What's in a name?

Unique Asset Identification using USNG Coordinates

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INTRO

Unique Asset Identification

- Unique identifier (“name”) required for various systems such as GIS, CMMS, WOMS, or hydraulic models
- For this discussion, “asset” = fixed, field-based asset such as hydrants & valves

Challenge

- Update water asset identifiers to be meaningful/logical unique names
- The MVWA has 22 feature classes in its water network geodatabase
  - Lines (3)
  - Facilities (11)
  - Features (8)

MVWA WaterNet Feature Classes

- **Lines**
  - **Pipes used in the transmission and distribution of water**
  - **Line Feature Classes**
    - **MainLine**
    - **ServiceLine**
    - **VirtualLink**

MVWA WaterNet Feature Classes

- **Facilities**
  - **Water network point facilities and junctions**
  - **Facility Feature Classes**
    - **Hydrant**
    - **Storage**
    - **MainLineValve**
    - **ServiceLineValve**
    - **SystemControlValve**
    - **PressureRegulatingValve**
    - **SystemMeter**
    - **Pump**
    - **CurbBox**
    - **SamplingStation**
    - **Fitting**

MVWA WaterNet Feature Classes

- **Features**
  - Spatial features that support the water network but do not transmit or control the flow of water
  - Feature Feature Classes
    - Casing
    - AboveGroundFacility
    - UnderGroundFacility
    - Equipment
    - SCADAsensor
    - ServiceZone
    - MapScan
    - RedLine

Field-based assets

ASSET NAMING OPTIONS

Identifier/Name Characteristics

- Required
  - Unique
- Desired
  - Meaningful
  - Hierarchical
  - Parsable
  - Same character length

Asset Naming Schemes

- Numbering
  - Random
  - Sequential
- Hierarchical
  - Ex. site, building, asset type, asset number
- Spatial / Geographical
  - Grid-based
  - Coordinate-based
- Hybrid
  - Combination of schemes

Hydrant Naming Thoughts

- Deserve a meaningful name, sure they're not as big as a building, but they're above ground J
- Need to communicate hydrant status information internally & with many fire departments and DPWs
- Experimented with various naming schemes
  - Including using an abbreviation for muni & street with nearest address number

Final Selection

- Street/address-based worked ok for hydrants, but wasn't ideal
- Heard a presentation about Hurricane Katrina response and started to explore using the USNG
- Using the USNG was a solid, logical choice…

United States National Grid

USNG

What is the USNG?

- Seamless, standardized alphanumeric point referencing system
- Universal coordinate system derived from UTM
- MGRS equivalent (NATO)
- Developed by FGDC
- Preferred grid for NSDI applications

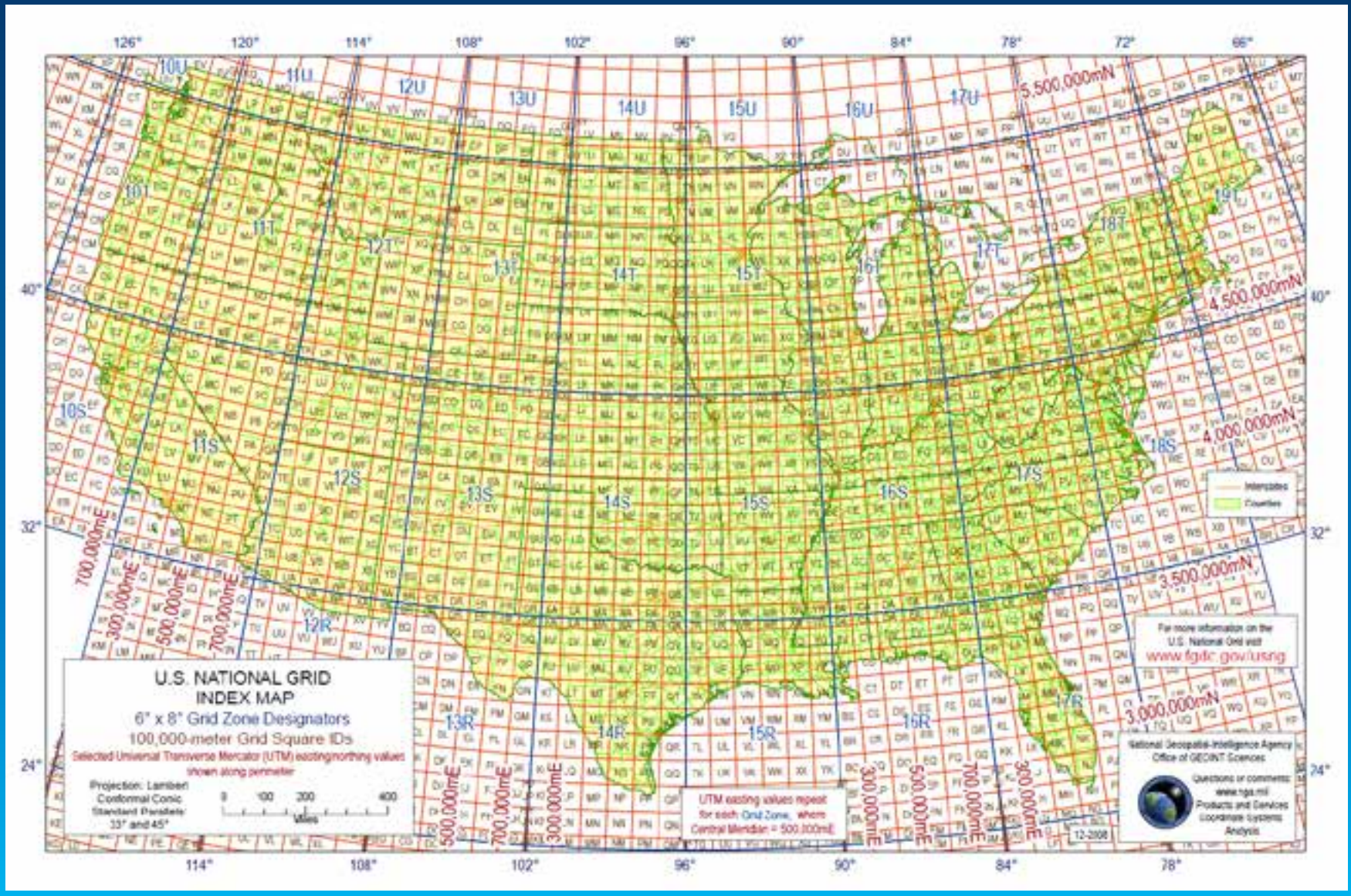
Why use the USNG?

- Single alphanumeric string
- Navigable
- Universal
- Hurricane Katrina
  - Talbot Brooks

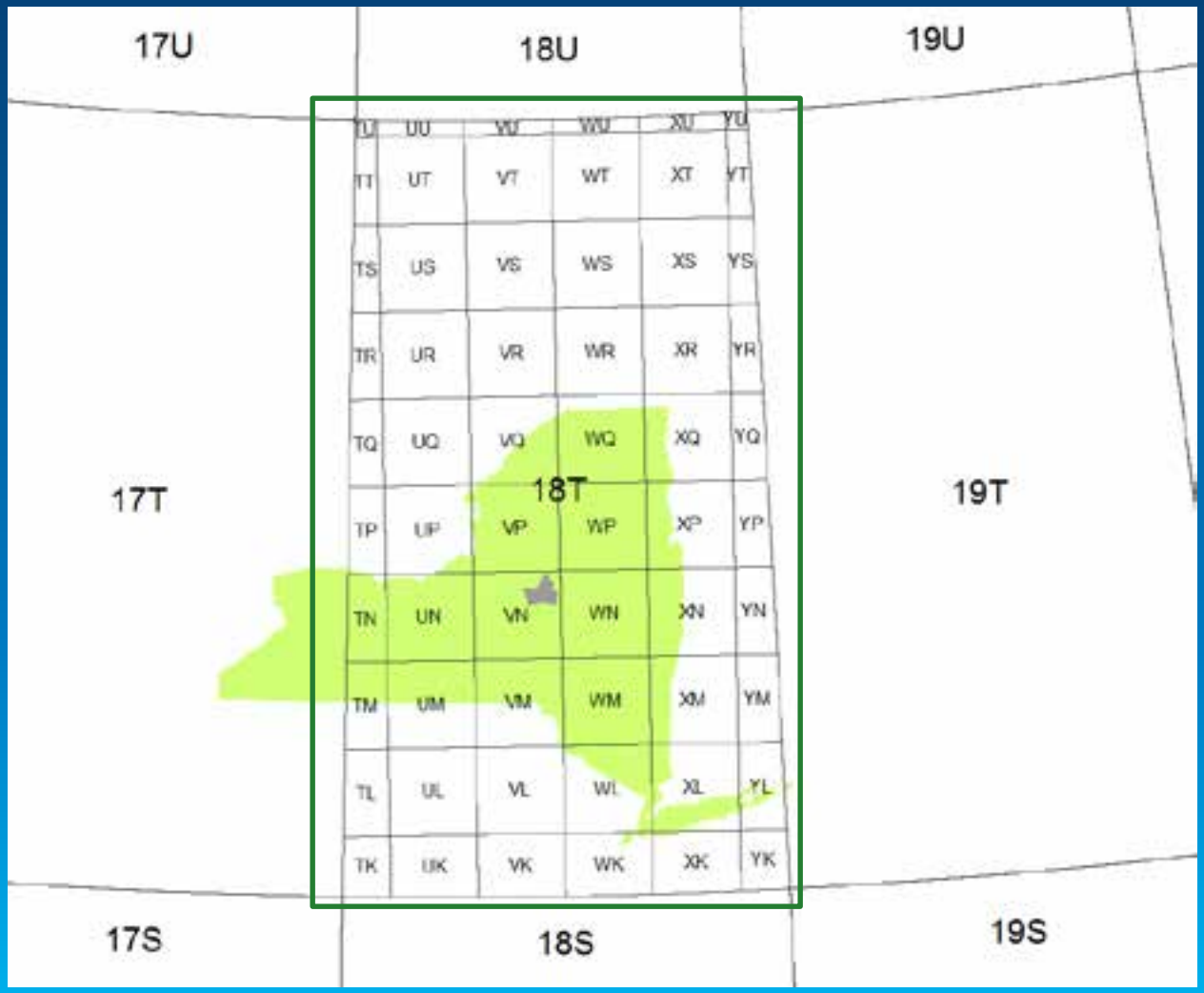
Levels of USNG

- **GZD – Grid Zone Designation**
  - The US is divided into 6-degree longitudinal zones designated by a number, and 8-degree latitudinal bands designated by a letter
- **100,000 Meter Square Identification**
  - Each GZD is gridded with 100,000 meter squares with a GZD-unique 2-letter designation
- **Grid Coordinates**
  - Point positions within the 100,000m square are given UTM grid coordinates (easting then northing)
  - An equal number of digits is used for each position
  - The number of digits is determined by the desired precision

USNG Index Map



GZD 18T


17U
18U
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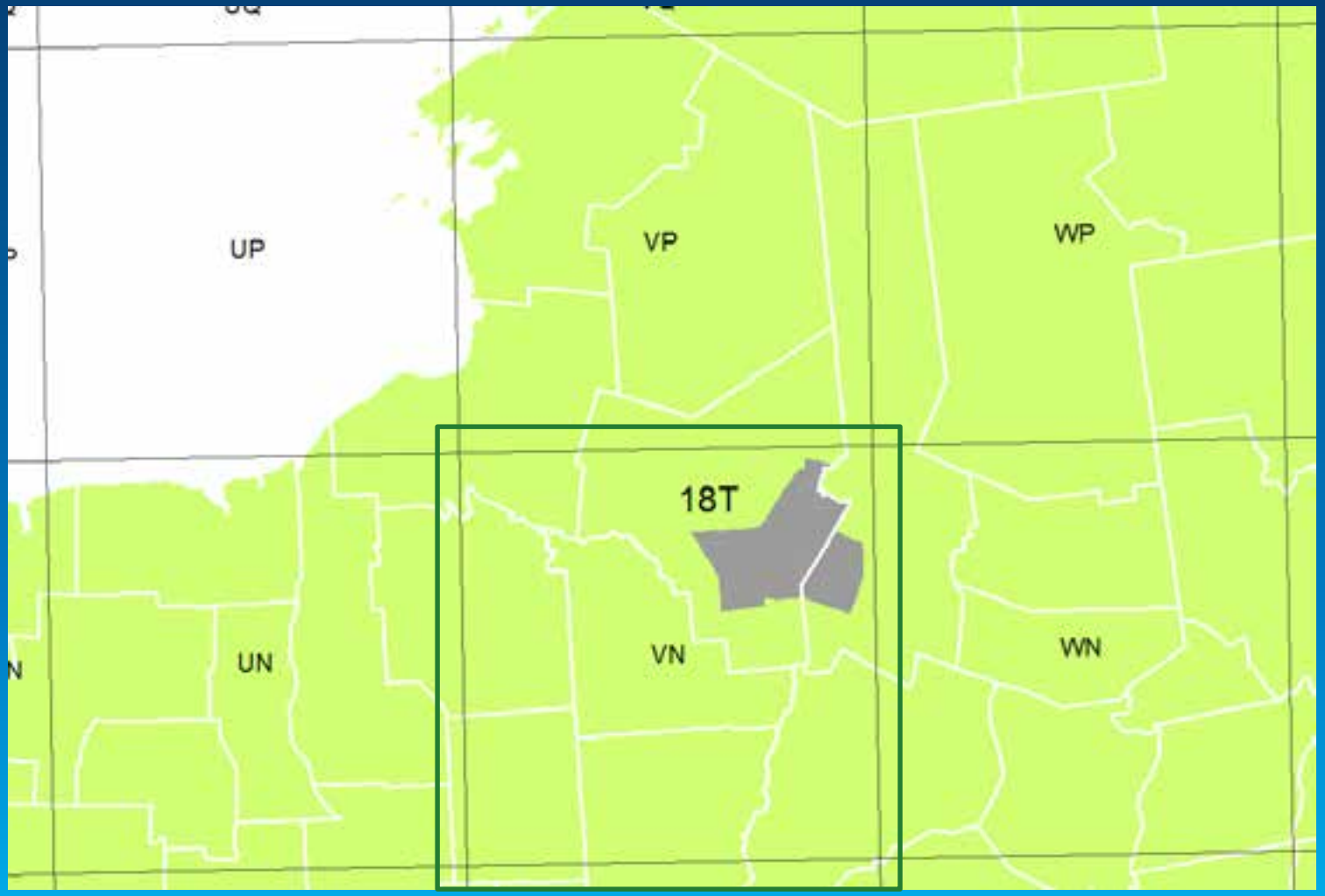
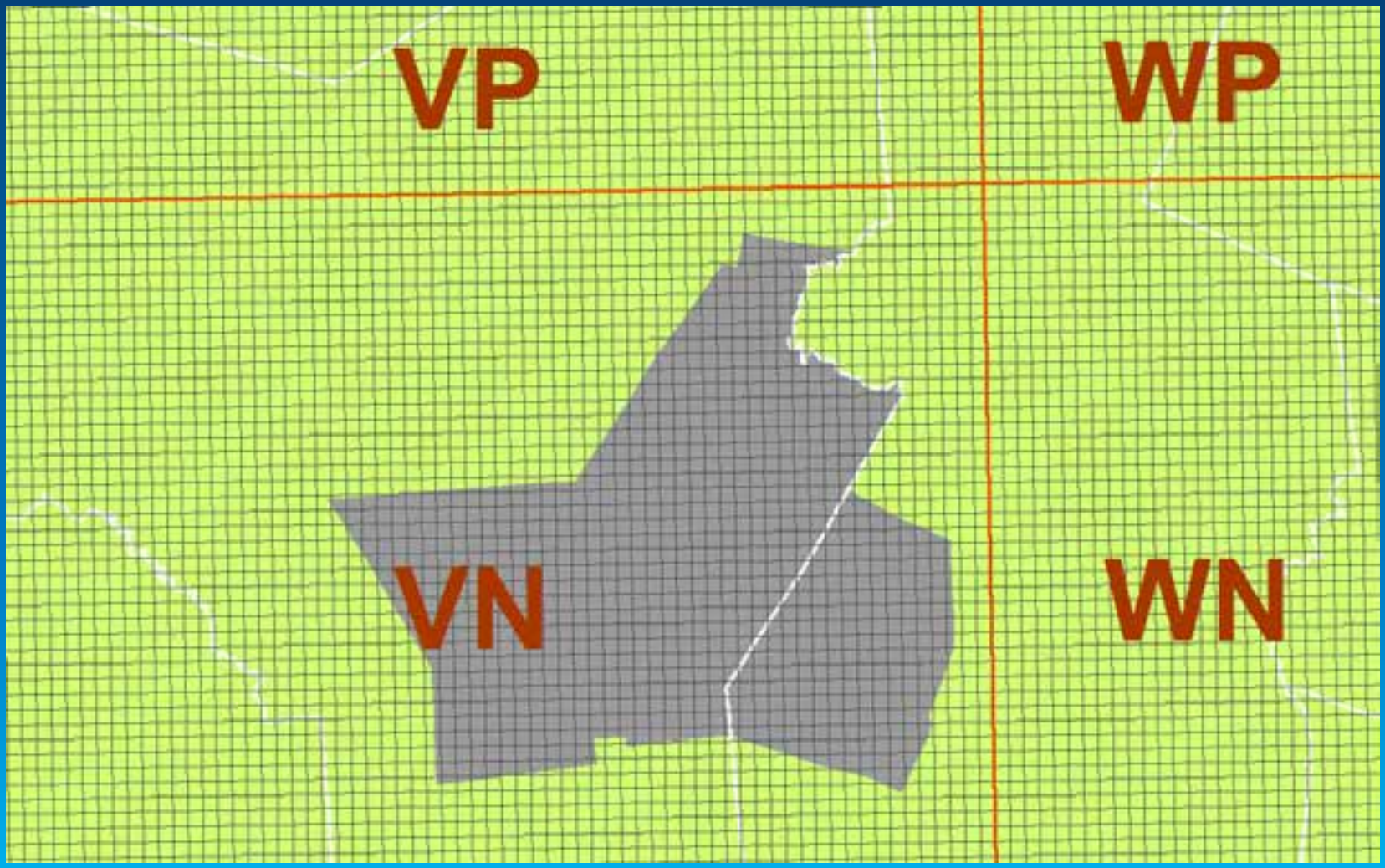
TU UU VU WU XU YU
TT UT VT WT XT YT
TS US VS WS XS YS
TR UR VR WR XR YR
TQ UQ VQ WQ XQ YQ
TP UP VP WP XP YP
TN UN VN WN XN YN
TM UM VM WM XM YM
TL UL VL WL XL YL
TK UK VK WK XK YK

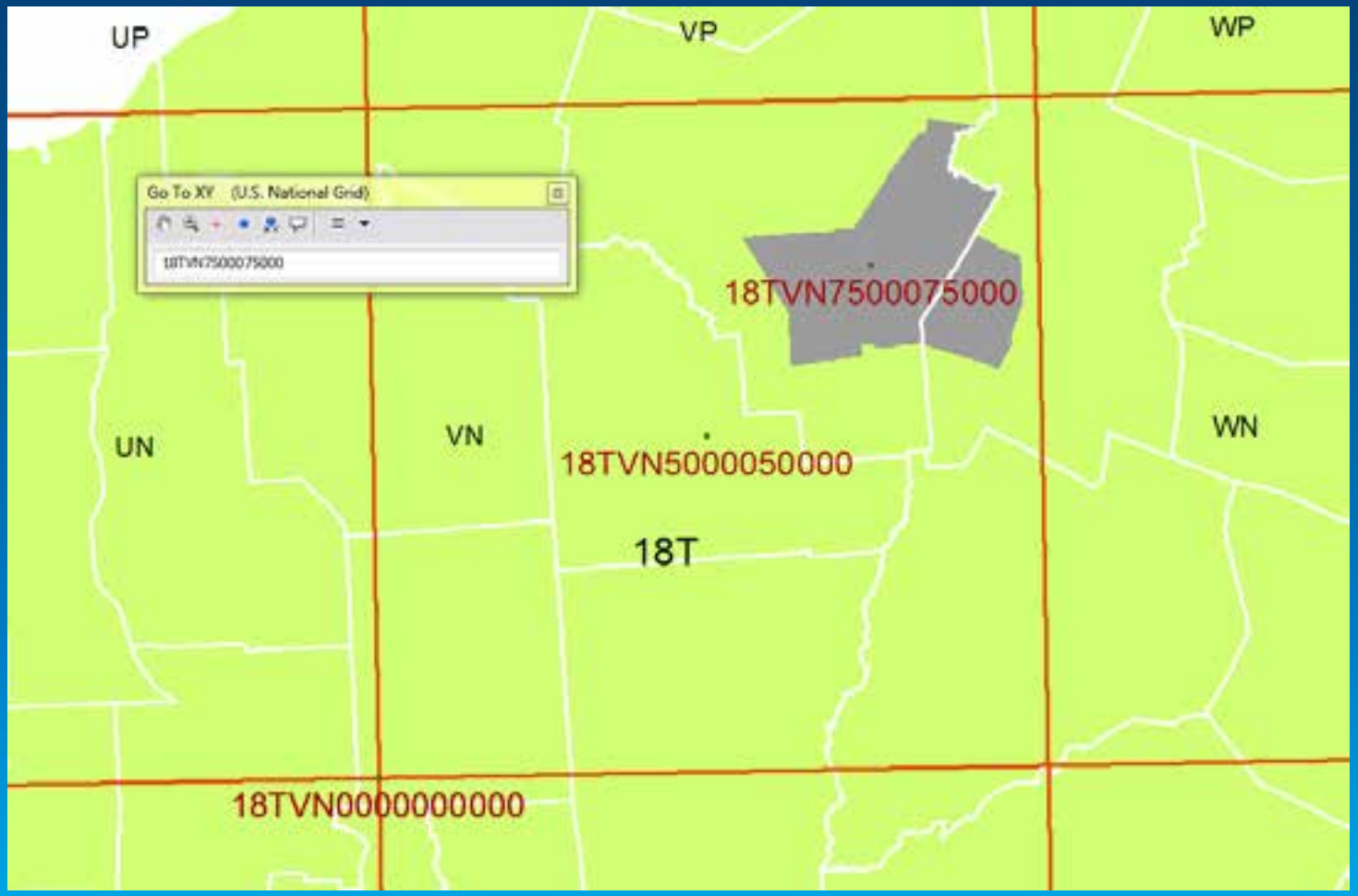
100,000 Meter Square VN



1 km Grid within VN

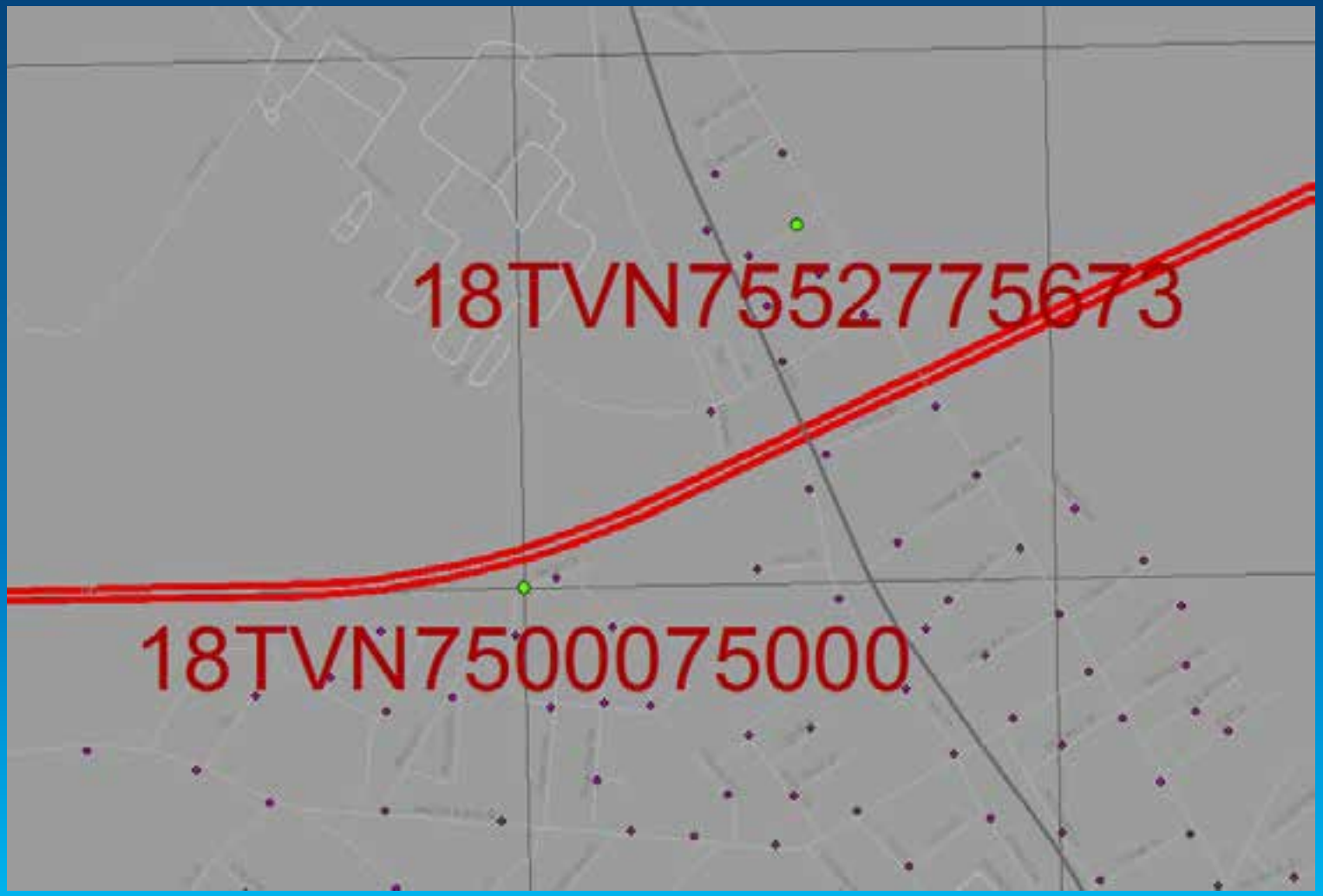


ArcMAP Go To XY Tool



1 km USNG Coord = 18TVN7575

1m USNG Coord over Hydrant



Planning

USNG ASSET NAMING

Using USNG for Asset Naming

- Opportunities
  - Since service area is within same 100km grid, MVWA could truncate first 5 digits of USNG coordinate (18T VN)
- Challenges
  - Only good to meter level without modifications
    - Sometimes there are multiple features within a square meter
      - Added prefix
      - Explored extending USNG to the decimeter level

Original USNG Naming Plan

MVWA WaterNet Feature	USNG Level	Coord Digits	Prefix	Total Digits
Hydrant	1 m	10	H	11
Storage	10 m	8	T	9
MainLineValve	0.1 m	12	MV	14
ServiceLineValve	0.1 m	12	SV	14
SystemControlValve	0.1 m	12	CV	14
PressureRegulatingValve	0.1 m	12	PV	14
SystemMeter	0.1 m	12	SM	14
Pump	0.1 m	12	P	13
CurbBox	0.1 m	12	C	13
SamplingStation	100m	6	SS	8
Fitting	0.1 m	12	F	13

Original USNG Naming Plan

- Extended USNG to get to decimeter level
- Determined that this did not produce unique names for our features
- Also tried rounding extra digits – still no luck
- Do we shift coordinates so names are unique?
- Do we extend the USNG in some other way?

Revised USNG Naming Plan

- Decided that it was ok that multiple features could occupy a square meter
- Checked USNG coordinate for uniqueness & added suffix
  - “-0” if unique
  - “-1”, “-2”, etc. if not unique
- Separated coordinates with a “-” for legibility

Revised USNG Naming Plan

- Examples
  - MV-33452-14903-1
  - H-167-028-0
- Benefits
  - Could “shorten” asset names
    - H6809208332 became H-680-083-0
  - Asset names are easier to communicate

Revised USNG Naming Plan

MVWA WaterNet Feature	USNG Level	Coord Digits	Prefix	Total Digits
Hydrant	100 m	6	H	11
Storage	1000 m	4	T	9
MainLineValve	1 m	10	MV	16
ServiceLineValve	10 m	8	SV	14
SystemControlValve	10 m	8	CV	14
PressureRegulatingValve	10 m	8	PV	14
SystemMeter	100 m	6	SM	12
Pump	1 m	10	P	15
CurbBox	1 m	10	C	15
SamplingStation	1000 m	4	SS	10
Fitting	1 m	10	F	15

Implementation

USNG ASSET NAMING

USNG Naming Process

- Data needs to be in UTM, NAD-83 to create USNG asset names
- Create asset ID field = String, 20

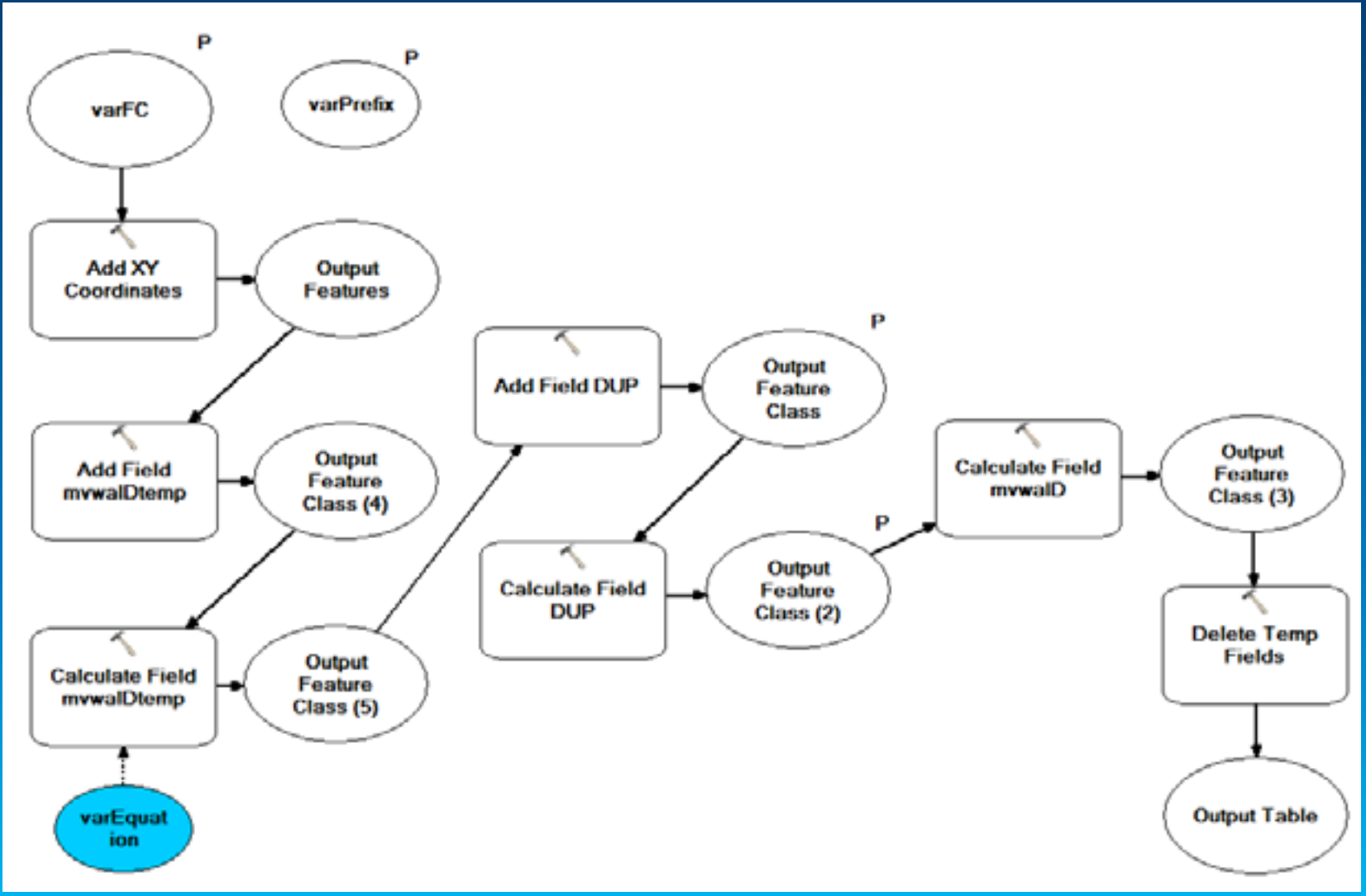
USNG Naming with Lines & Polygons

- **Since USNG is a Point-based referencing system, points are needed…**
  - **For Line Features – Find midpoint (use Feature to Point (inside option) to create temp point fc)**
  - **For Polygon Features – Find centroid (use Feature to Point (inside option) to create temp point fc)**
- **Important that line and polygon feature classes have a unique temp ID before running Feature to Point so that USNG IDs can be joined to original feature**

USNG Naming Process

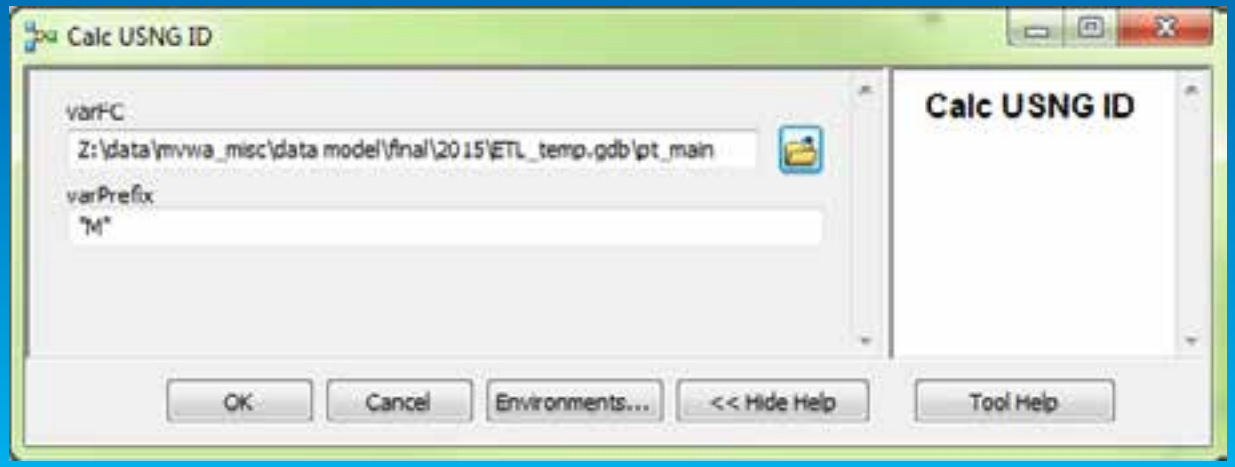
- Add XY Coordinates (creating POINT_X & POINT_Y fields)
- Use POINT_X & POINT_Y to create USNG coordinate (in tempID field)
- Check for duplicates & create duplicate field
- Create final asset name using prefix, USNG coordinate, & duplicate suffix
- Clean up temp fields

Model Builder Diagram

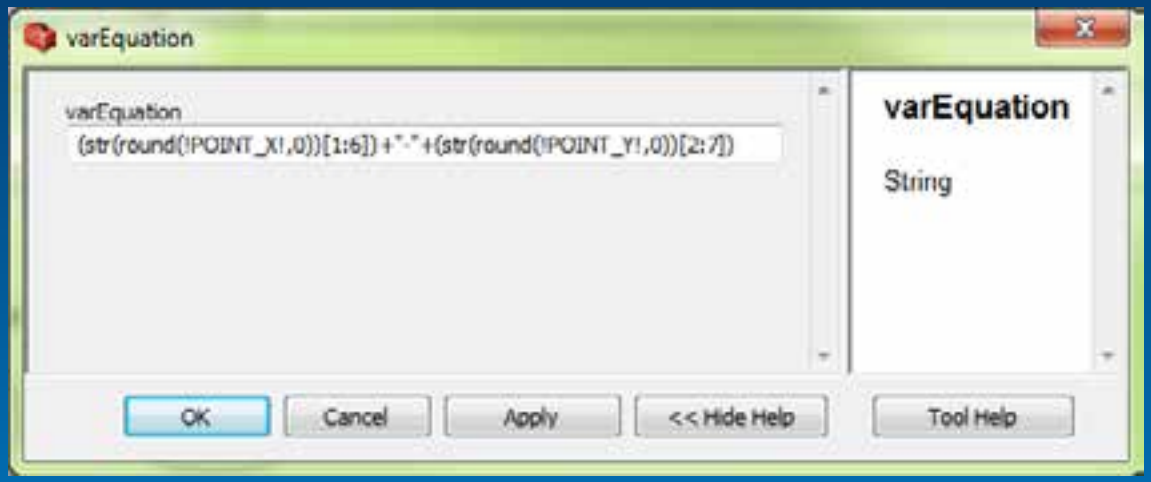


Run Model


Calc USNG ID
varFC
varPrefix
Calc USNG ID
OK
Cancel
Environments...
<< Hide Help
Tool Help


Calc USNG ID
varFC
Z:\data\mvwa_misc\data model\final\2015\ETL_temp.gdb\pt_main
varPrefix
"M"
Calc USNG ID
OK
Cancel
Environments...
<< Hide Help
Tool Help

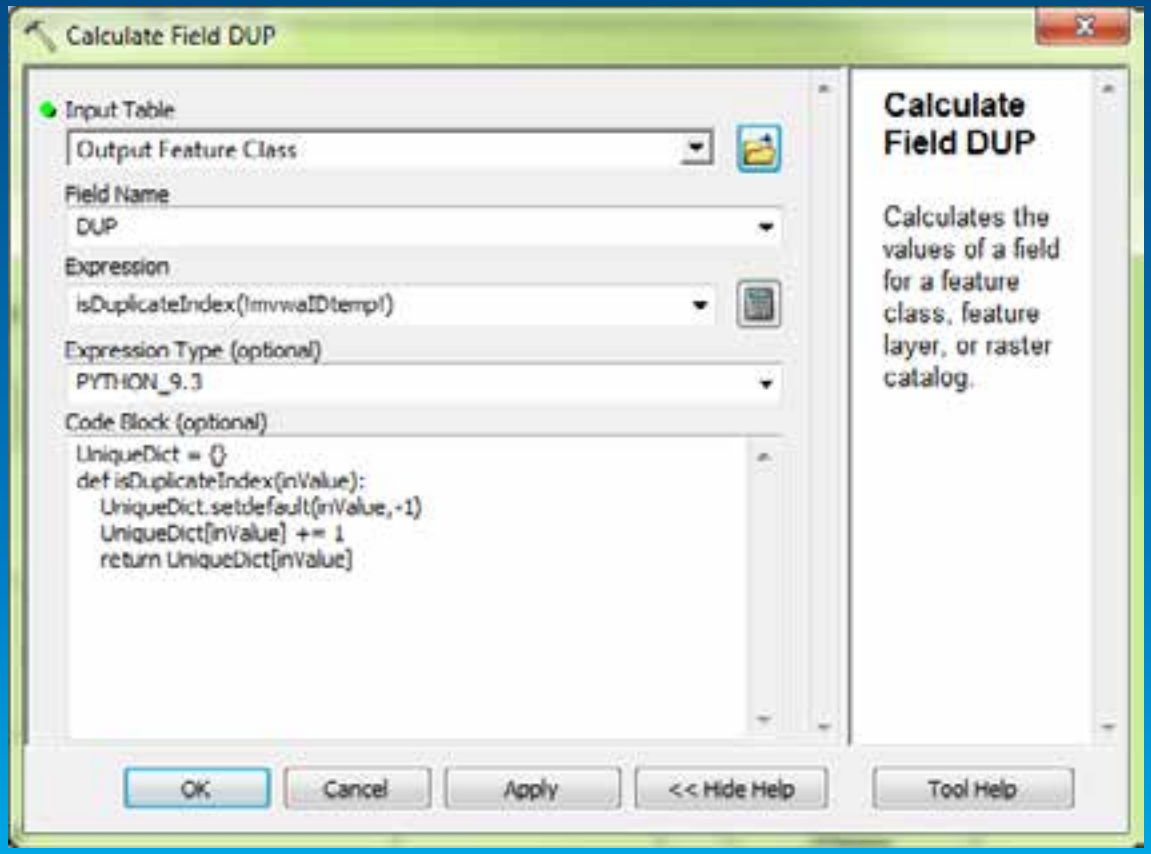
Extract USNG Coordinate



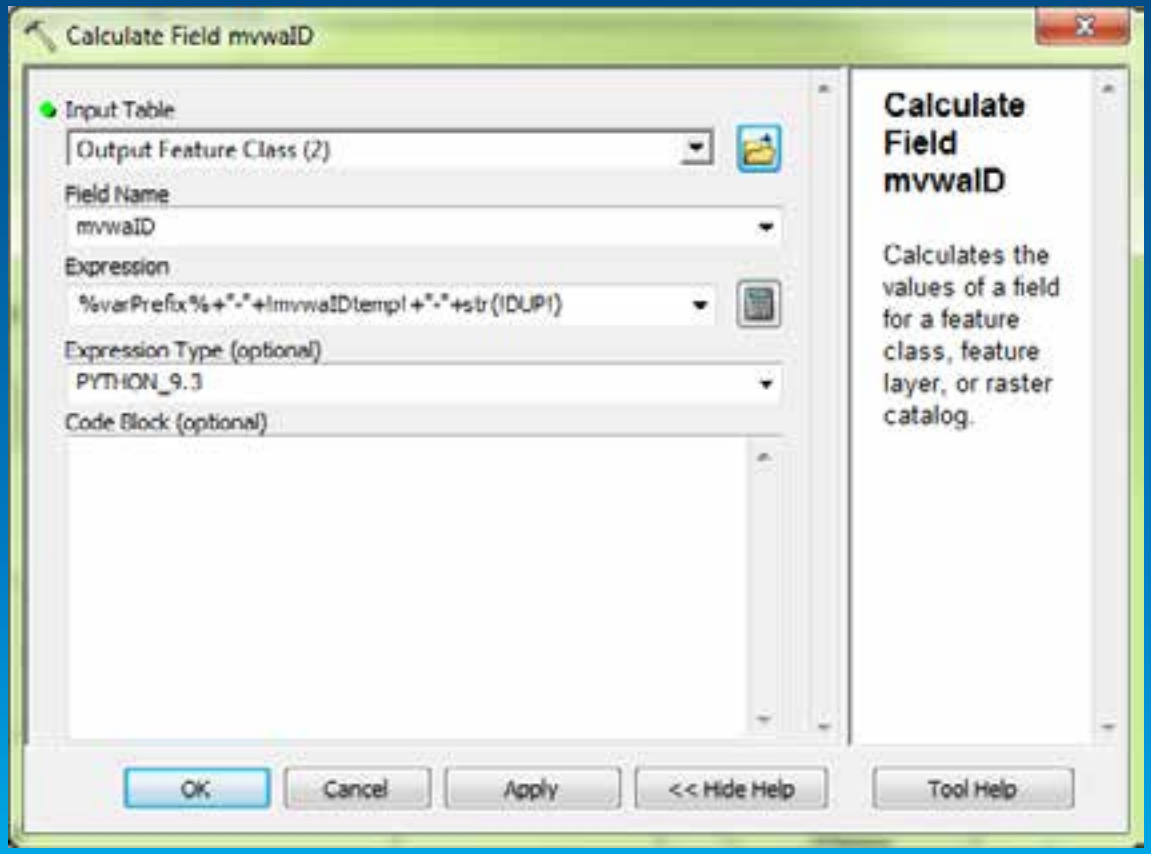
Accuracy	USNG Digits	varEquation
100 m	6	(str(round((!POINT_X!*.01),0))[1:4])+"-"+(str(round((!Point_Y!*.01),0))[2:5])
10 m	8	(str(round((!POINT_X!*.1),0))[1:5])+"-"+(str(round((!Point_Y!*.1),0))[2:6])
1 m	10	(str(round(!POINT_X!,0))[1:6])+"-"+(str(round(!Point_Y!,0))[2:7])
0.1 m	12	(str(round((!POINT_X!*10),0))[1:7])+"-"+(str(round((!Point_Y!*10),0))[2:8])

Find Duplicates

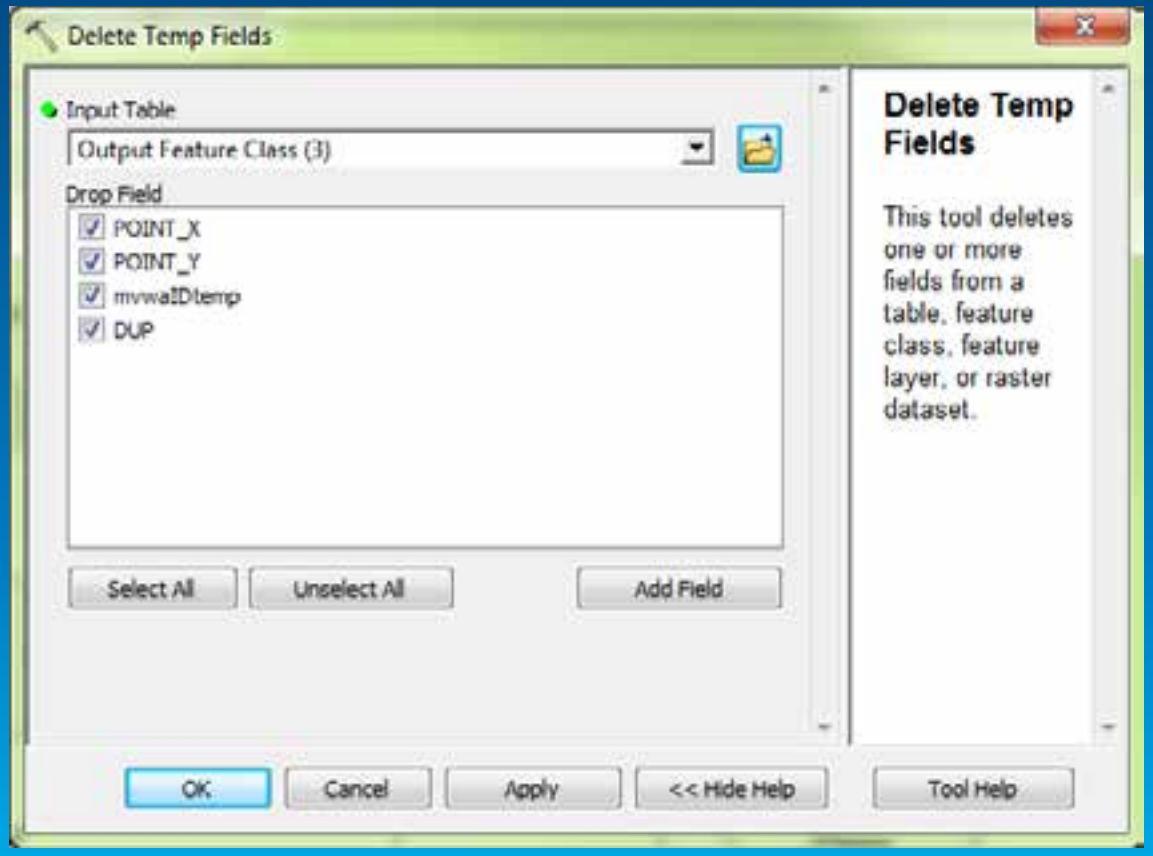
- **DUP field is type Short**



Create USNG Asset Name



Clean Up!


Delete Temp Fields
Input Table
Output Feature Class (3)
Drop Field
POINT_X
POINT_Y
mvwaIDtemp
DUP
Select All
Unselect All
Add Field
Delete Temp Fields
This tool deletes one or more fields from a table, feature class, feature layer, or raster dataset.
OK
Cancel
Apply
<< Hide Help
Tool Help

Future Enhancements

- Incorporate look-up table so that model automatically determines prefix and coordinate length based on feature class
- Incorporate into Attribute Assistant so that USNG ID is automatically generated when features are added.

Questions?

For additional questions, scripts, & updates to this USNG Asset Naming Project, please contact:

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