

2017 Dec 19

Using USGS TNM Vector Data to Create Seamless Topographic Maps in ArcGIS

One of the most popular download on this site is [how to convert USGS geopdf to geotiffs using ArcGIS](#). So I started to thinking about why not use the USGS Topo Vector Data to create seamless maps that are very similar to the USGS geopdfs? Why do I want to use the USGS Topo Vector Data to create topographic maps? Because it's a hassle and a pain in neck to get USGS GeoPDFs into a GIS, and sometimes the web mapping services just don't cut it (e.g. resolution not good enough, limited control over styling, etc.).

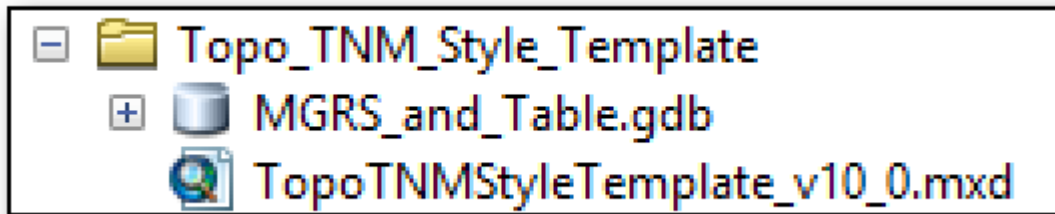
This post is a follow up post to the previous, [USGS TNM Style Template ArcGIS](#). Data for Hawaii is now available to use with the ArcGIS map document template. I like the USGS TNM Topographic maps as basemaps – it provides an informative but clean background for whatever data layers I overlay on top of it and plus most people are familiar with it. If you are looking to recreate a USGS Topographic Quadrangle maps (7.5-Minute topo quads) in ArcGIS – I suggest you follow the instructions given on the [USGS site](#). What I want is to assemble a statewide dataset for use with the TNM style template to create a seamless USGS topo maps. You should read the [USGS FAQ](#) on using the USGS TNM style template.

Step 1: Download Datasets and TNM Style Template

So, the first step is to download the datasets needed for Hawaii and the style template.

1. A good place to look for data is here: <https://viewer.nationalmap.gov/basic/> or go directly to <https://viewer.nationalmap.gov/tools/topotemplate/>

First you should download the TNM Style template and Topo Map Vector Data GDBs for all the 7.5-Minute quads of interest. Here I have the Topo_TNM_Style Template which contains the ArcMap map document that will be used for the styling and map making later.

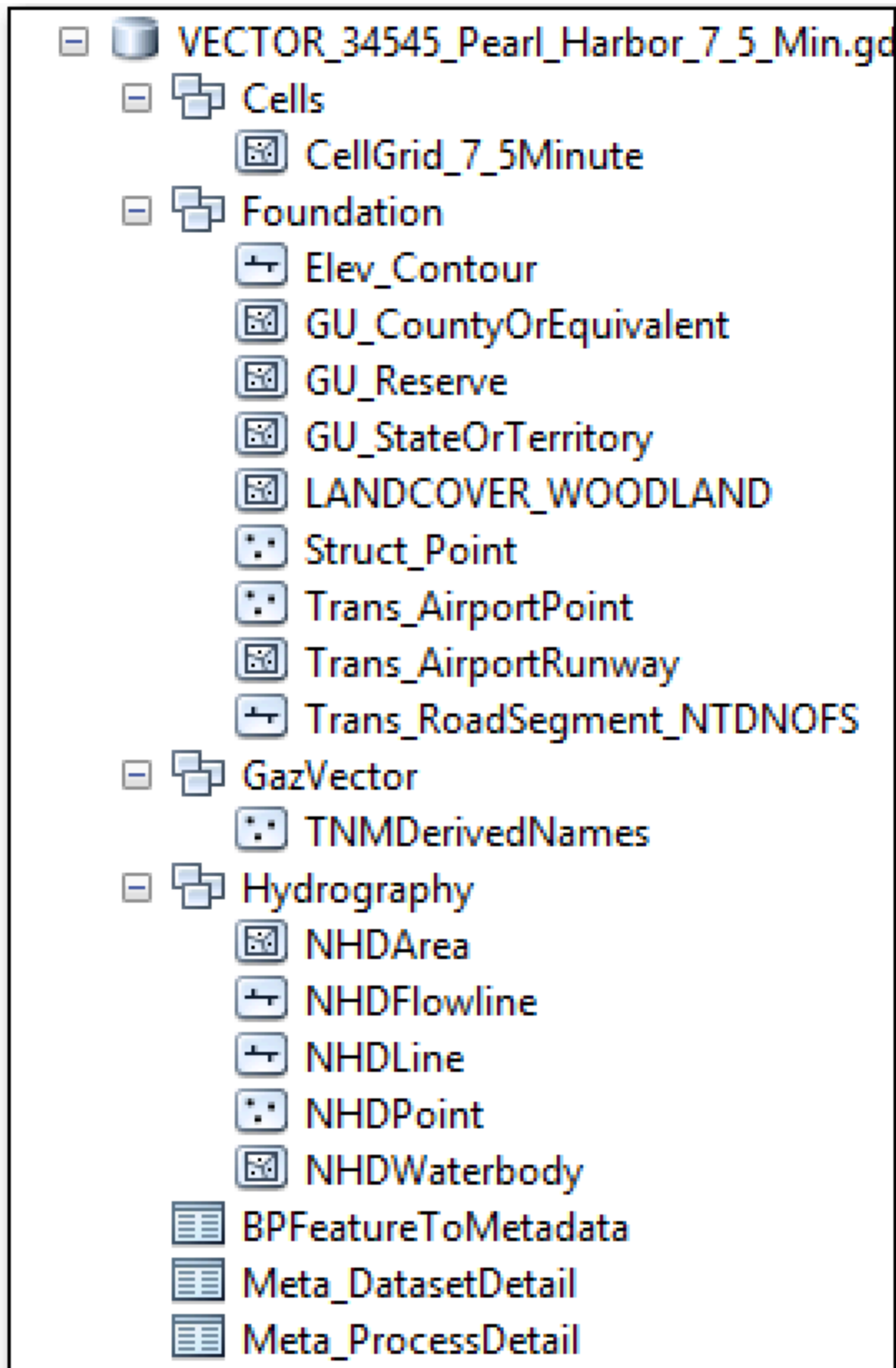


Also I have downloaded all the vector data by island. **Make sure you download data as file geodatabases** and not shapefiles. If you know what you're doing then you can go directly to the [Cloud Browse FTP site](#) and download what you need. Unfortunately the listing of [staged vector data](#) doesn't include Hawaii so I have use the data download service instead.

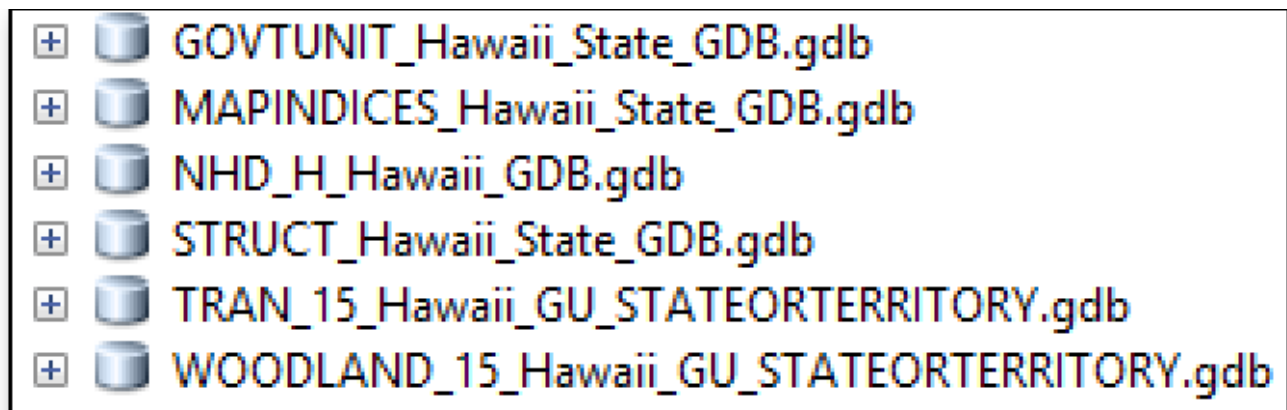


Topo Vector Data for 7.5-Minute cells for Oahu

If you look at the topo vector data GDB file you'll see that it contains the following data - shown below is a example for Pearl Harbor quad, but all the GDBs should contains the same datasets. Using this as a reference I'm going to download the statewide (Hawaii) equivalents to created my Statewide Topo Vector Data GDB.



You will need to download the following datasets:



- **GOVTUNIT_Hawaii_State_GDB.gdb** - file GDB containing boundary layers for Hawaii
- **MAPINDICES_Hawaii_State_GDB.gdb** - file GDB containing map indices for Hawaii. You'll want to use the 7.5-Minute map index
- **NHD_H_Hawaii_GDB.gdb** - file GDB containing the National Hydro Dataset for Hawaii
- **STRUCT_Hawaii_State.GDB.gdb** - file GDB containing point structures for Hawaii
- **TRAN_15_Hawaii_GU_STATEORTERRITORY.gdb** - file GDB containing transportation layers for Hawaii
- **WOODLAND_15_Hawaii_GU_STATEORTERRITORY.gdb** - file GDB containing woodland land use for Hawaii

For the **Elevation Data** - you can download the contour data directly from the [Cloud Browse FTP site](#) or use the Download GIS Data web service. Here I am using the data download service.

Secure | <https://viewer.nationalmap.gov/basic/#productGroupSearch>

USGS

TNM Download (v1.0) [How to](#) [Start Over](#) [Custom Views](#)

[Datasets](#) [Products](#)

[Advanced Search](#) [Options](#) [Find Products](#)

☒ Elevation Products (3DEP)

Product Search Filter

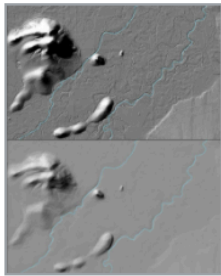
☐ All Subcategories

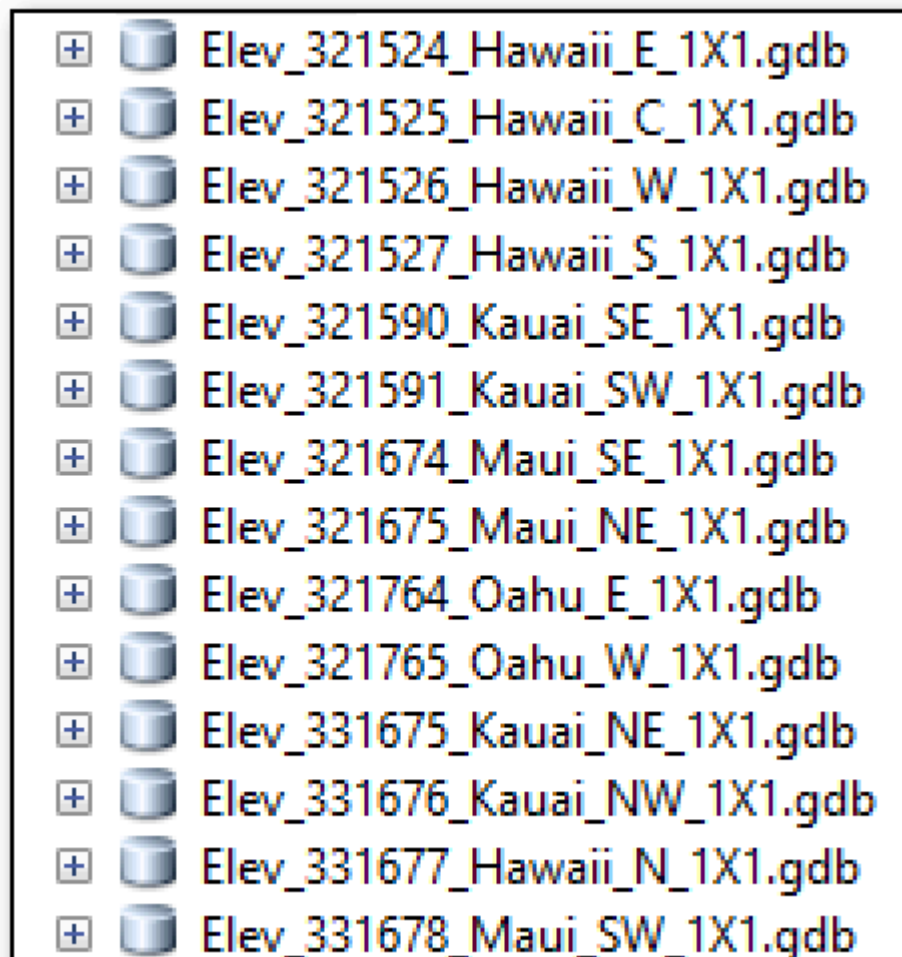
- ☐ 1 arc-second DEM [Show Availability](#)
- ☐ 1 meter DEM [Show Availability](#)
- ☐ 1/3 arc-second DEM [Show Availability](#)
- ☐ 1/9 arc-second DEM [Show Availability](#)
- ☐ 2 arc-second DEM - Alaska [Show Availability](#)
- ☐ 5 meter DEM (Alaska only) [Show Availability](#)
- ☒ Contours (1:24,000-scale) [Show Preview](#)

Data Extent
1 x 1 degree

File Format

- ☐ Shapefile
- ☒ FileGDB 10.1


[Description](#)



Step 2: Create an empty geodatabase schema

So after downloading the data I need, I going to create an empty geodatabase schema based on one of the Vector Data Quad GDB (e.g. Vector_34545_Pearl_Harbor_7_5_Min.gdb). I'm going to then load the statewide datasets into this new GDB and this will be my new Topo Vector Data GDB for Hawaii.

Export existing Vector_xxx_7_5_Min.gdb schema

1. In ArcCatalog, right click on the Vector_xxx_7_5_Min.gdb >> Export >> XML Workspace Document
2. In the Export XML Workspace window: Select only the schema to export and give the output xml a name. Click Next and make sure you Select all features to included in the export

Export XML Workspace Document

×

This wizard lets you export data from this geodatabase to an XML workspace document file.

Exporting data from: C:\Temp\USGS_TNM2017\Quads_by_Island\OAHU_Quads\VECTOR_34545_Pearl_Harbor_7_5_Min.gdb

What do you want to export:

☐ Data

☒ Schema Only

How do you want the geometry to be represented in the XML document:

☒ Binary (smaller)

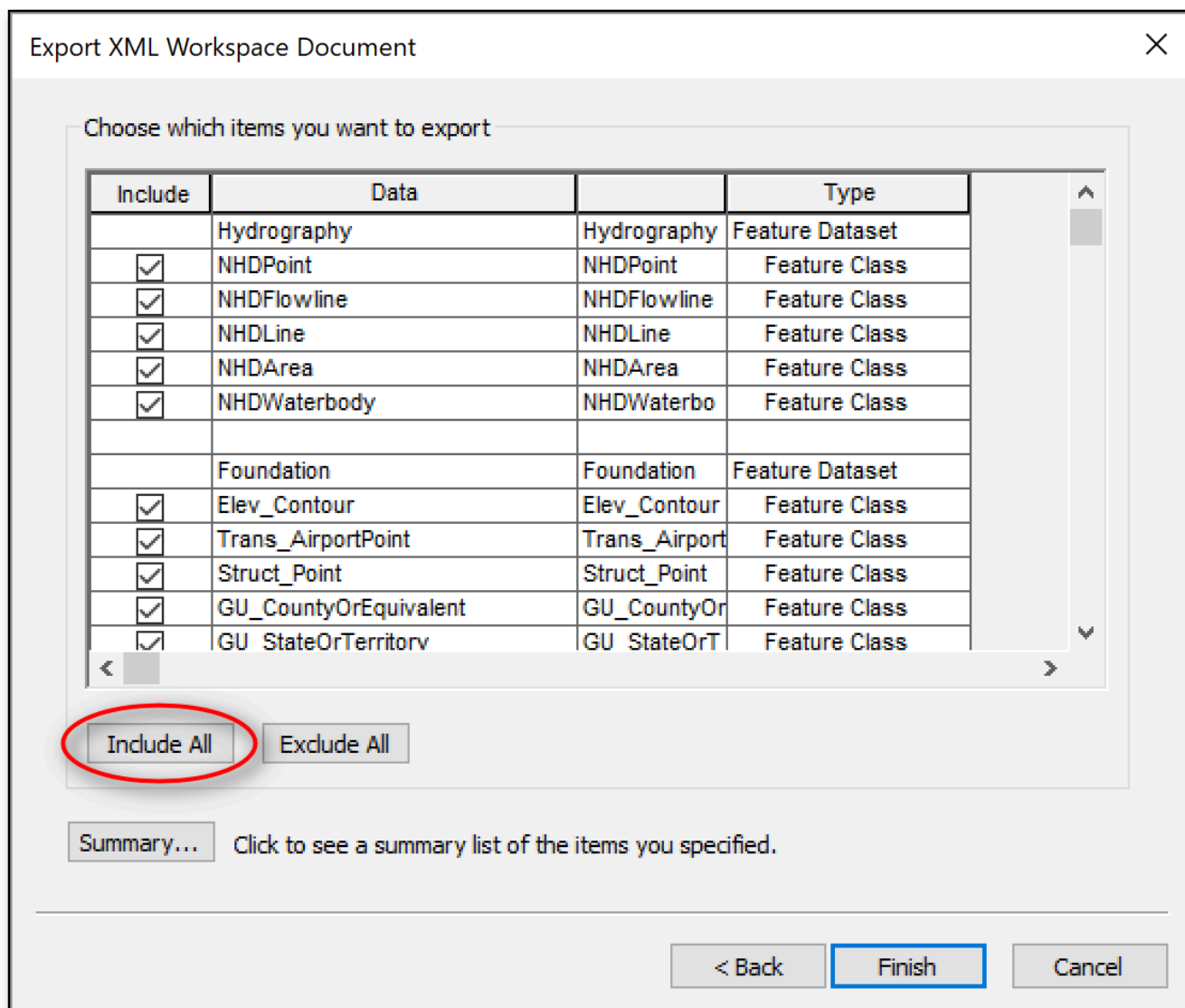
☐ Normalized (larger)

Specify the output XML file:

C:\Temp\USGS_TNM2017\StateTNM\TopoVectorGDB.xml 

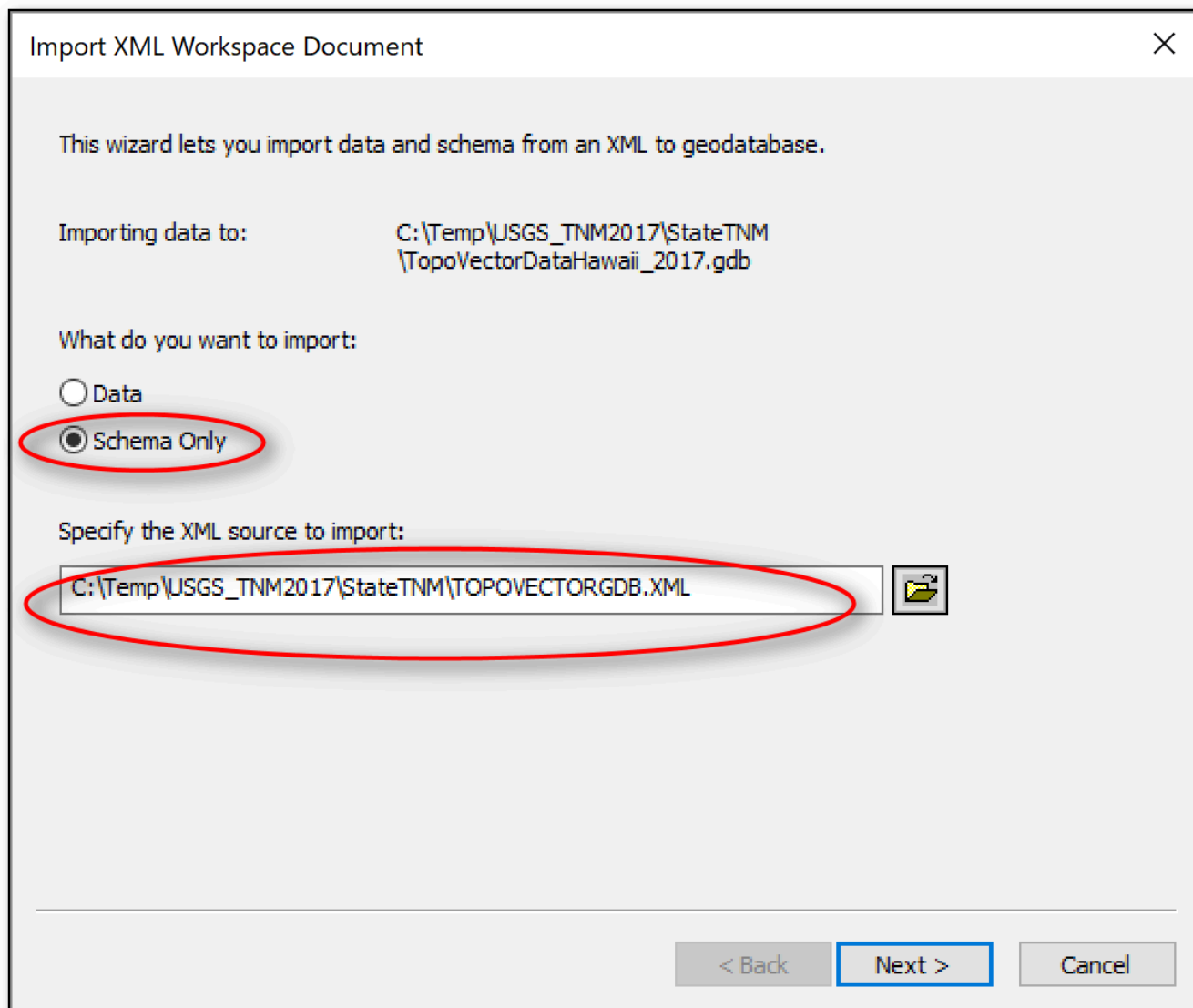
☒ Export Metadata

< Back Next > Cancel



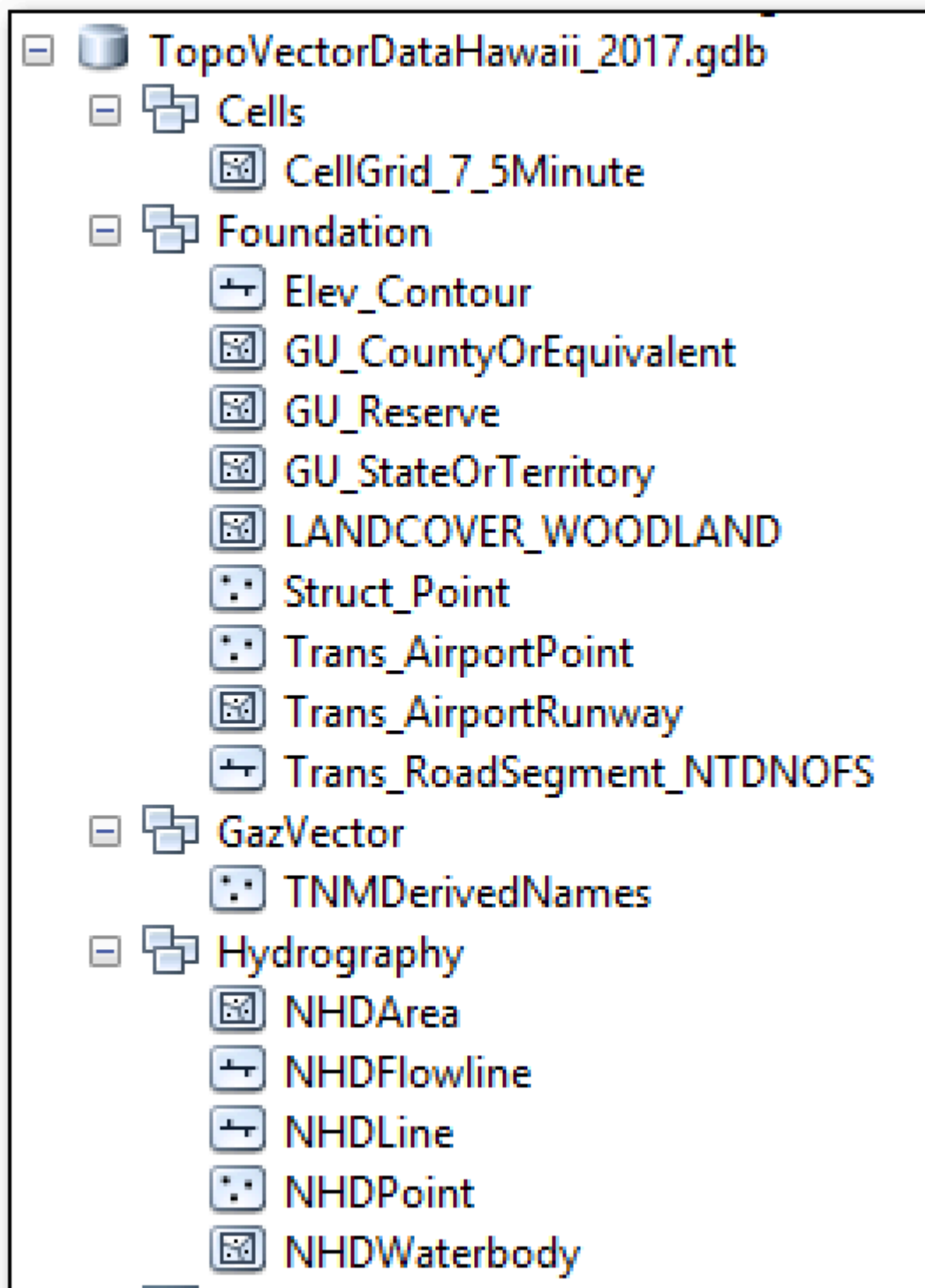
Create a new file geodatabase with existing schema

1. In ArcCatalog, create a new file geodatabase then import the existing XML schema your exported previously (Right click on file GDB >> Import >> XML Workspace Document)
2. In the Import XML Workspaced Document, select to import only the schema



Step 3: Load Data into the New Statewide GDB

1. You should now have an empty file GDB with the proper schema to load data into.



2. In ArcCatalog start loading the corresponding statewide data into the correct feature classes. For example, here I'm going to load the features from my `MAPINDICES_Hawaii_State_GDB.gdb\Cells\CellGrid_7_5Minute` layer into the corresponding `TopoVectorDataHawaii_2017.gdb\CELLS\CellGrid_7_5Minute` layer. Right click on the feature class for which

you want to load features into >> Load >> Load Data. In the Simple Data Loader window: input your parameters.

The image shows a 'Simple Data Loader' dialog box with the following elements and annotations:

- 1**: A red circle with the number 1 is placed next to the 'Input data' label.
- 2**: A red circle with the number 2 is placed next to the 'Add' button.
- 3**: A red circle with the number 3 is placed next to the 'Next >' button.

The dialog box contains the following text and controls:

Simple Data Loader

Enter the source data that you will be loading from. Click Add to add it to the list of source data to be loaded. You can load from multiple data sets in the same operation if they share the same schema.

Input data

M:\MAPINDICES_Hawaii_State_GDB.gdb\Cells\CellGrid_7_5Minute

List of source data to load

Buttons: Add, Remove, < Back, Next >, Cancel

Simple Data Loader

×

Select the target geodatabase and feature class that you will be loading the source data into.

Choose an existing geodatabase:

C:\Temp\USGS_TNM2017\StateTNM\TopoVectorDataHawaii_2



Select the target feature class:

CellGrid_7_5Minute

▼

☒ I do not want to load all features into a subtype.

☐ I want to load all features into a subtype.

Select the target subtype.

▼

< Back

Next >

Cancel

Simple Data Loader



For each target field, select the source field that should be loaded into it.

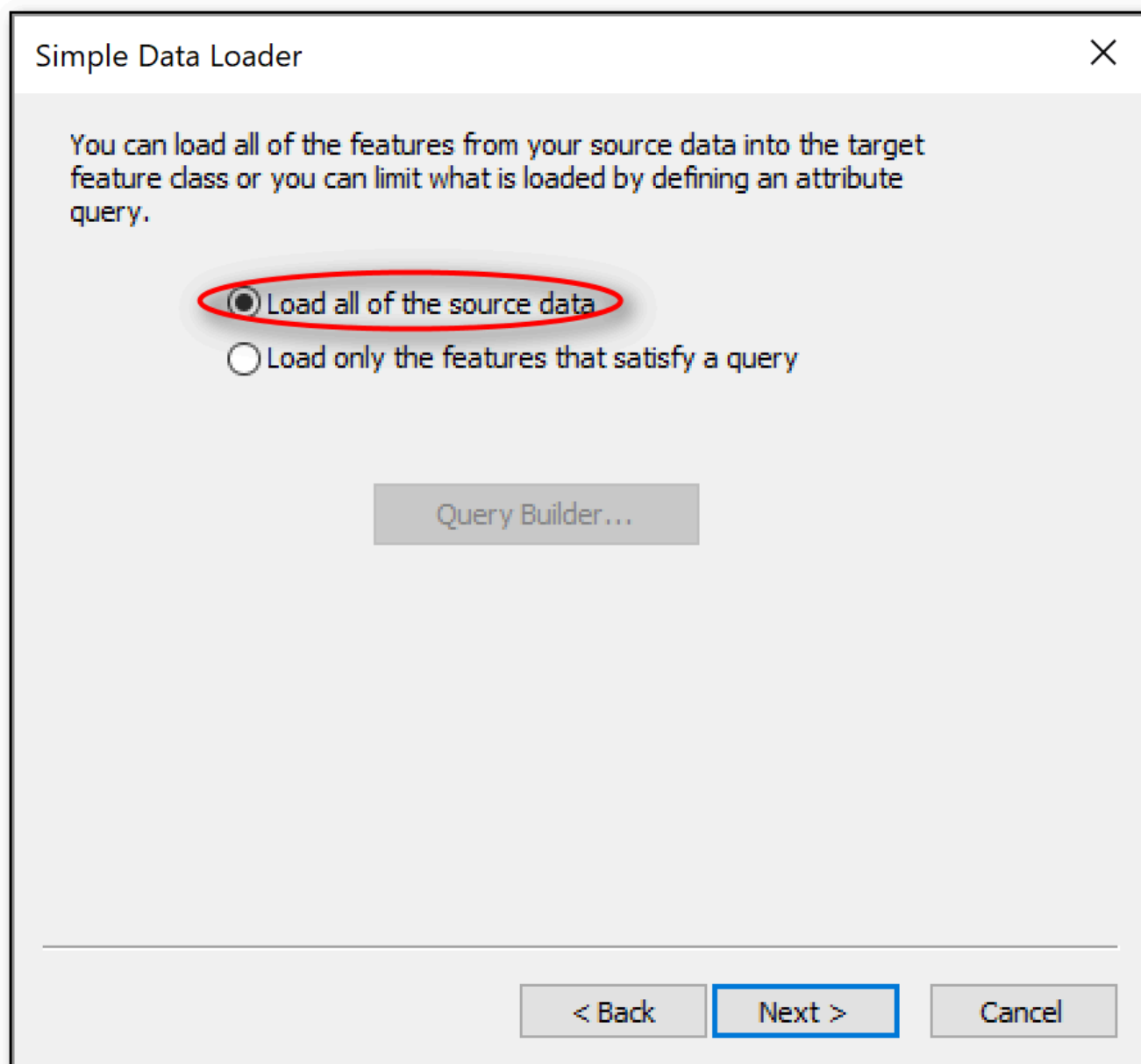
Target Field	Matching Source Field
CELL_ID [int]	CELL_ID [int]
CELL_NAME [string]	CELL_NAME [string]
PRIMARY_STATE [string]	PRIMARY_STATE [string]
STATE_ALPHA [string]	STATE_ALPHA [string]
SEQ_GOVTUNITS [string]	SEQ_GOVTUNITS [string]
CELL_MAPCODE [string]	CELL_MAPCODE [string]
CELL_TYPE [int]	CELL_TYPE [int]
CELL_ALLWATER [int]	CELL_ALLWATER [int]
CELL_DESCRIPTION [string]	CELL_DESCRIPTION [string]
CELL_DIACRITIC [string]	CELL_DIACRITIC [string]

Data Types of the Target and Matching Source Fields must be the same (otherwise will not work)

< Back

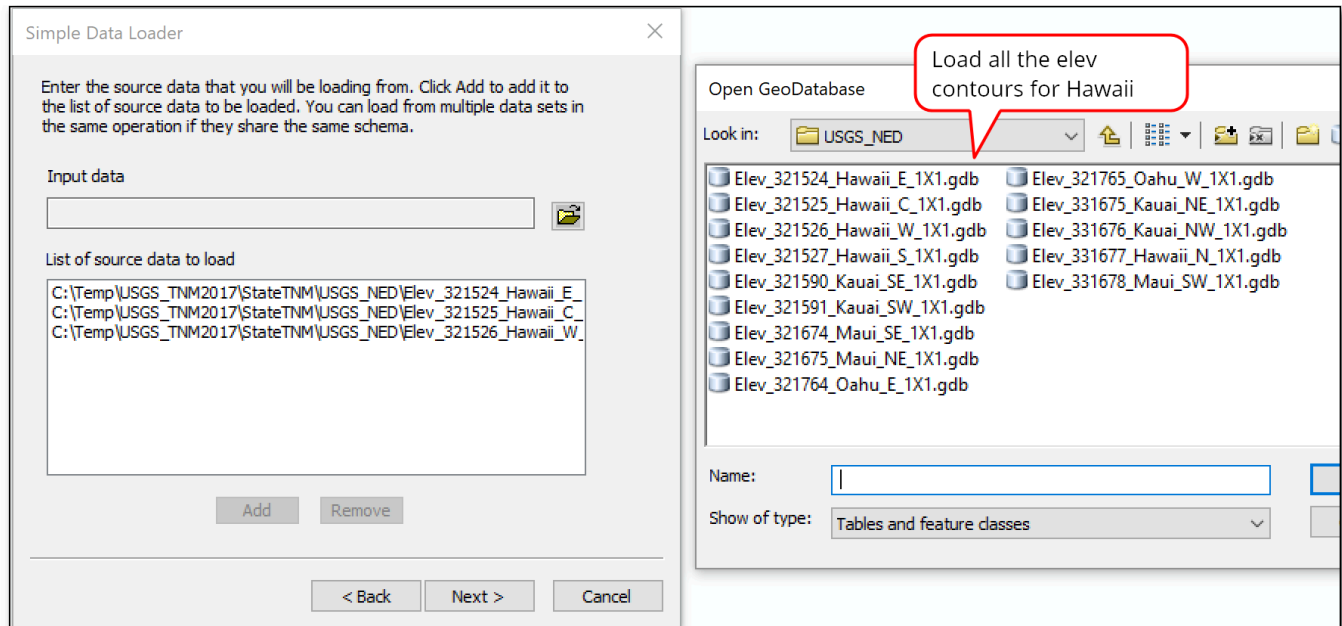
Next >

Cancel



3. Use the Simple Loader method to load features into all the corresponding feature classes - exceptions below. You can load features from multiple layers -- see example below for elev_contours.

Note: For Transportation Road features the Target Fields and Matching Source Fields will not all match (some Source Fields will be blank or None) - this should be ok since the fields for display (TNMFRC) and label (FULL_STREET_NAME) match. Also the TNMDerivedNames feature class does not have a statewide equivalent (explained further below) - follow Step 3A below for a work around solution.



Step 3A: Batch Selecting and Merging TNM Derived Names Points

The USGS TNM Style guide says that "TNM Derived Names is a filtered and enriched dataset intended specifically to be used for labeling named features. TNM Derived Names data are provided only in conjunction with Topo Map Vector Data products." So there are no national or statewide data for TNMDerivedNames layer - you'll have to merged all the points from each of the Vector Quad GDB. Note that you can't just merged the points together because a quad can contain points for other adjacent quads as well so you'll end up having duplicates if you don't filter them first. What you'll need to do is select only the points in the quad of interest then do the merge so the resulting layer won't contain duplicates (see example image below:

Only points with cell id 76070 should be selected/kept

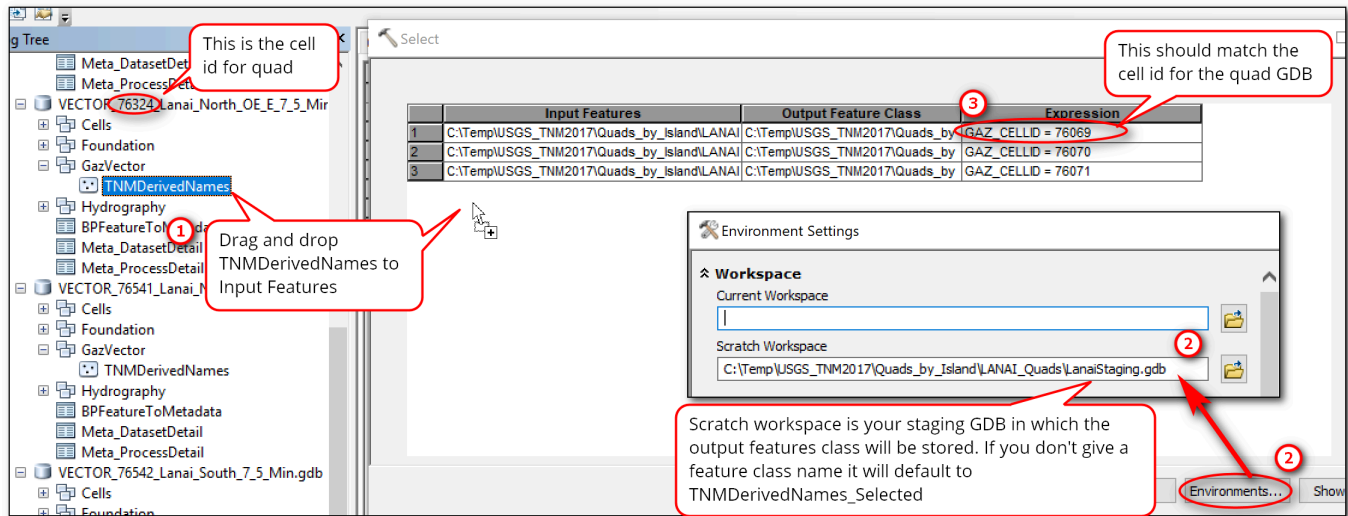
These points should not be in this layer (which is 76070)

GAZ_FEATURECLAS	GAZ_CELLID	FEATURE_CODE
Channel	76051	20700
Cape	76070	15018
Reservoir	76070	43600
Beach	76070	
Cape	76070	
Beach	76070	
Cape	76070	
Beach	76070	
Valley	76070	
Valley	76070	
Valley	76070	
Cape	76070	
Populated Place	76070	61500
Valley	76070	15050
Island	76541	15032
Civil	76542	99902
Civil	76542	99902

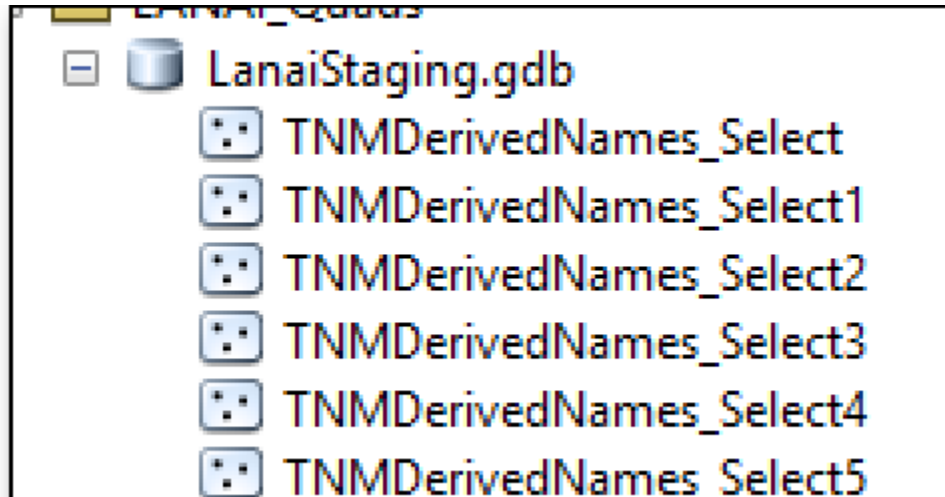
Batch Selecting TNM Derived Names Points of Interest

The example shown here is batch selecting features for all 6 quads for Lanai.

1. Create a new file GDB for the data staging (e.g. LanaiStaging.gdb)
2. In ArcToolbox, go to Analysis Tools >> Extract >> Right click on Select >> Batch
3. In the Batch Select grid: (there are 6 quad cells so there should be 6 output feature classes)
 - Input Features: TNMDerivedNames layer from each quad
 - Setup your Environment settings to use your staging GDB as the Scratch Workspace (e.g. LanaiStaging.gdb)
 - Output Feature Class: Use the default or input a name



Here is an example for the LanaiStaging.gdb



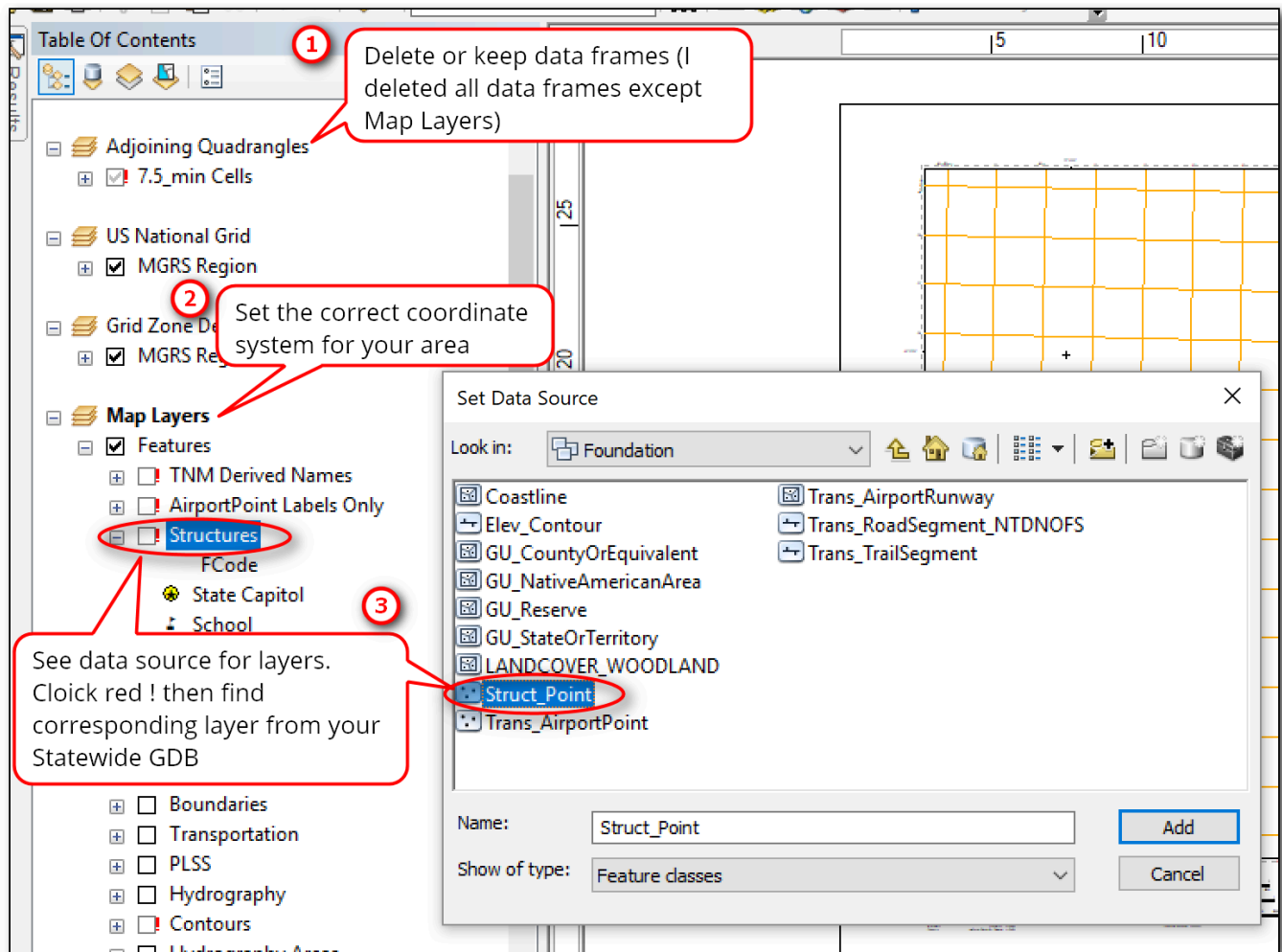
Merging or Loading the TNMDerivedNames Output Feature Classes

After you are done with the batch feature selections, use the Simple Data Loader (right click on the target layer >> Load >> Load Data) to load in the features from your staging GDB into the TNMDerivedNames feature class. Alternatively you could also use the Merge Tool in ArcCatalog.

Once you are done with the merging or feature loading, you can then link the data sources in the TNM Style Template MXD.

Step 4: Linking Data Sources to TNM Style Template

1. Open the TNM Style Template map document (e.g. TopoTNMStyleTemplate_v10_0.mxd)
2. Modify the map document to fit your needs:
 - Delete data frames that you don't need - I only kept the Map Layers and Images Data Frames
 - Change the coordinate system of the Map Layers Data Frame
 - Set the Data Source links for layers with missing data links. Note PLSS does not exist for Hawaii.
 - Save a copy of the map document



3. "Layers" under the Images Data Frame are web services. **Note that the WetlandsTopoService needs fixing (existing URL to service is doesn't work).**

- In a web browser, go to <https://viewer.nationalmap.gov/services/> and scroll down to Themed Overlays >> FWS Wetlands - Topo Symbols >> Click on REST - this should open a new page to the REST service - copy this URL up to "...services/"



- In ArcCatalog, add this web service. Go to GIS Servers >> Add ArcGIS Server. In the Add GIS Server window: select use GIS server >> Next. Then Paste the Server URL you copied and click Finish

You should now have the FWS Wetlands Topo Services added to your GIS server in ArcCatalog - see below.

4. Back in the ArcMap document, what you have to do is remove the existing WetlandsTopoService then add it back in using the new FWS GIS Server. **Note: Setting the data source/link to the existing WetlandsTopoService didn't seem to work for me - not sure why** (I'm using ArcGIS Desktop 10.5.1).

5. Modify your map document and map layout to fit your needs. That's it.

Example showing a "seamless" TNM Style map -- very similar to the USGS topo quad maps

Another example showing a more close up view with no modifications of labels or symbology - note since this is all vector data (with exception of web services) everything looks sharp and can be modified as needed.

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