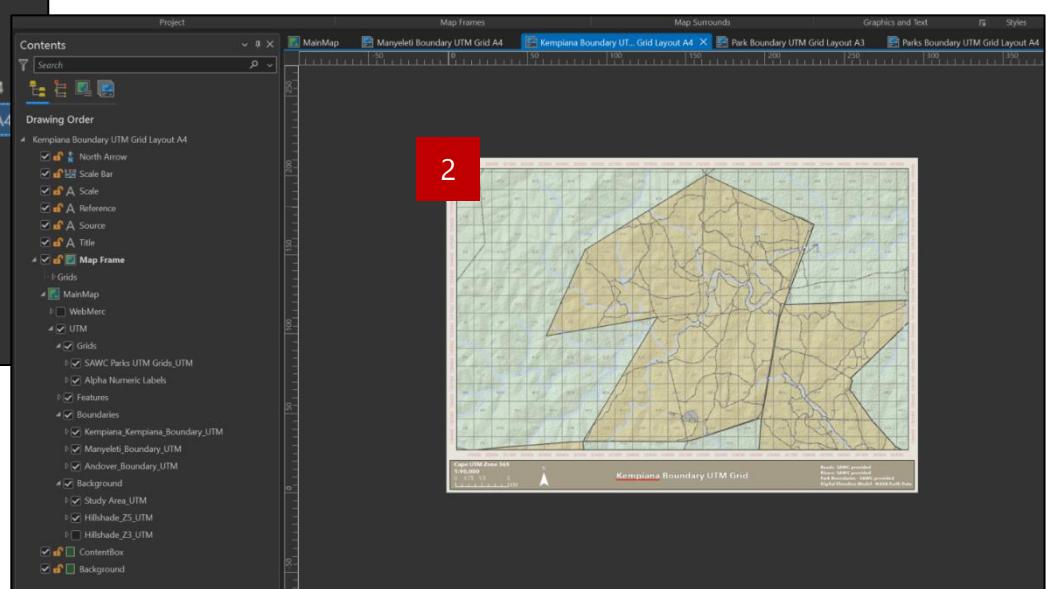
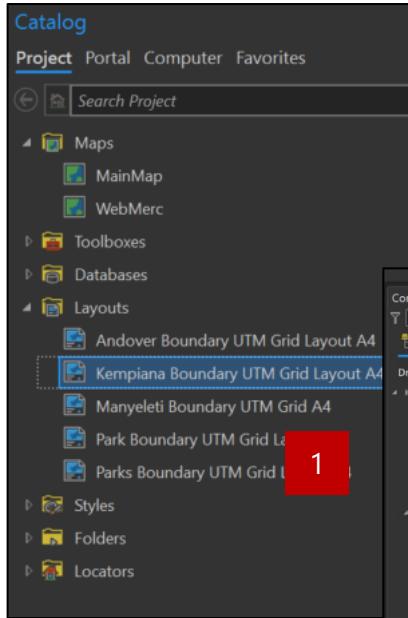
Making quick map updates using the provided ArcGIS Project and layout

This section applies to quick / minor edits to update the way the map is visualized, or for the inclusion of reference data. If the extent of the grid needs to be changed, it should be regenerated (see next section) to avoid creating conflicting naming systems. A project file has been provided with the applicable project geodatabase, layer symbology, layouts, and layers; projected in UTM and Web Mercator, for quick editing.

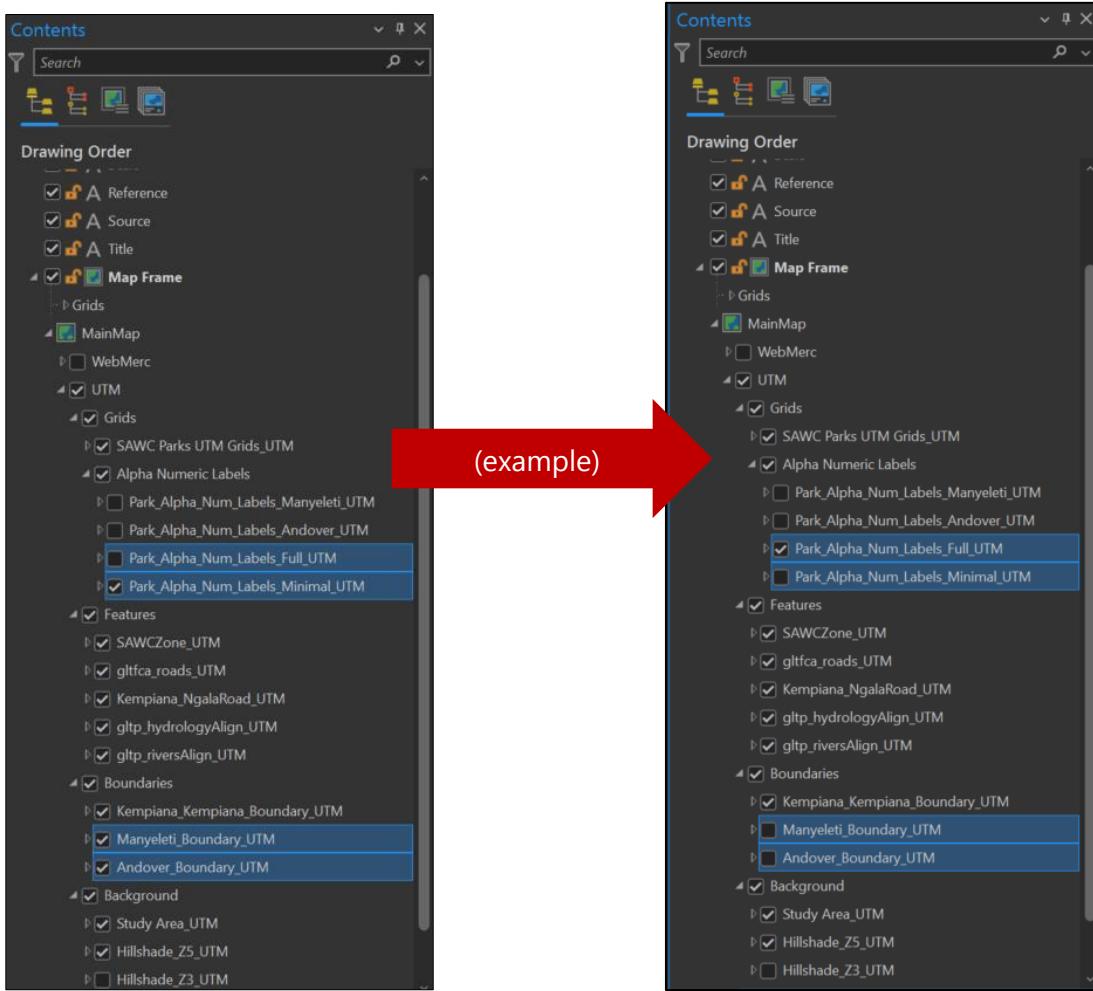
- Open the 'ParkGrids_Project' ArcGIS Project file, and the map labelled 'MainMap'.



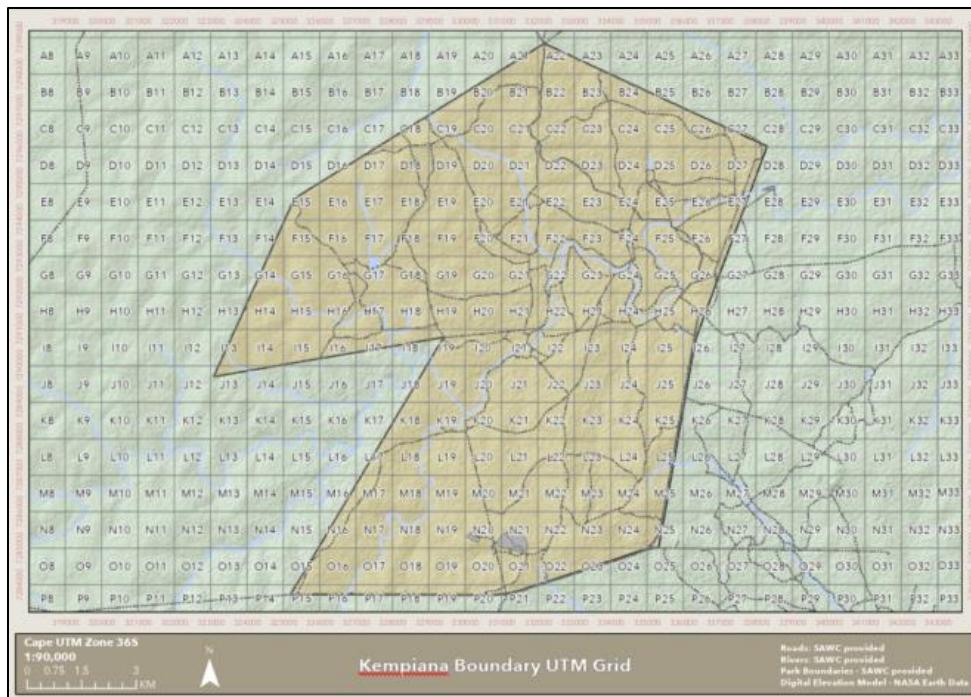
- Open the relevant layout that you would like to update, in the Catalog Pane. Examine the layout and determine the necessary changes.



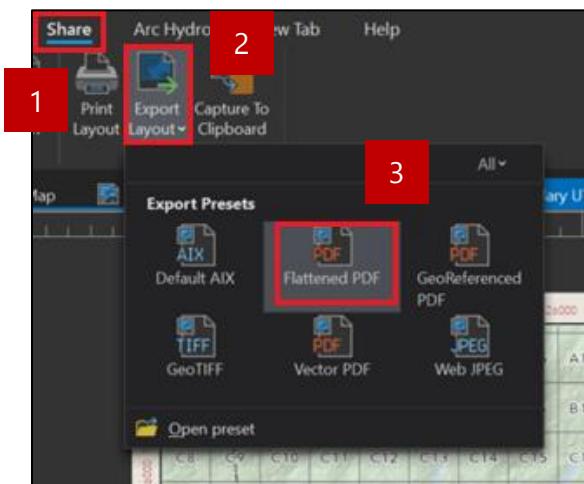
- Turn on / off the appropriate layers from the 'UTM' group in the Contents Pane that are relevant to the layout you are trying to update.



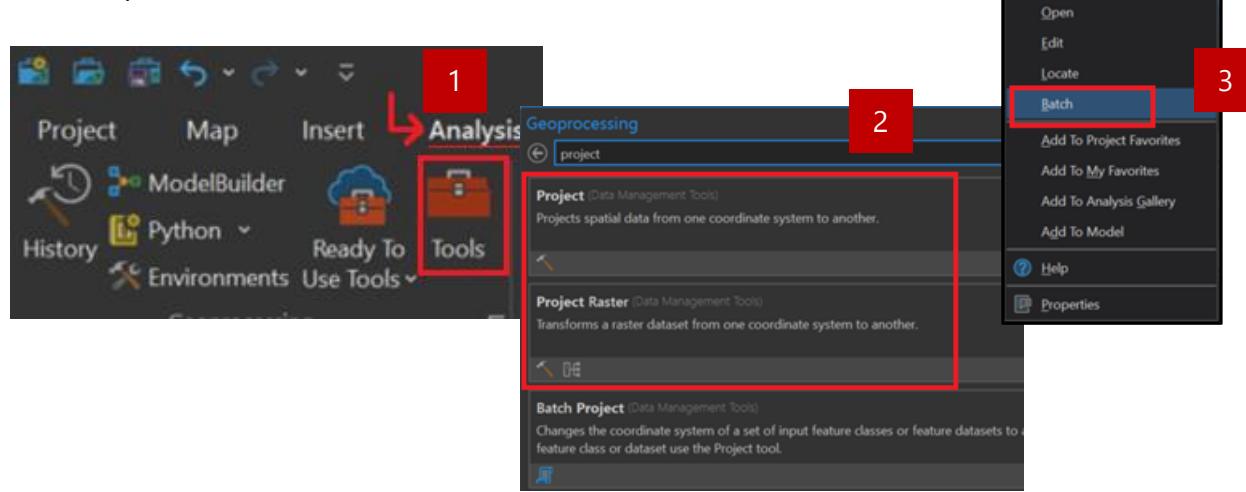
Note: Grids and label layers in the Contents Pane, have been created from the Grids' section in the layout. The layout grids can be found underneath 'Map Frame' in layout view. Turn these grid systems on and off in the Map Frame to get a better understanding of each. For more information on how to make edits to this data, see the next section for more information on how these layers are created.



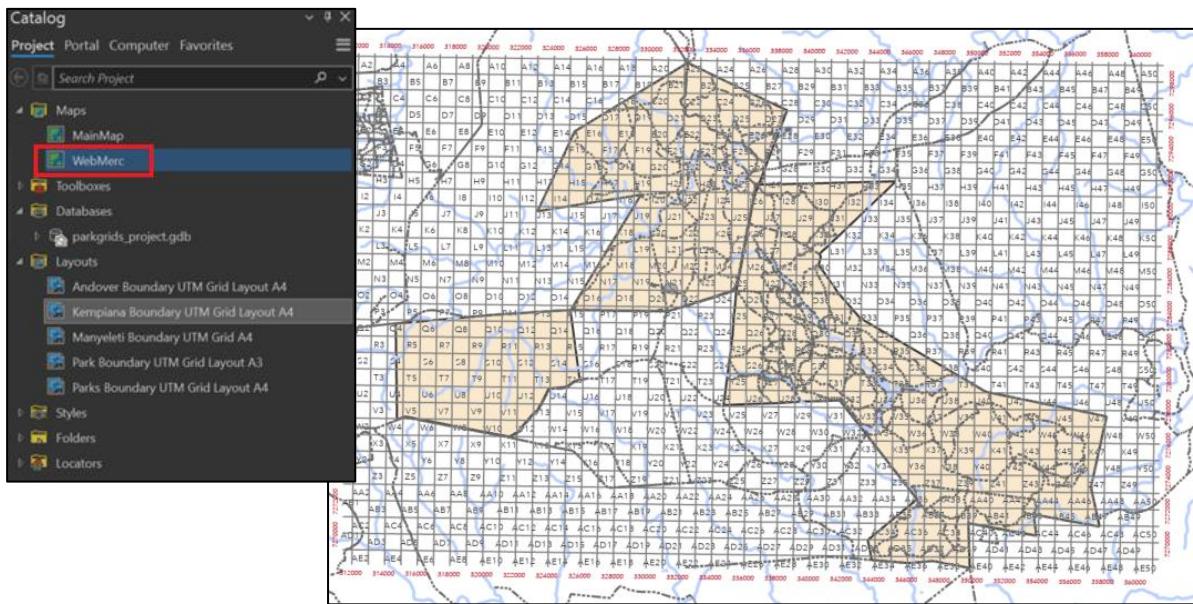
- Make the applicable changes to the layout element (what appears surrounding the map) in the layout tab(s), or changes applicable to the information within the map, in the 'MainMap' map.
- Changes made to the layout can be copied and pasted to the other layouts if desired (see next section).
- Updates to map data for the PDF maps should be made with data projected in the UTM spatial reference.
- Once the layout is ready for PDF export, navigate to the 'Share' ribbon, select 'Export Layout', and choose the desired output format.



- Updates to data that will be uploaded into AGOL should be projected into Web Mercator before uploading (use 'Project' or 'Project Raster' tools, right click and select 'Batch' for multiple files).



- Copy and paste reprojected files into data in the 'WebMerc' map before uploading to see what they will look like. If uploading the annotation layer, see the next section.



- If you are the owner of the applicable data, replace any new / edited Web Mercator layers into AGOL (see *SAWC GIS Instruction Package – Section 1.4*) and in the SAWC File Geodatabase Library (SAWC File GDB Library) (see *SAWC GIS Instruction Package – Section 1.1 and 1.2*). Files in the SAWC FGDB Library should also be projected in Web Mercator, to match the rest of the database. These files can be reprojected in local projects as needed.

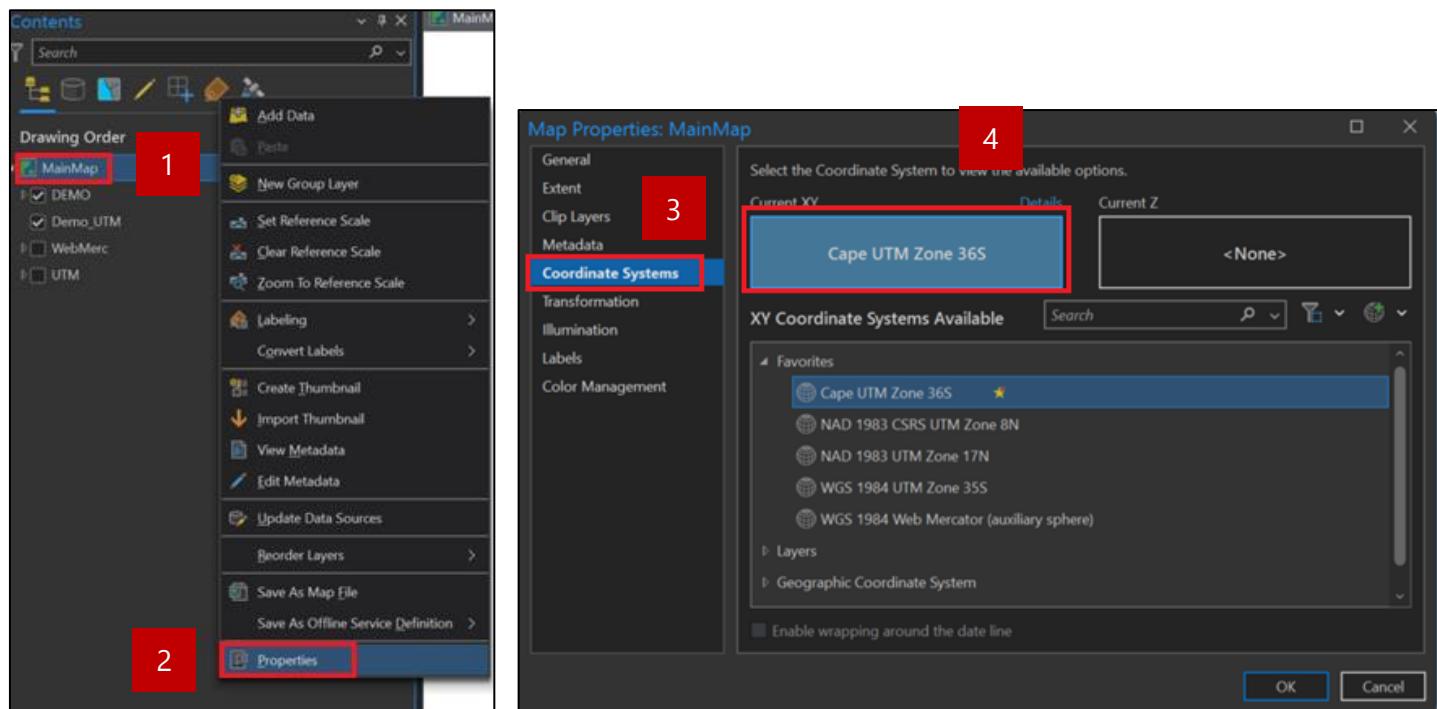
Creating a new UTM referenced grid

The SAWC grid code uses the existing UTM grids (Cape UTM Zone 36S spatial reference) which are generated in a map layout, then exported as a feature class, with a custom naming system applied.

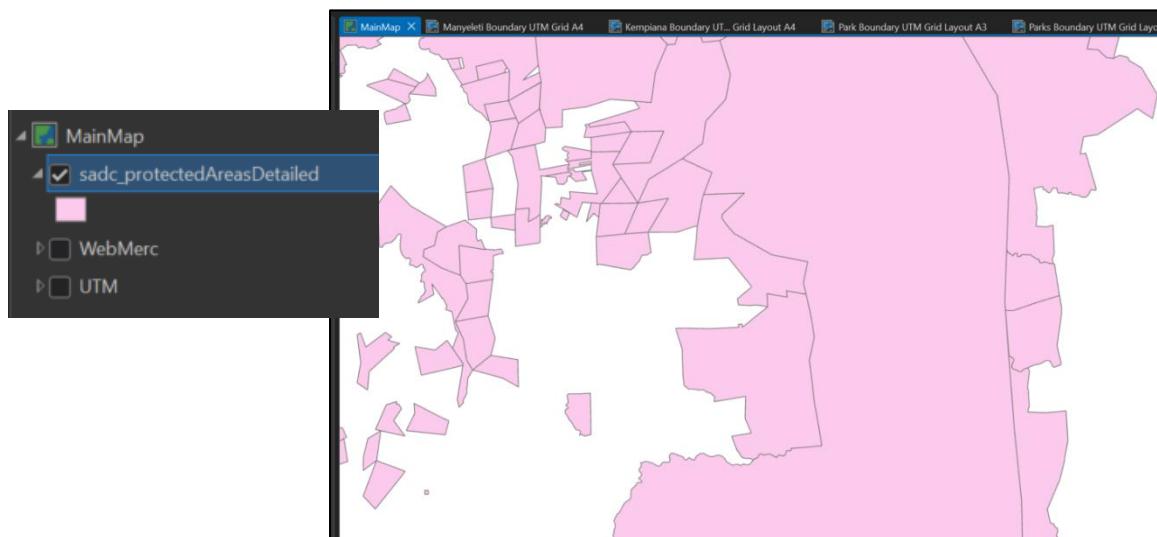
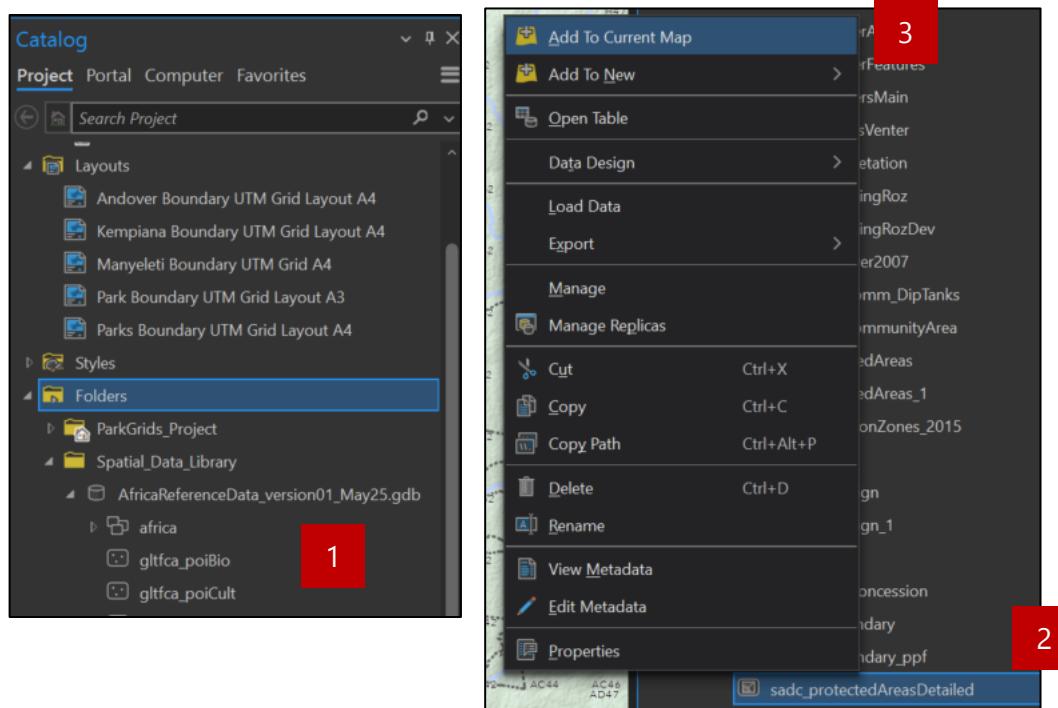
One grid code has been created that covers all three parks of interest, to prevent conflicting codes. When creating new grid codes (for instance, to add new areas of interest), care should be taken to ensure that a single grid code covers all the areas of interest, and/or that the new grid code does not conflict with existing grids. Having two grid codes named 'A2' in different areas could lead to significant coordination issues.

Alternatively, if frequent changes are expected, it may be more effective to teach users how to read and communicate locations by reading UTM coordinates. UTM coordinates can be generated automatically using the layout, does not require generating custom grid names, and are significantly easier to produce. See the 'Other References' section at the bottom of this document for more information on reading UTM coordinates.

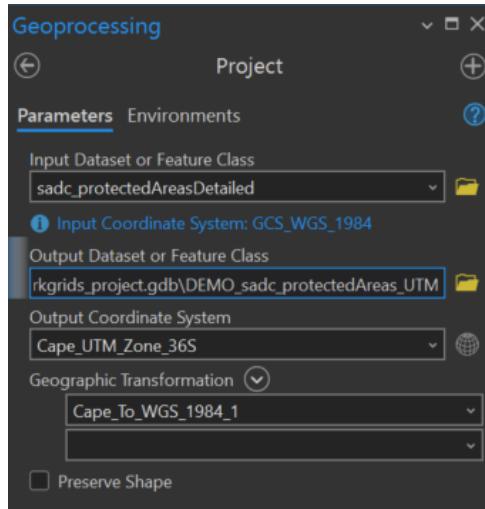
- Open up the 'ParkGrids_Project' ArcGIS Project file and select the 'MainMap' map (alternatively, you can begin with a new blank project space if desired).
- If creating your own project, ensure the map is set to the appropriate UTM spatial reference (Right click on the Map frame and select 'Properties'), then select 'Coordinate System'.



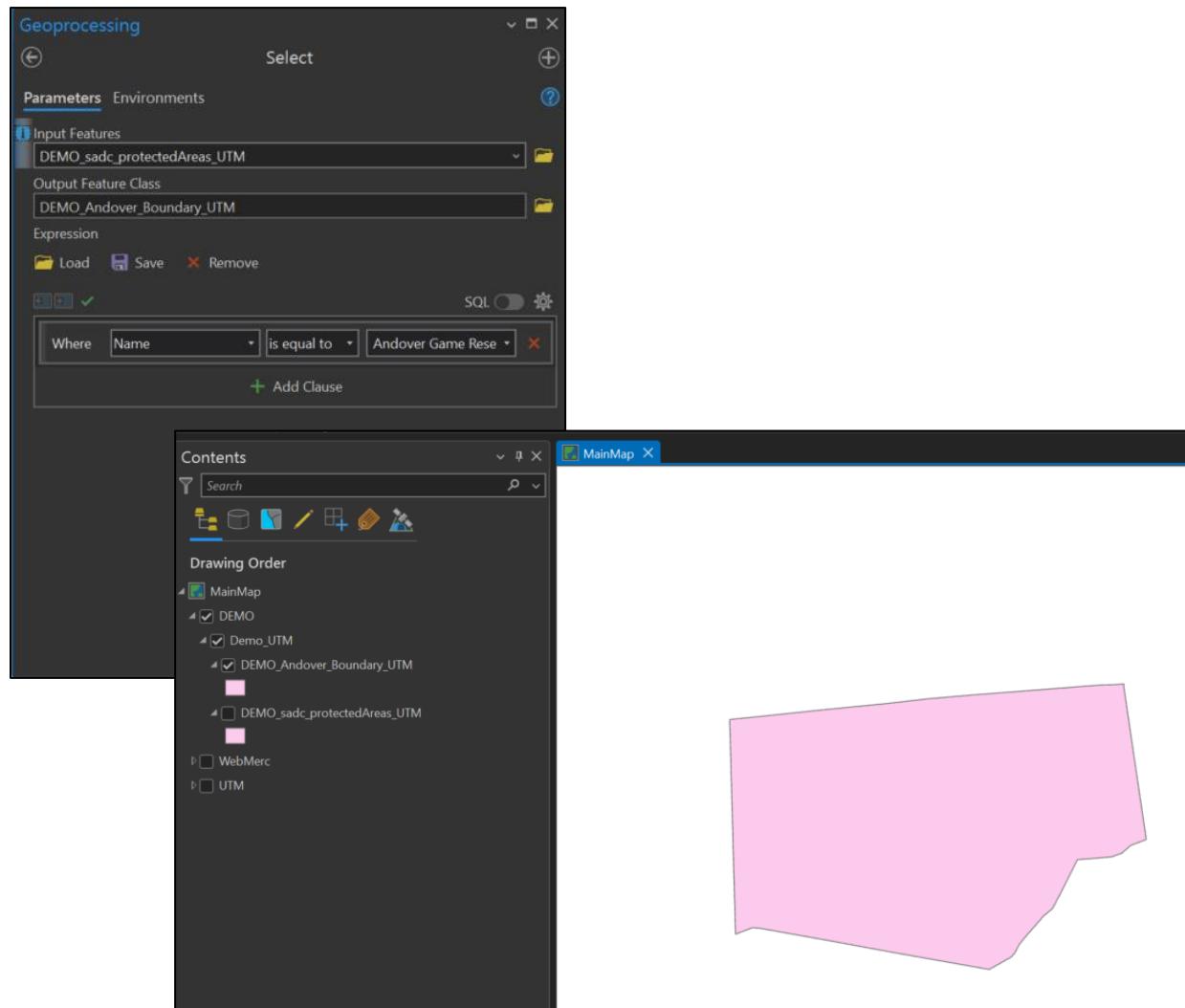
- Create a boundary to represent the area you would like included in the grid system and import any relevant data.
- Sample workflow for creating a boundary file:
 - Import a copy of the 'sadc_protectedAreasDetailed' file from the African Reference Data GDB, into the map.



- Project the file into the Cape UTM Zone 36S reference system if necessary.

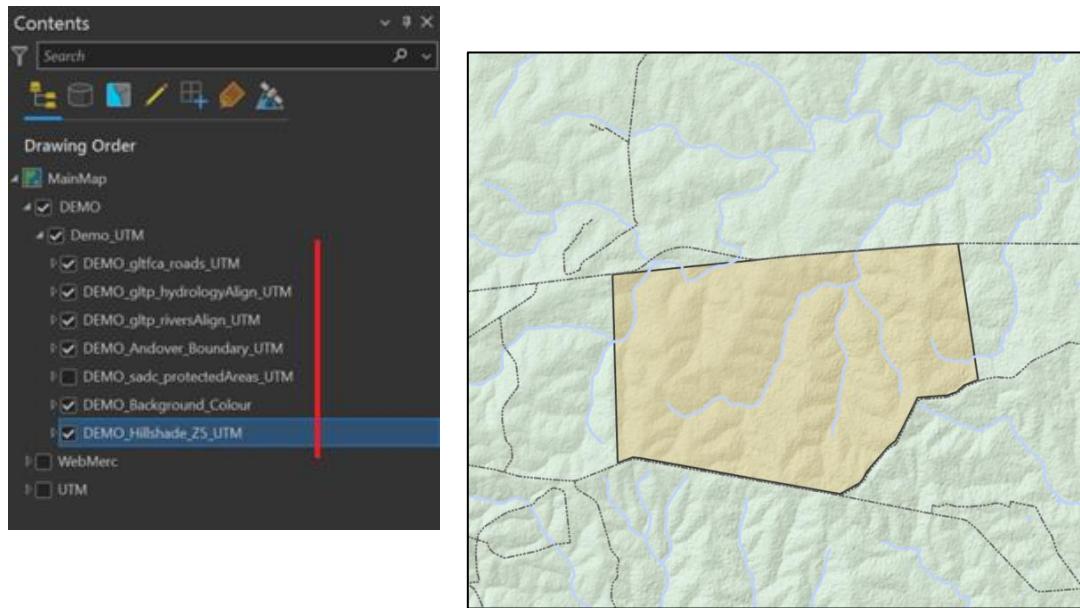


- Create a new feature class for the desired boundary by using the 'Select' tool.

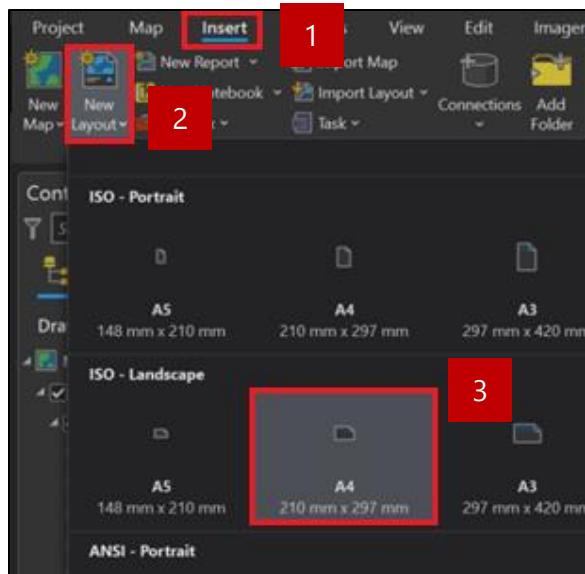


The screenshot shows the 'Geoprocessing' tool dialog box with the 'Select' tool selected. The 'Input Features' is set to 'DEMO_sadc_protectedAreas_UTM' and the 'Output Feature Class' is set to 'DEMO_Andover_Boundary_UTM'. An expression is defined: 'Where Name is equal to Andover Game Rese'. Below the tool, the 'Contents' pane shows a tree view of layers: 'MainMap' contains 'DEMO' (which contains 'Demo_UTM' and 'DEMO_Andover_Boundary_UTM'), 'WebMerc', and 'UTM'. The 'MainMap' view shows a pink polygon representing the selected boundary.

- Add the applicable reference data that may be necessary for your map (e.g., roads, rivers, hillshade and background).

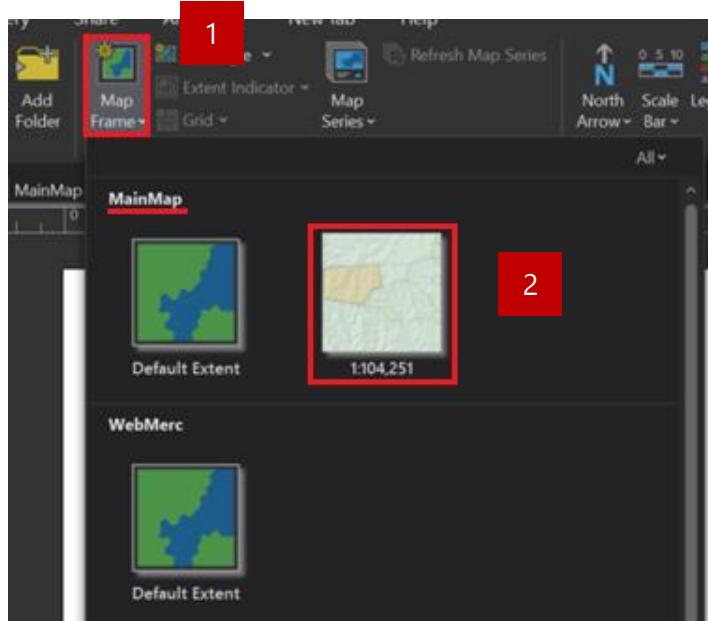


- Add a new layout in the applicable size.

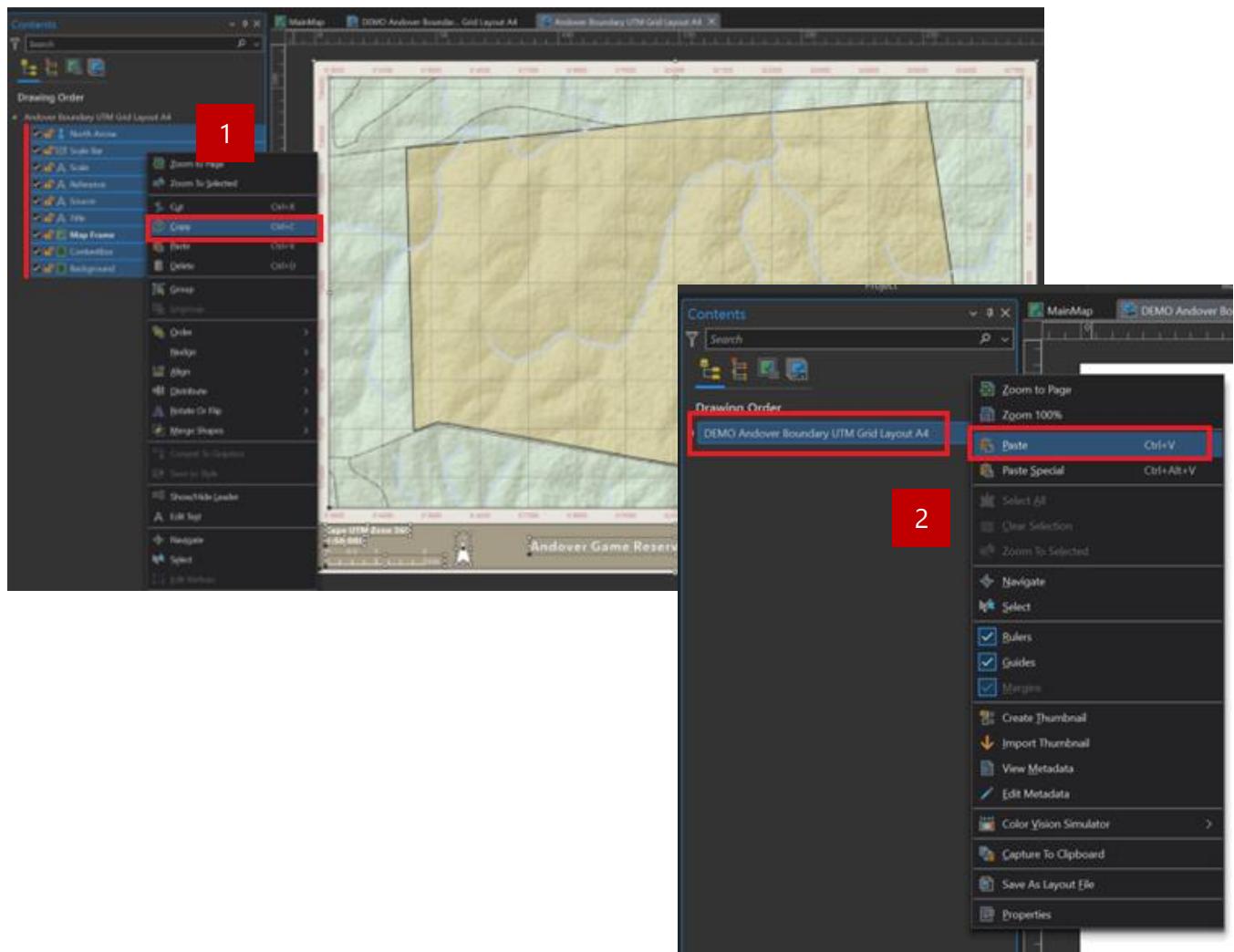


- Create a new layout from scratch, referencing the main UTM Map, or copy and paste the elements from one of the existing layouts in the project file, and customize as needed.

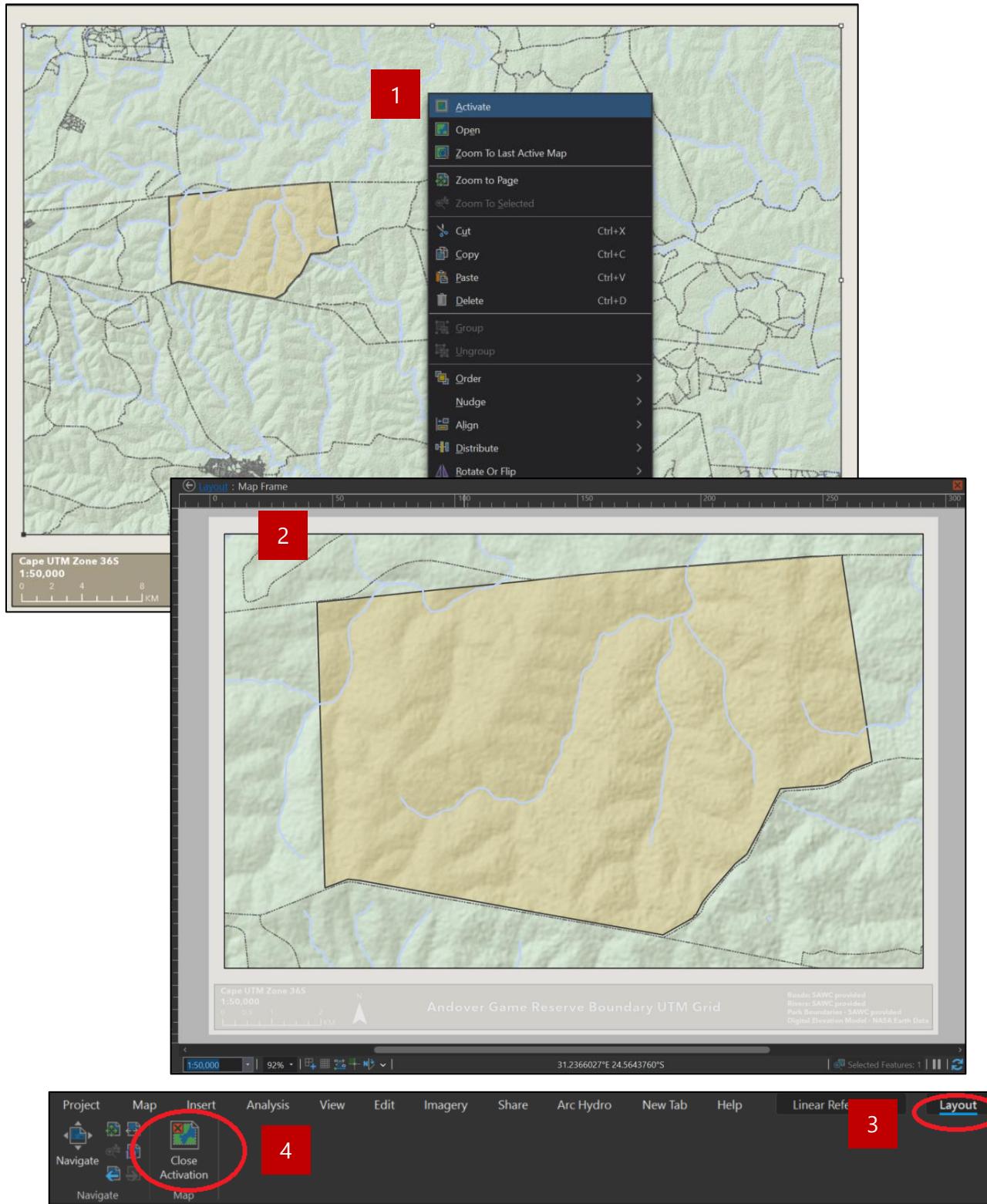
(Creating a new map layout from scratch, adding in the map frame of our main UTM map)



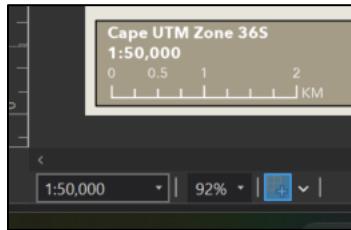
Or... (Copying and pasting in an existing map layout)



- If necessary, Right click on the map Frame and select 'Activate', then ensure that the study area is in clear view and at an appropriate extent, then close the activation.



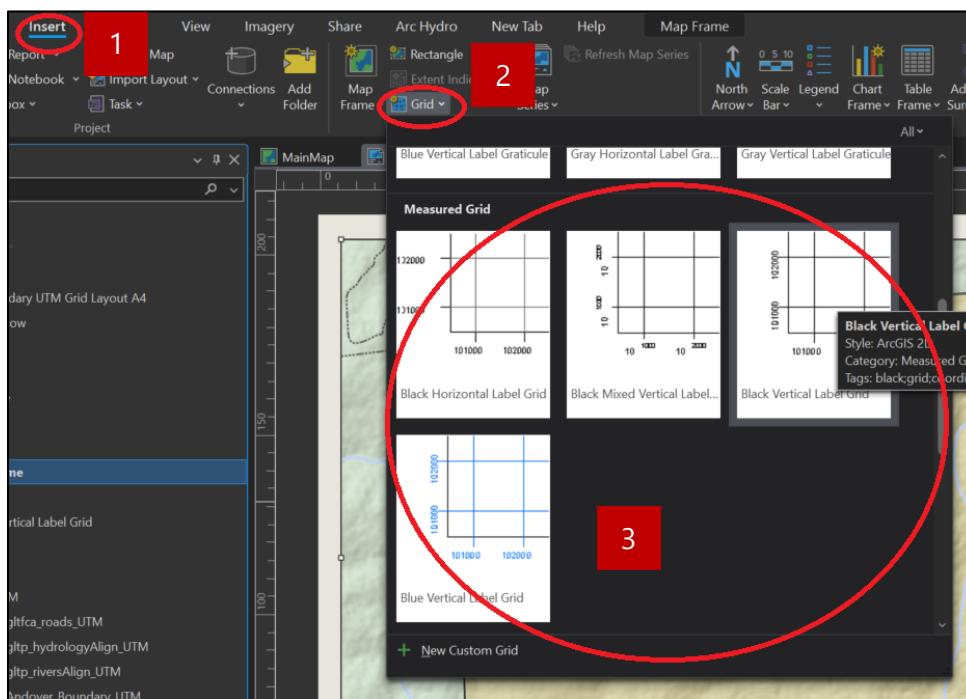
- Be sure to add or update the scale within the layout to accommodate the new extent.

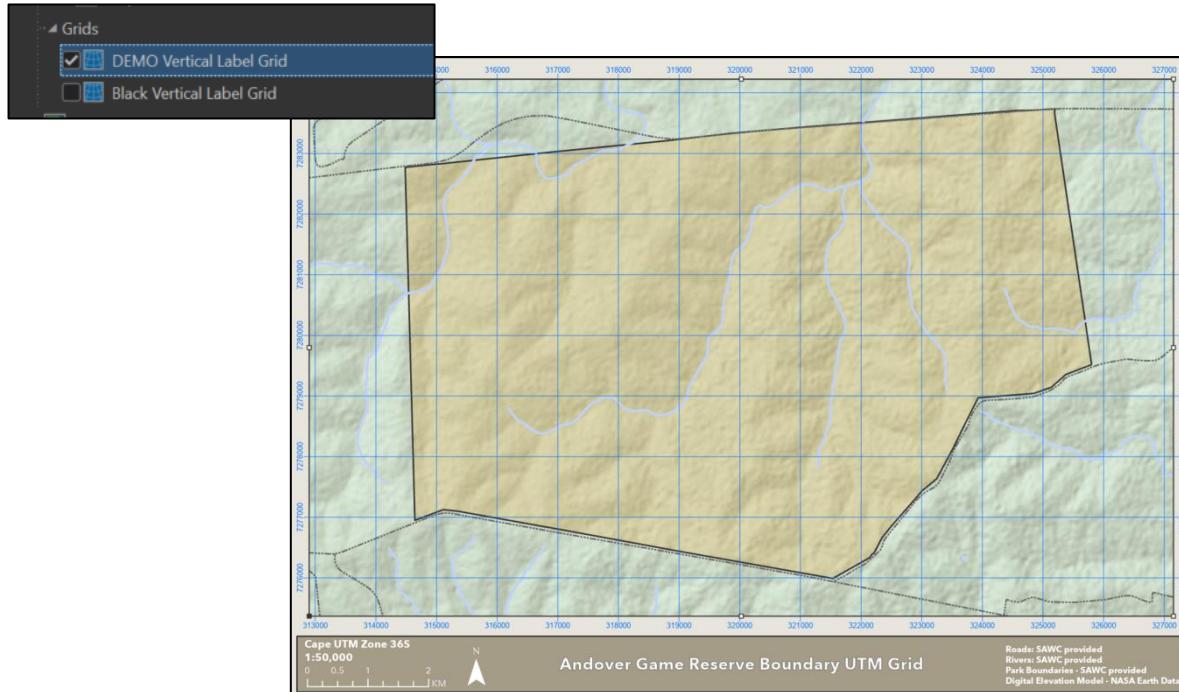


If copying and pasting an existing layout from the provided project file, there will already be a Grid built into the map frame. But for the sake of demonstration, we will review how to create a new one.

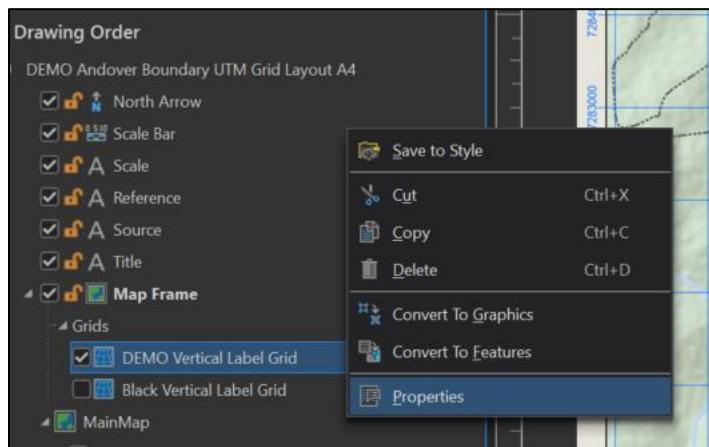


- Insert tab > Grid > Select a 'Measured Grid' as UTM is a projected coordinate system. The colour is not important, as this can be customized.

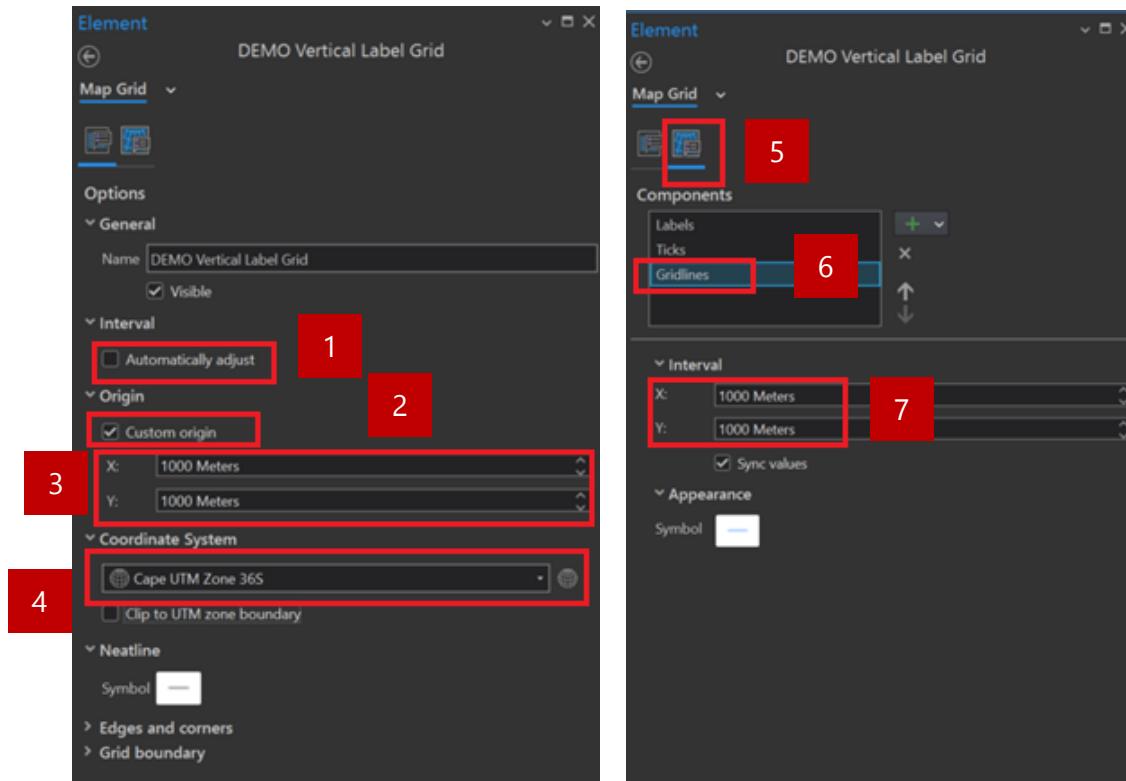




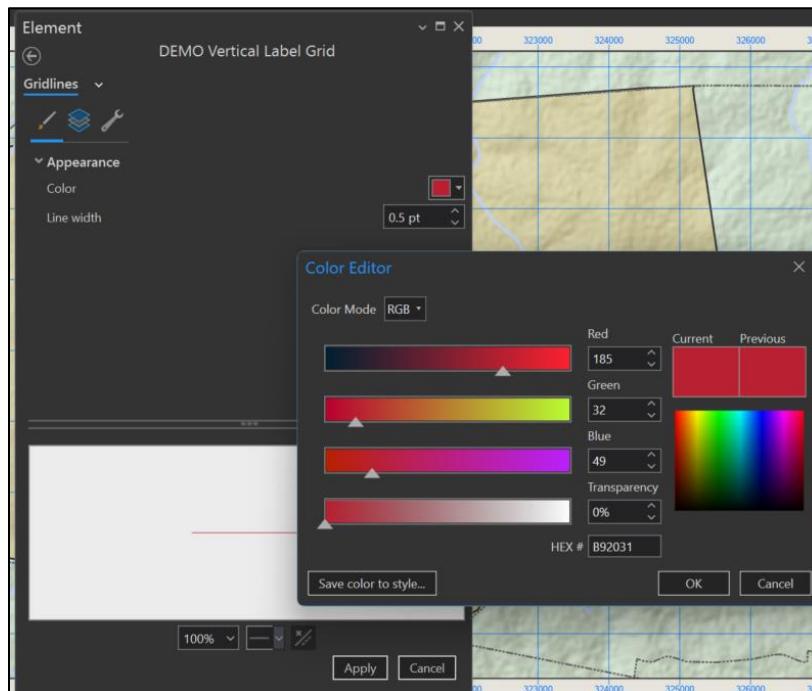
- Right click on the grid in the Contents Pane and select 'Properties'.



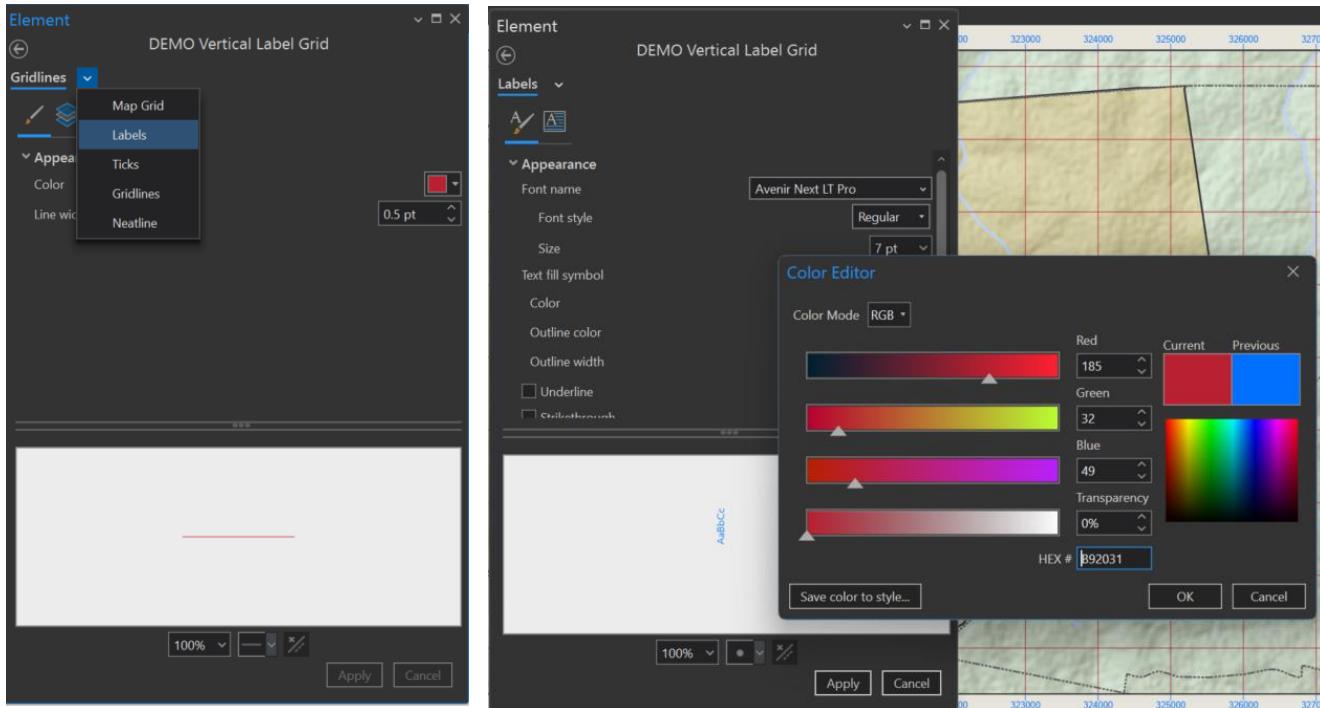
- In the options tab, ensure 'Automatically adjust' is unchecked, and 'Custom origin' is checked. Select 1000 Meters x 1000 Meters for 1km grids (adjust if desired).
- In the components tab, ensure the X and Y intervals are set to 1000 Meters x 1000 Meters for 1km grids.
- Labels and Ticks interval can be set to preference (in the provided solutions, ticks were turned off, and labels were set every 2000 Meters for smaller scale map layouts).



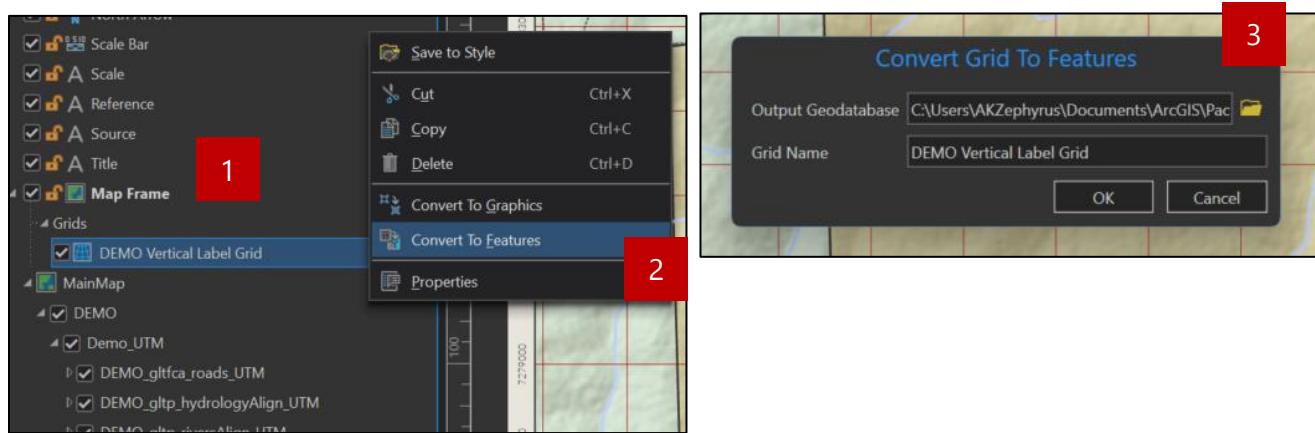
- While the Gridlines component is select, change the 'Symbol' under appearance to the desired colour.



- Use the drop down to select other components of the grid, and style as appropriate.

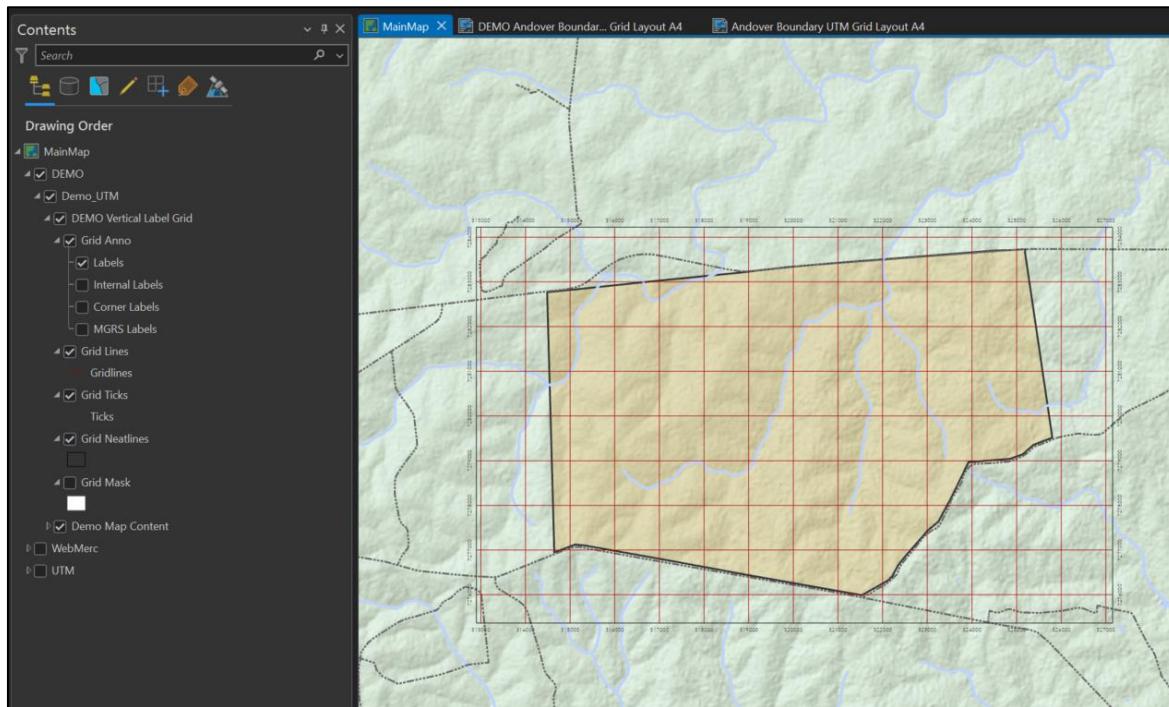


- Right click on the Map Grid you have now created and select 'Convert to Features'. We need this to be a feature class, to build a custom naming grid system and for use outside of the layout.

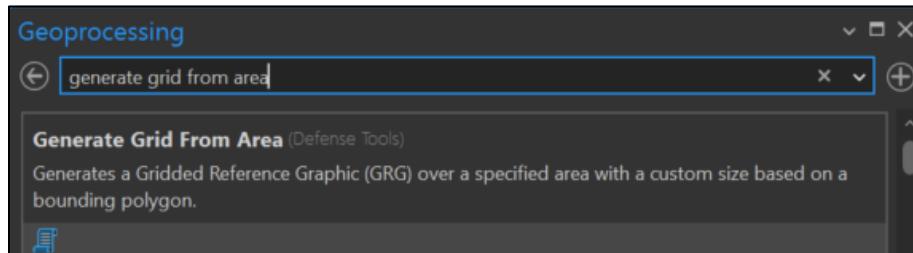


The grid will now turn off and be replaced by the symbology from the feature class.

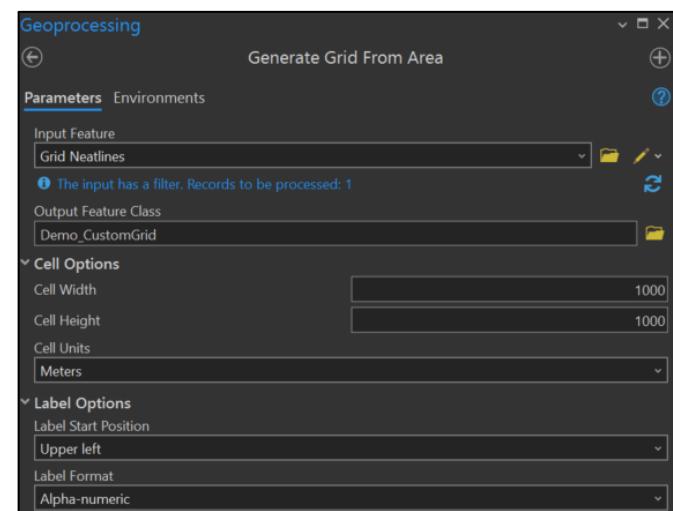
- Switch over from the layout to the map view. You can see the layout grid information is now available as various feature classes.
- Turn off the more distracting layers such as Grid Mask.



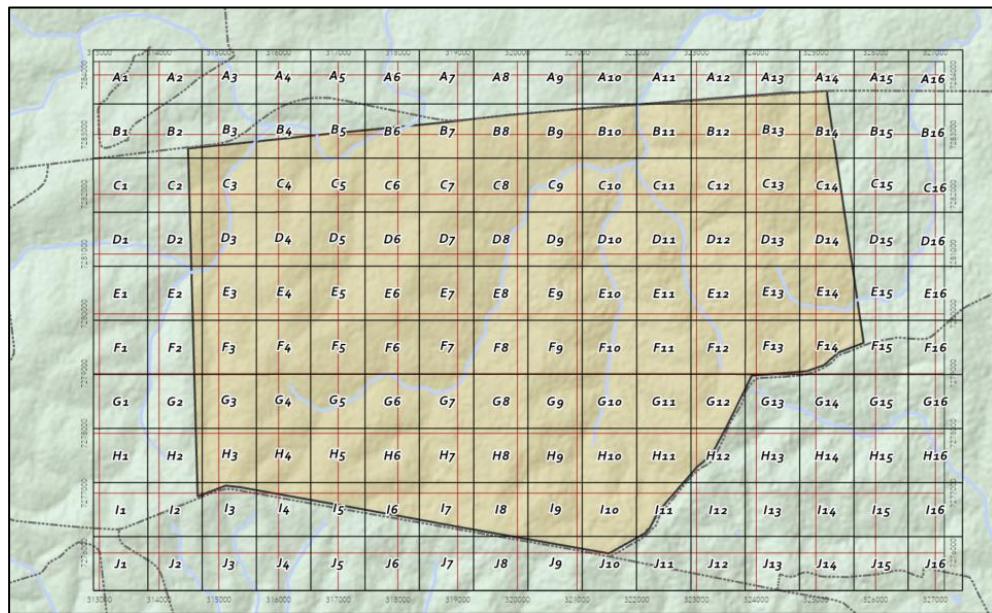
- The grid neat line will now be used as the extent for a custom grid. From the Analysis Toolbox, search for the 'Generate Grid From Area' tool.



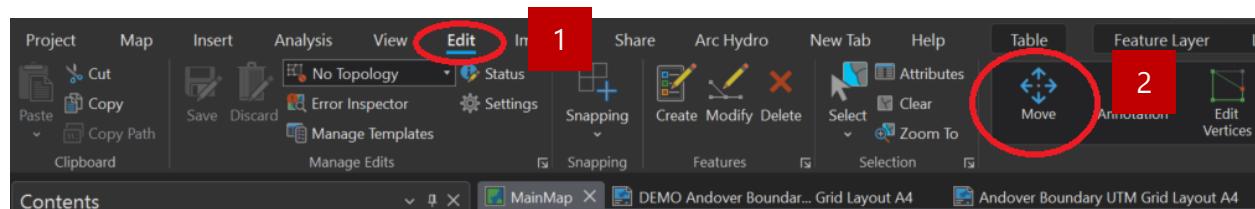
- Ensure that the Cell Width and Cell Height is set to 1000 meters for 1KM grids (this should match the size used earlier for the UTM grids). An Alpha-numeric label format was used, beginning in the Upper Left corner for the provided maps.



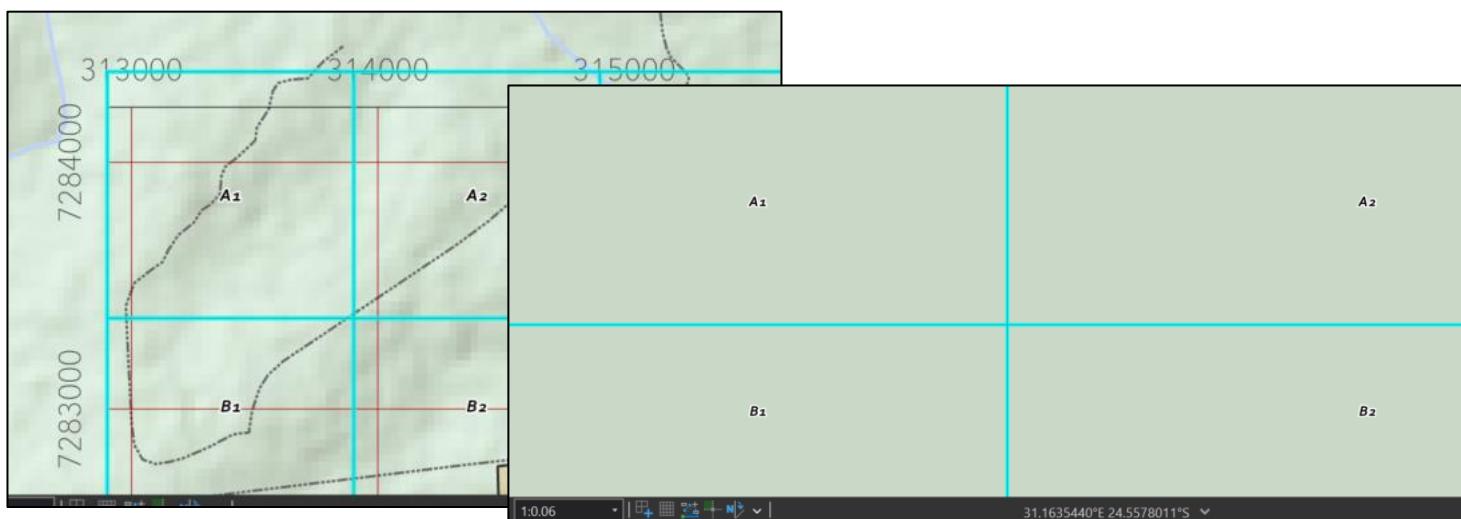
- The resulting output will be the correct size but will be slightly off-center to the actual UTM Grids. That is alright, they should be the correct size, so we can align them as needed.



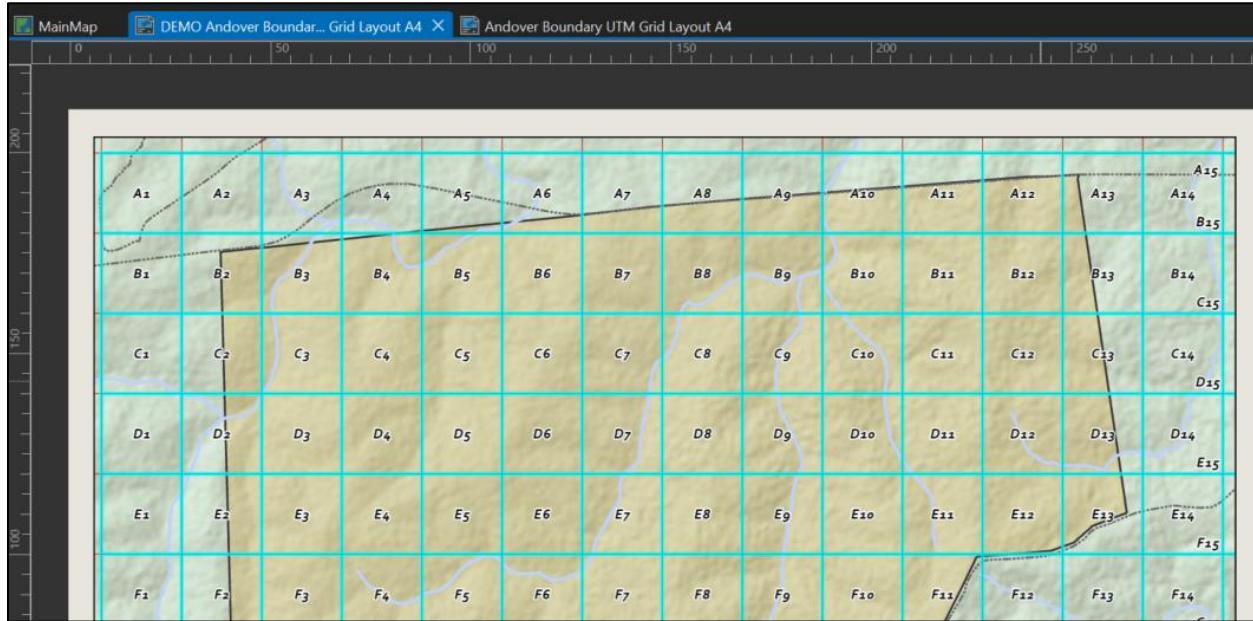
- Select all the data within the custom grid (open the attribute table, and select all), then select the 'Move' tool under the 'Edit' tab



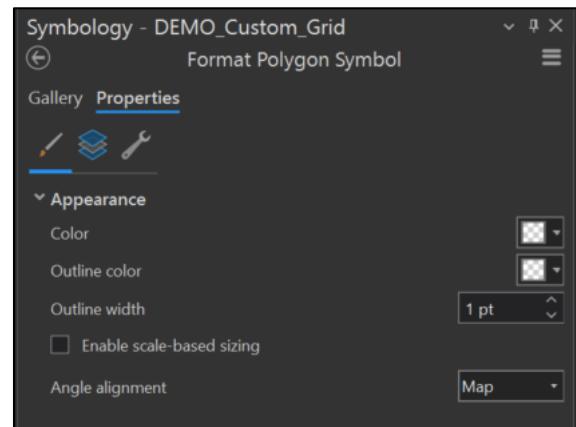
- Line the custom grid up with the UTM reference grid. Zoom in as close as possible for maximum precision. Deviation at a small scale will have big repercussions at a large scale.



- Check in the layout to confirm that the new custom grid perfectly matches the original UTM grid that was generated in the layout.



- Switch back to the map view. Turn the symbology off for the custom grid, while leaving the grid system on, to avoid an overlapping effect. An easy way to accomplish this is to turn the colour and the outline in the symbology properties, to no colour.
- Apply appropriate labeling topography. Small font sizes will be necessary for best performance.

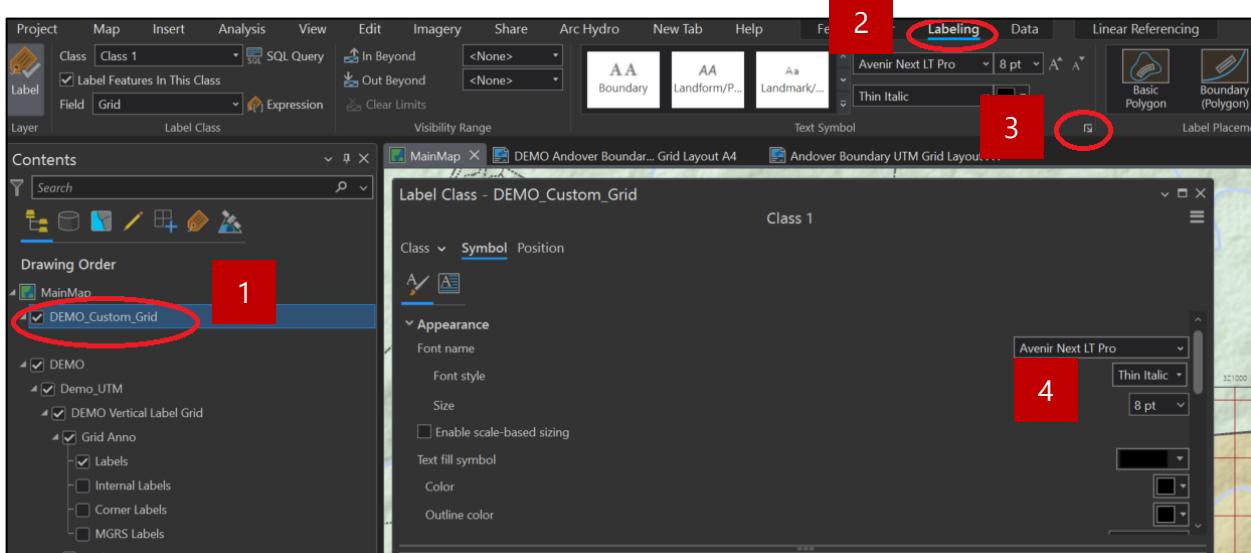


1

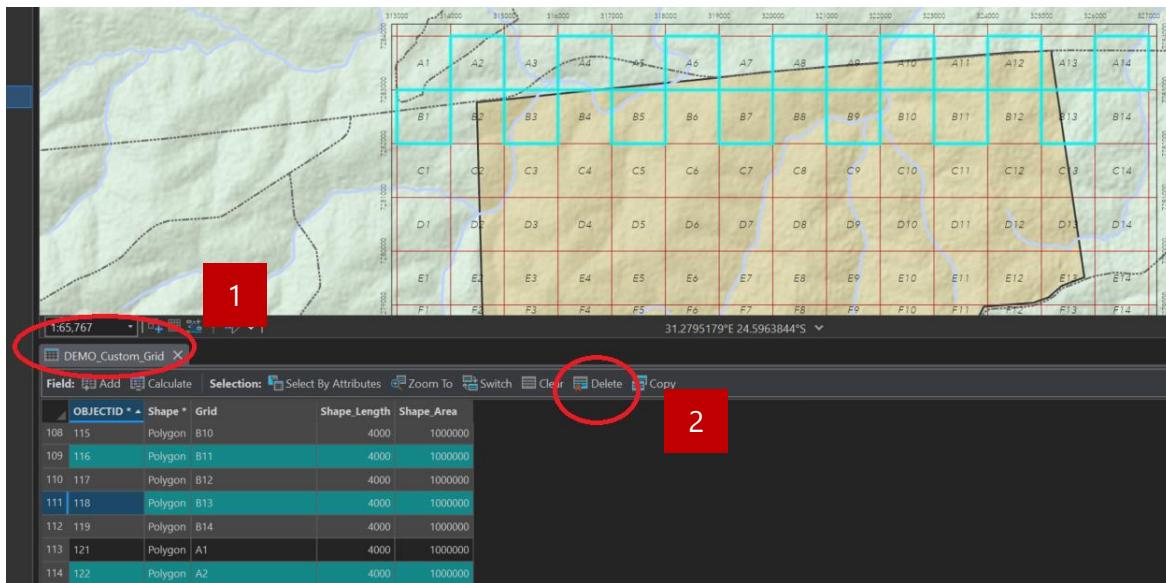
2

3

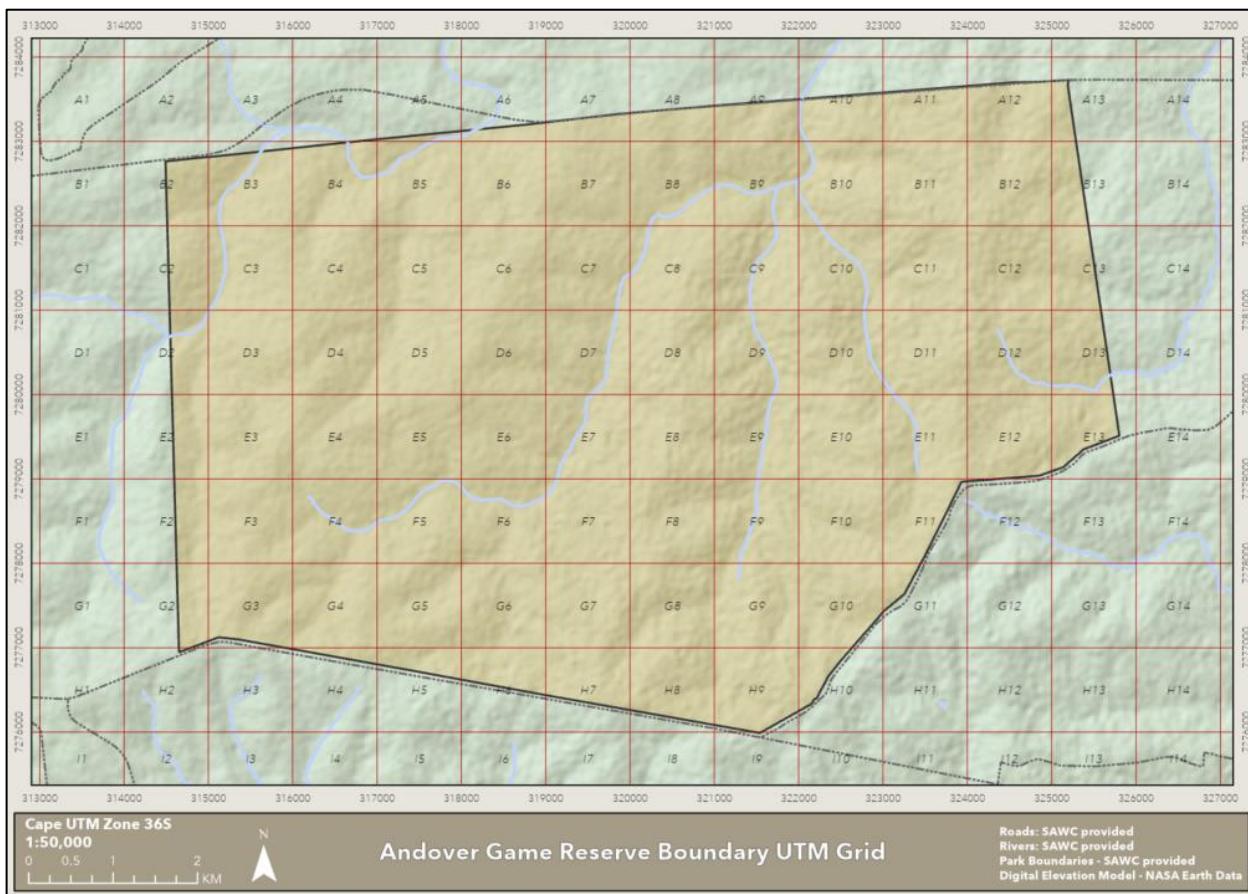
4



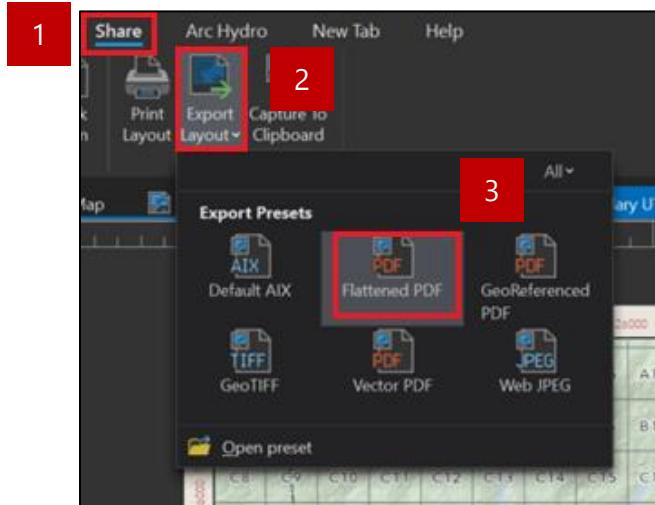
- Optional:* If this is being applied to a small-scale map, it may be difficult to see all the symbology neatly, even with small font. That is why a 'minimal' version of the alpha numeric labels has been made available. If this is the case, consider opening the custom grid's attribute table, and deleting every other cell in the row, to create a cleaner grid.



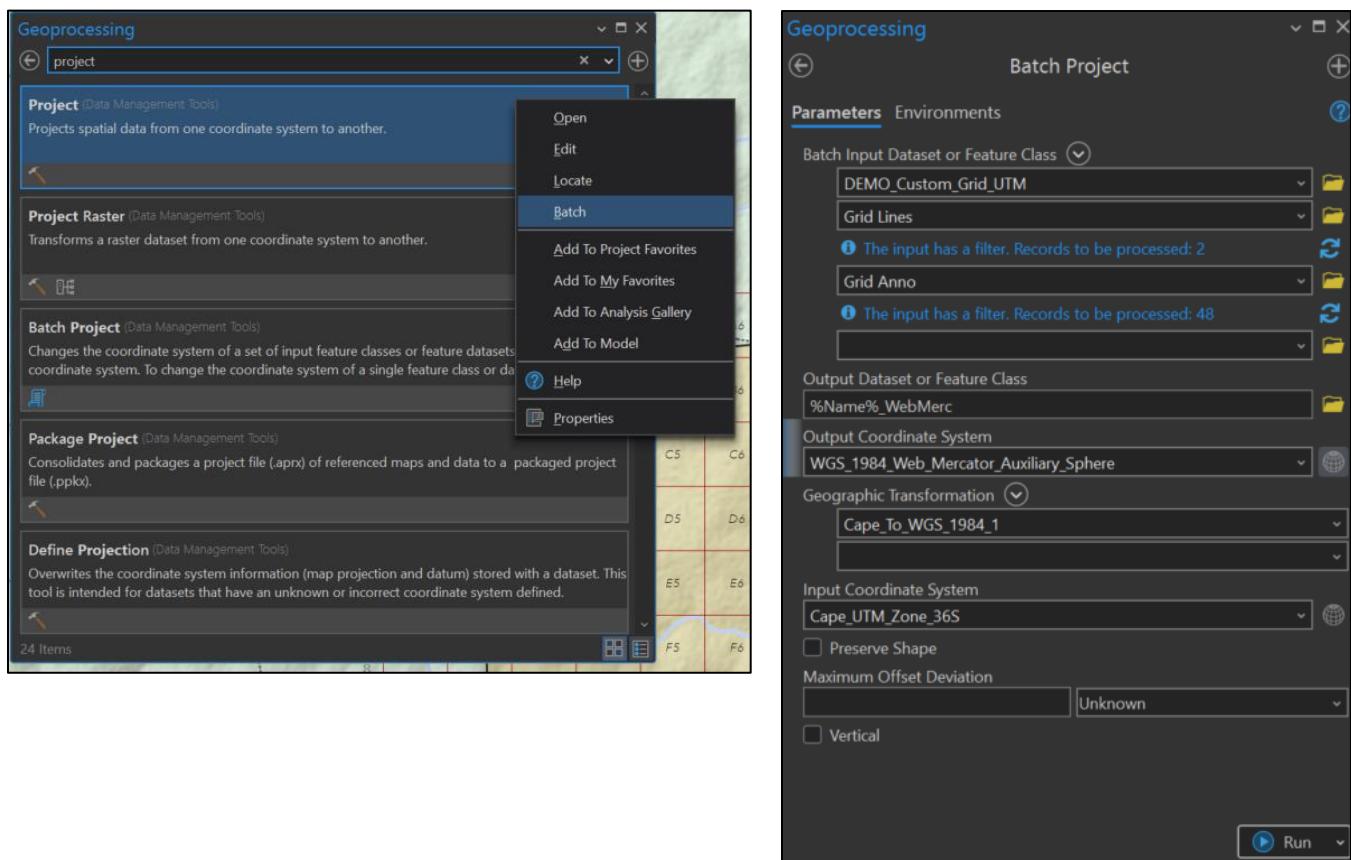
- Turn off the neat line and Grid Anno labels in the map view, and switch back to the Layout view.
- Turn the original layout UTM grid back on and ensure the custom grid labels line up correctly.



- Add or adjust the remaining applicable layout elements such as North Arrows, Scale Bar, Title, Source statement, etc.
- Export a PDF of the layout by selecting Share > Export Layout



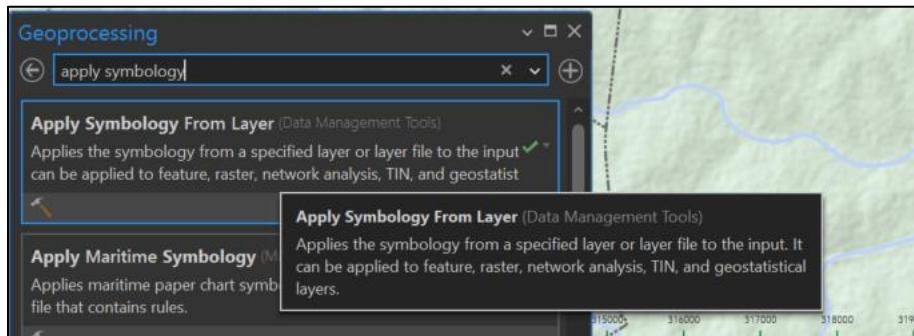
- Switch back to map view and turn back on the grid lines, UTM labels, and custom grid labels. Use the batch 'Project' tool to create Web Auxiliary versions of this data.



The screenshot shows the Geoprocessing pane in ArcGIS Pro. On the left, a list of tools is visible, and a context menu is open over the 'Batch Project' tool, with 'Batch' selected. On the right, the 'Parameters' tab is active for the 'Batch Project' tool. The parameters are as follows:

- Batch Input Dataset or Feature Class: DEMO_Custom_Grid_UTM
- Grid Lines
- Grid Anno
- Output Dataset or Feature Class: %Name%.WebMerc
- Output Coordinate System: WGS_1984/Web_Mercator_Auxiliary_Sphere
- Geographic Transformation: Cape_To_WGS_1984_1
- Input Coordinate System: Cape_UTM_Zone_36S
- Preserve Shape
- Maximum Offset Deviation: Unknown
- Vertical

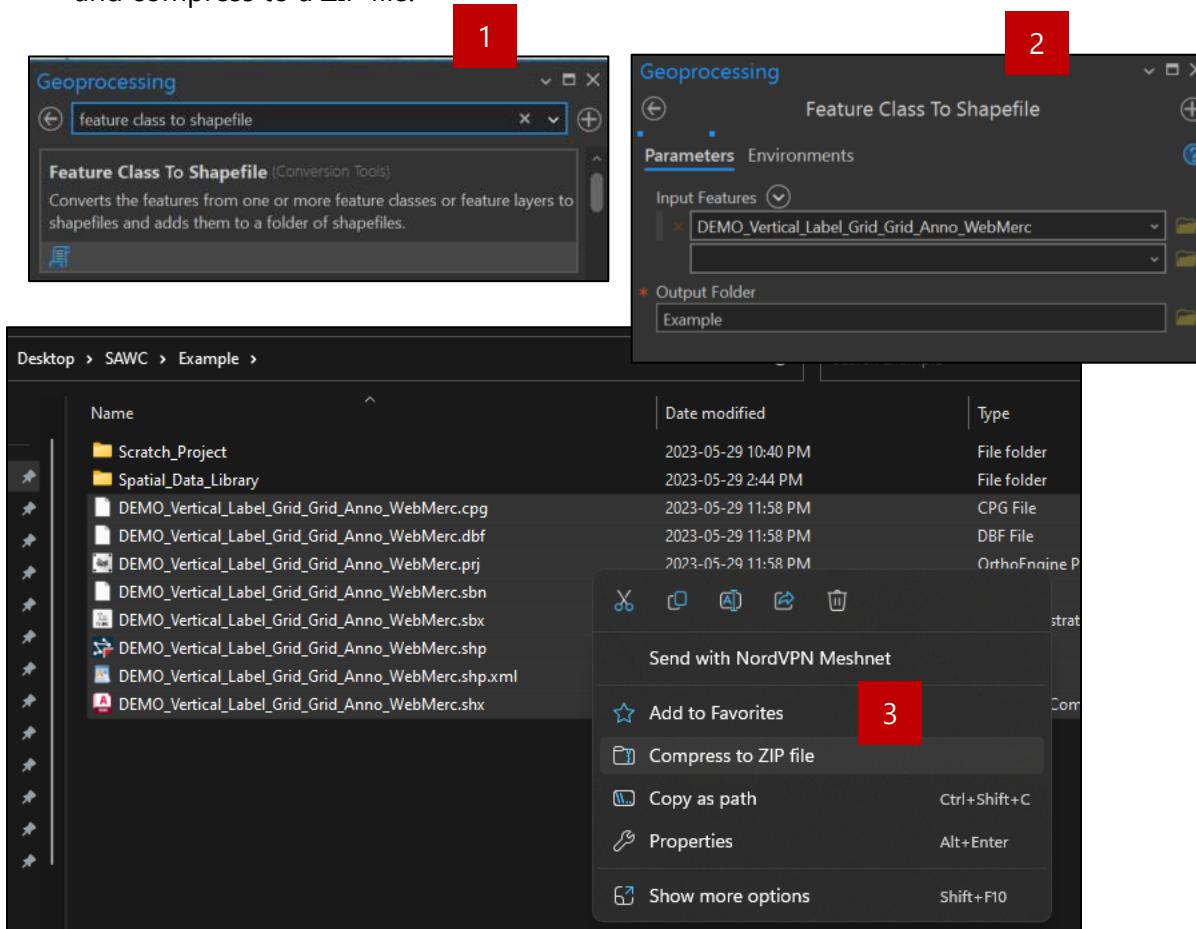
- Use the 'Apply Symbology From Layer' tool to recreate the desired symbology for the new feature classes (will not work for the reference UTM labels which are annotation type).



- Follow the *SAWC GIS Instruction Package – Section 1.4* to upload or replace the gridlines and custom grid code layers into AGOL and apply to the appropriate web maps.

Uploading annotation feature classes

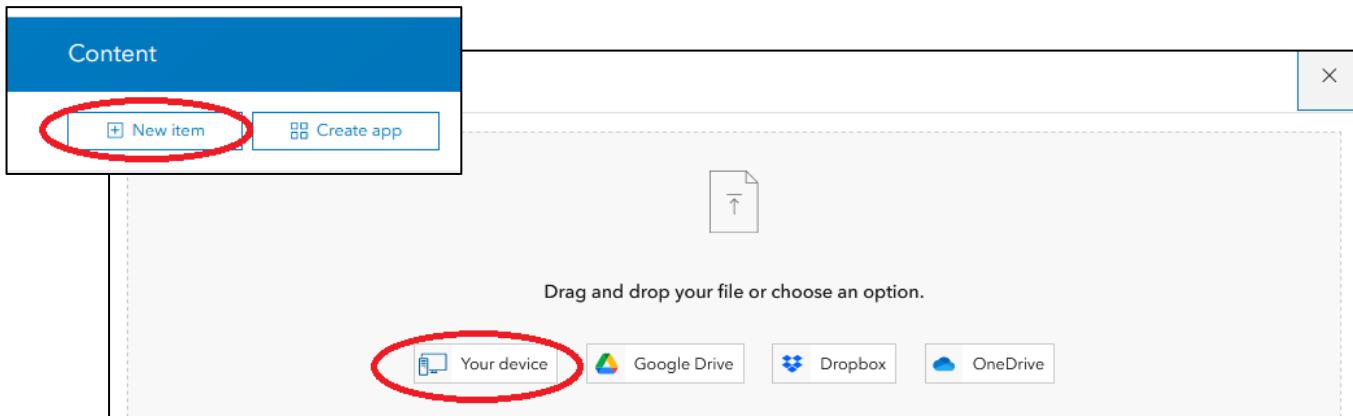
- The reference UTM labels, as an annotation class cannot be uploaded in the standard way. Use the 'Feature Class to Shapefile' tool to create a shapefile.
- Go to the folder where the shapefile was created. Select all the files relating to the shapefile and compress to a ZIP file.



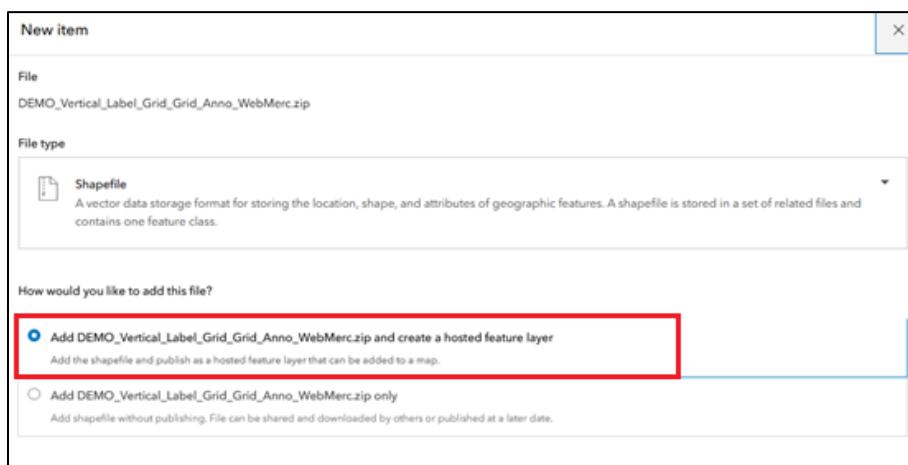
The image illustrates a three-step process:

- Step 1:** The 'Geoprocessing' pane shows the 'feature class to shapefile' tool selected. A red box labeled '1' is over the search bar.
- Step 2:** The 'Feature Class To Shapefile' dialog box is open. It shows the 'Input Features' dropdown set to 'DEMO_Vertical_Label_Grid_Grid_Anno_WebMerc' and the 'Output Folder' dropdown set to 'Example'. A red box labeled '2' is over the dialog box.
- Step 3:** A context menu is open over a file named 'DEMO_Vertical_Label_Grid_Grid_Anno_WebMerc.shx' in a file explorer window. The menu items shown are: 'Send with NordVPN Meshnet', 'Add to Favorites', 'Compress to ZIP file' (highlighted with a red box), 'Copy as path', 'Properties', and 'Show more options'. A red box labeled '3' is over the 'Compress to ZIP file' option.

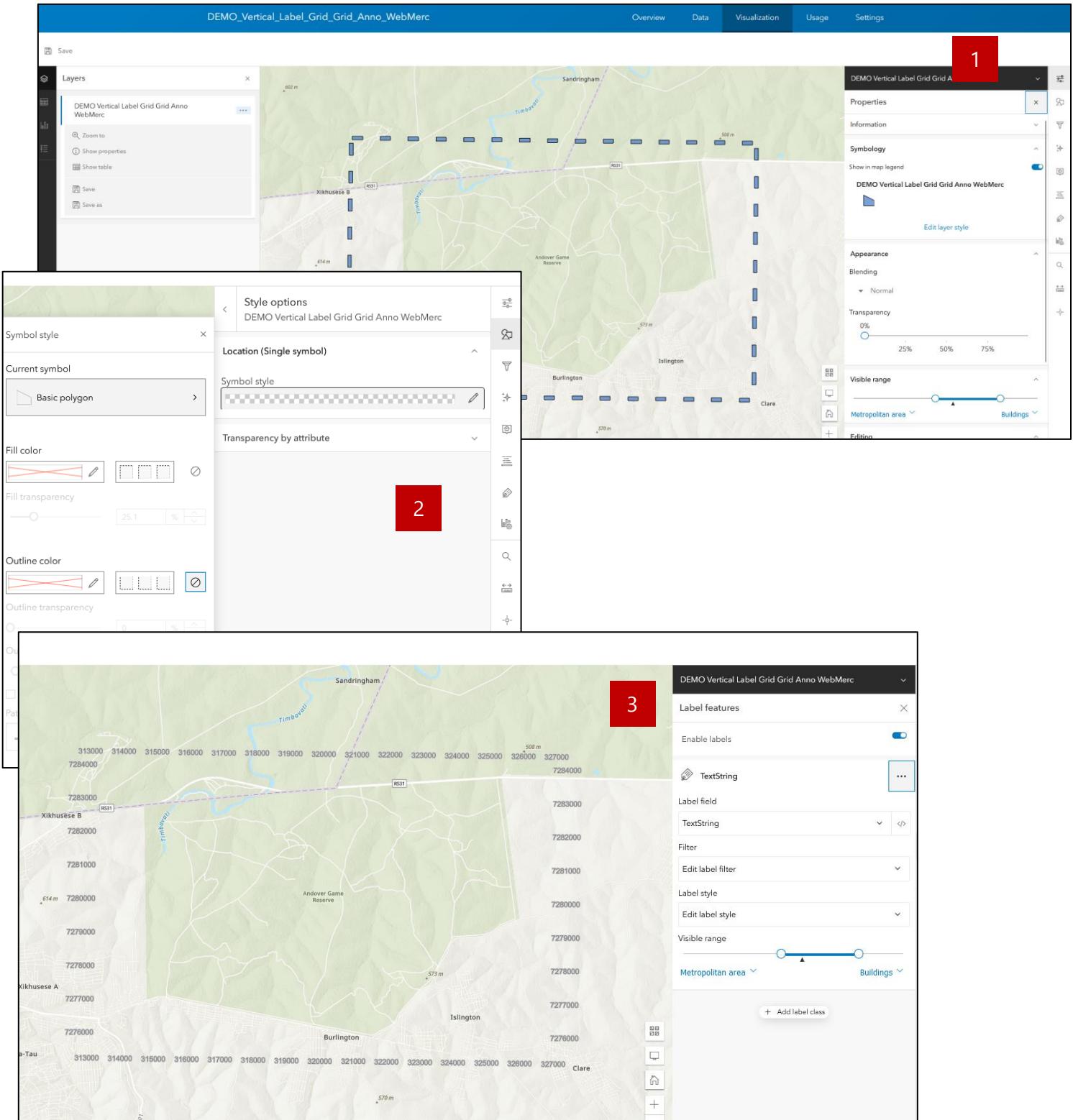
- Login into ArcGIS Online, and in the 'Content' tab, select 'New Item' , and choose to upload an item from 'Your Device'.



- Select the ZIP file of the shapefile that you just created. Then select the first option that appears in AGOL.



- In the 'Visualization' for the uploaded annotation shapefile, turn the symbology off, and the labels on.

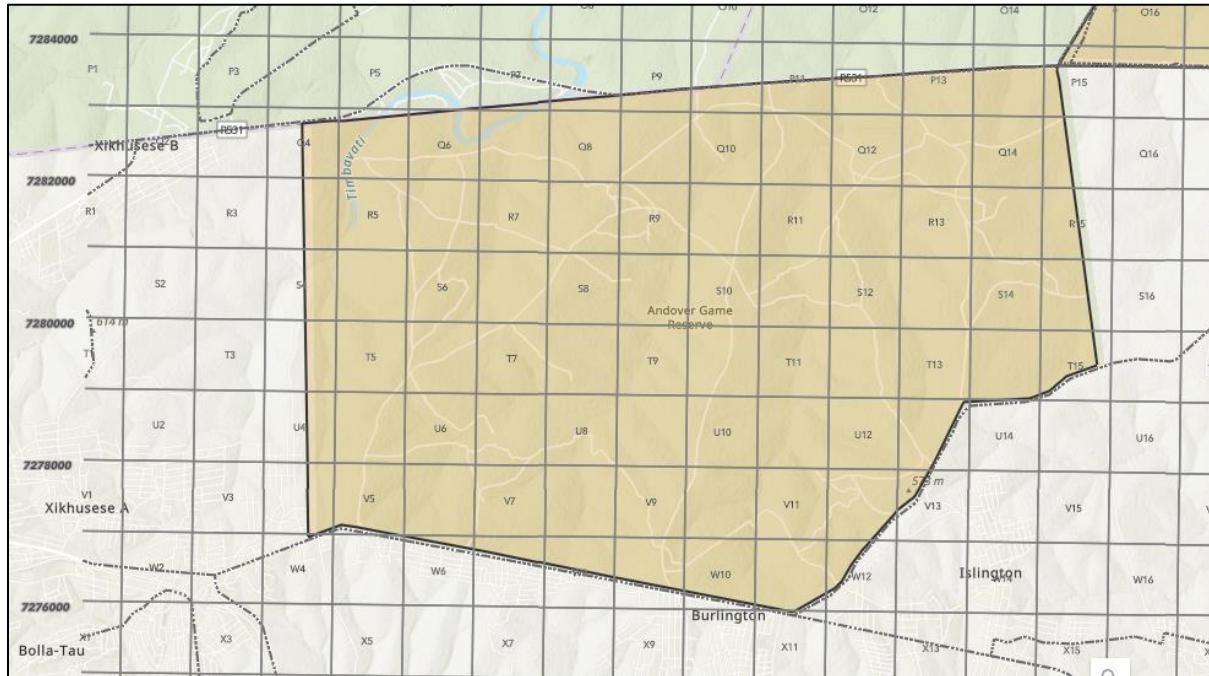


The screenshot illustrates a workflow for creating a vertical grid overlay on a map. The process involves three main steps:

- Step 1:** The top panel shows the map interface with a vertical grid layer applied. A red box labeled "1" highlights the "Properties" section of the right-hand panel, which displays settings for the "DEM0 Vertical Label Grid Grid A" layer.
- Step 2:** The middle panel shows the "Style options" dialog for the "Basic polygon" symbol. A red box labeled "2" highlights the "Symbol style" tab, where fill and outline colors can be customized.
- Step 3:** The bottom panel shows the map with the vertical grid now labeled with numerical values (e.g., 313000, 314000, 315000, etc.) along its segments. A red box labeled "3" highlights the "Label features" section of the right-hand panel, which includes options for "TextString" labels and "Edit label filter".

- Combine the newly uploaded shapefile with the other hosted feature layers relevant to the grid in a web map and add the appropriate applications as required.

Note the mildly distorted / crooked appearance of the UTM grids as they are projected in a web Mercator global coordinate system.



Associated project links

Park navigation and grid systems

- [PDF links \(teams page\)](#)
- [Field maps link \(for phone\)](#)



- [Webmap item link \(SAWC AGOL\)](#)
- [Webmap map viewer link \(SAWC AGOL\)](#)

Other resources

SAWC Documentation: [*SAWAC GIS Instruction Package*](#)

USGS: [*The Universal Transverse Mercator \(UTM\) Grid*](#)

Map Tools: [*A Quick Guide to Using UTM Coordinates*](#)

ArcGIS Pro Documentation: [*Project Tool*](#)