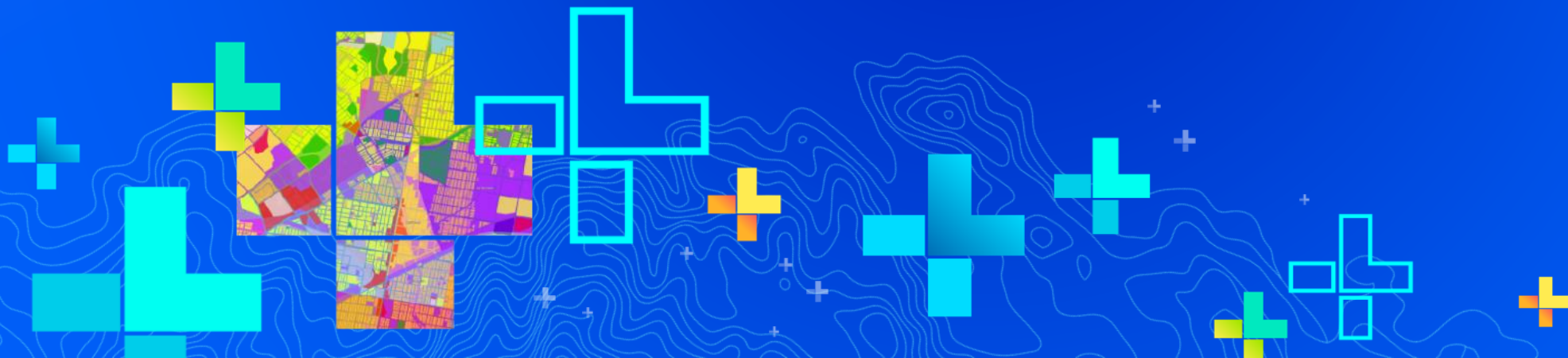




Topographic Map Production: An Introduction

Amber Bethell, John Grammer



SEE
WHAT
OTHERS
CAN'T

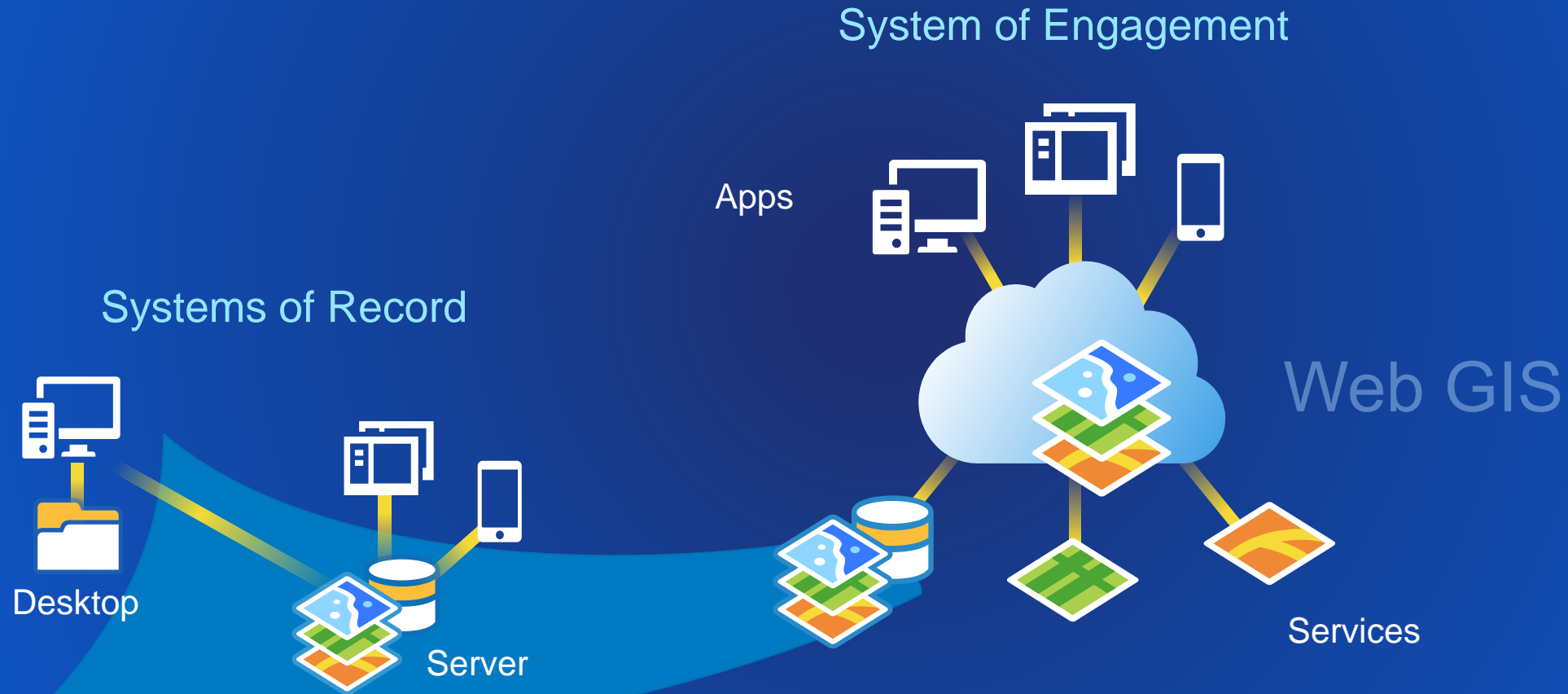
Topographic Map Production: Agenda

- Overview
- Production Management / Workflows
- Data Collection / Data Quality
- Multiscale Mapping
- Road Ahead

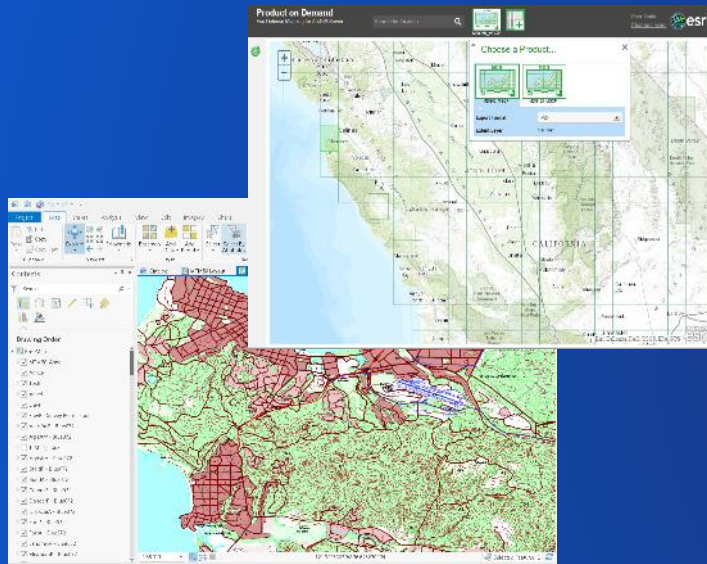


Topographic Map Production

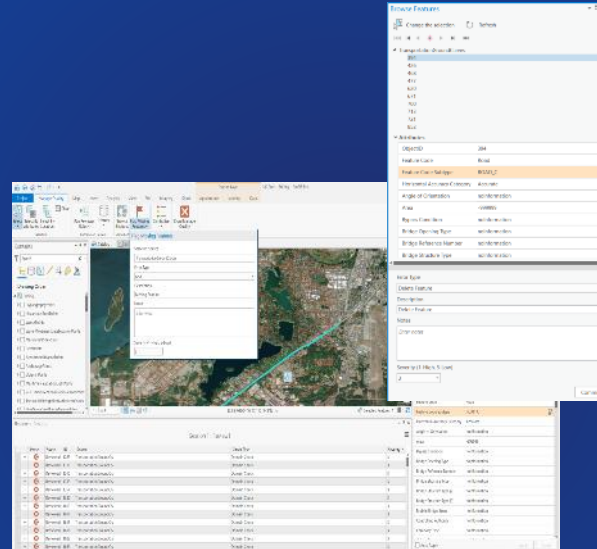
Produce, Manage, and Share Authoritative Content



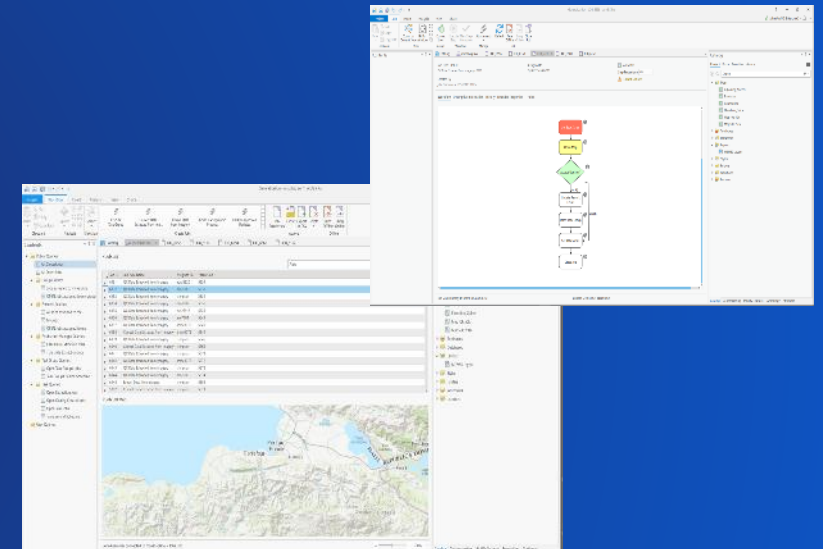
Topographic Map Production: Extensions



Production / Defense Mapping



GIS Data Reviewer



Workflow Manager

Topographic Map Production: Production Management

- Production Manager
- Workflows

Job ID	Job Type Name	Assigned To	Parent Job
6131	QC Data Extracted from Imagery	edw5825	5331
6132	QC Data Extracted from Imagery	daw2702	5333
6133	QC Data Extracted from Imagery	slmpson	5334
6134	QC Data Extracted from Imagery	daw2702	5335
6135	QC Data Extracted from Imagery	huad913	5338
6136	QC Data Extracted from Imagery	jan7184	5341
6137	QC Data Extracted from Imagery	arhb3273	5343
6138	Correct Data Extracted from Imagery	arhb3273	5344
6139	QC Data Extracted from Imagery	slmpson	5345
6140	Correct Data Extracted from Imagery	slmpson	5349
6141	QC Data Extracted from Imagery	slmpson	5371
6142	QC Data Extracted from Imagery	arhb3273	5372
6143	QC Data Extracted from Imagery	slmpson	5373
6144	QC Data Extracted from Imagery	daw2702	5374
6145	Extract Data from Imagery	slmpson	5352
5792	Correct Data Extracted from Imagery	slmpson	5371

Job Name	Assigned To	Schedule Status	Priority	Status	% Complete	Run Date	Job Type	Product Type	Scale Date	Data Store
DC_DEVMO_JOB_1801_18221448		Behind Schedule	10 (High)	Scaling Up	0	2/22/2015	MSCP Vector Data Production (7-14.paw)	(none)	(1/1/1)	MSCP
DC_DEVMO_JOB_1802_18111420		Behind Schedule	6	Scaling Up	0	2/22/2015	MSCP Vector Data Production (7-14.paw)	(none)	(1/1/1)	MSCP
DC_DEVMO_JOB_1403_18111420		Behind Schedule	4	Scaling Up	0	2/22/2015	MSCP Vector Data Production (7-14.paw)	(none)	(1/1/1)	MSCP
DC_DEVMO_JOB_4261_18111420		Plan Day	3	Scaling Up	0	2/22/2015	MSCP Vector Data Production (7-14.paw)	(none)	(1/1/1)	MSCP
DC_DEVMO_JOB_4261_18111420		Plan Day	7	Scaling Up	0	2/22/2015	MSCP Vector Data Production (7-14.paw)	(none)	(1/1/1)	MSCP

Production Manager

- Create Jobs
- Manage Jobs
 - Job status
 - Job Assignment
 - Percent Complete
- Job Details
 - Job Properties

Production Manager
East Defense Mapping for ArcGIS Server

Queries: In-House Vector Data Production Jobs

Job Status

Back to Overview

Schedule Status

AOI Transparency

Group jobs by: None

Behind Schedule
Past Due

Production Manager
for ArcGIS Pro

Queries: Open Extractions Jobs

Schedule Status

Job Assignment

Job Type

Percent Complete

Job Priority

Job Duration

Job Status

Job Properties

Save Cancel

Job Type: TDS DATA EXTRACTION

Created By: john1425

Job Owner: John Grammer

Assignment: John Grammer

Schedule Status: Behind Schedule

Job Status: Working

Percent Complete: 0

Priority: Medium

Start Date: 6/28/2019

Due Date: 12/27/2019

TDS DATA EXTRACTION

Job Description:

TDS DATA EXTRACTION

Current Step Properties

Step Name: Set Next Task

Percent Complete: 0

TOPO_PRODUCTION_PROPERTIES

Production Type Name: TDS DATA EXTRACTION

Rework Count: 0

Data Source Name: silver

Portal Item Name: TDS_DataExtraction

Portal Item URL: http://pmdemo.esri.com/portal/

TOPO_TASK_GROUP_PROPERTIES

Task Group ID: 5

Notes

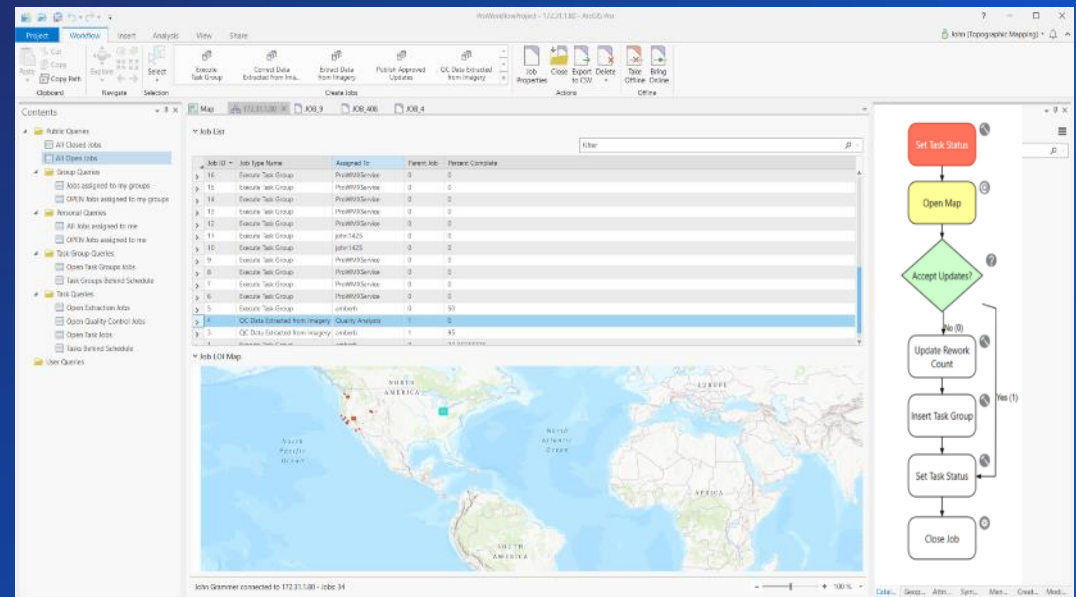
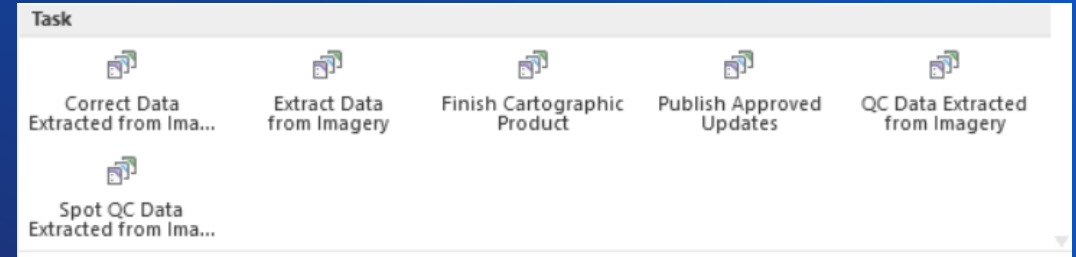
Attachments

Activity Log

Holds

Workflows

- Using workflow driven systems
 - Increase productivity through:
 - Preconfigured and repeatable processes
 - Simplification and automation
 - Build in quality through:
 - Process control/configuration management
 - QA/QC process enforcement
 - Accountability
 - Manage the workforce

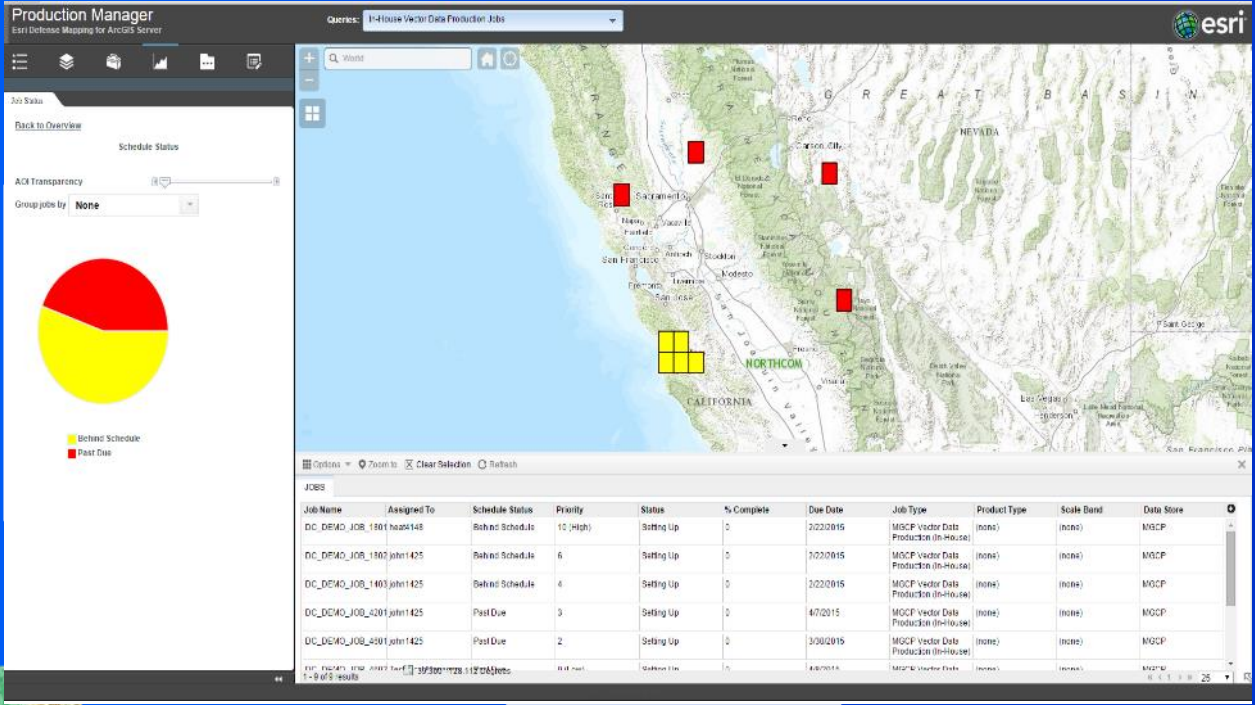


Workflow Management Interface

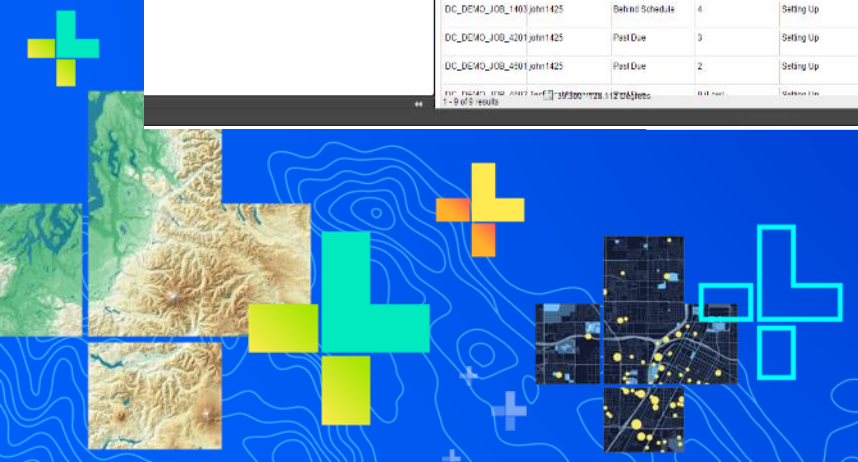
Job ID	Job Type Name	Assigned To	Parent Job	Parent Complete
16	Extract Task Group	Proven@Service	0	0
15	Extract Task Group	Proven@Service	0	0
14	Extract Task Group	Proven@Service	0	0
13	Extract Task Group	Proven@Service	0	0
12	Extract Task Group	Proven@Service	0	0
11	Extract Task Group	john1425	0	0
10	Extract Task Group	john1425	0	0
9	Extract Task Group	Proven@Service	0	0
8	Extract Task Group	Proven@Service	0	0
7	Extract Task Group	Proven@Service	0	0
6	Extract Task Group	Proven@Service	0	0
5	Extract Task Group	andrew	0	89
4	QC Data Extracted from Imagery - Quality Analysis		1	0
3	QC Data Extracted from Imagery - andrew		1	85

Workflow Diagram:

```
graph TD; A[Set Task Status] --> B[Open Map]; B --> C{Accept Updates?}; C -- No (0) --> D[Update Rework Count]; C -- Yes (1) --> E[Insert Task Group]; D --> E; E --> F[Set Task Status]; F --> G[Close Job];
```

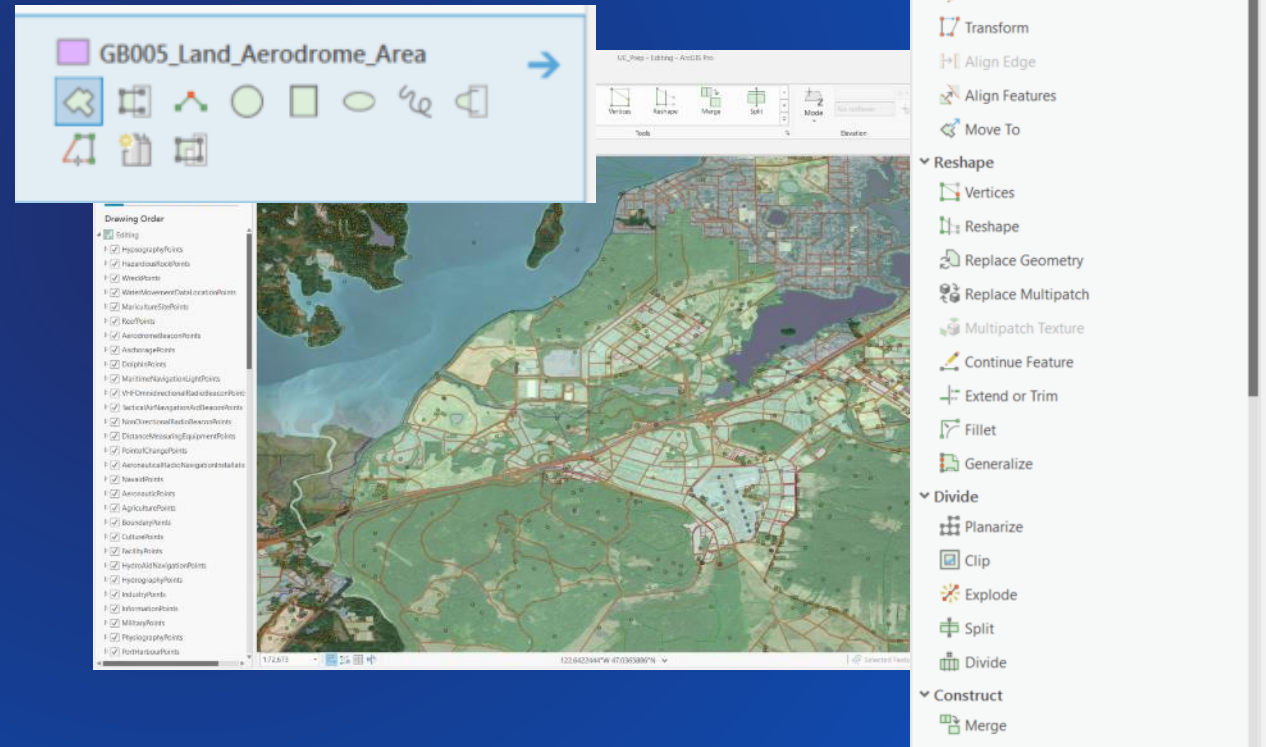


Production Management / Workflows Presenter(s)



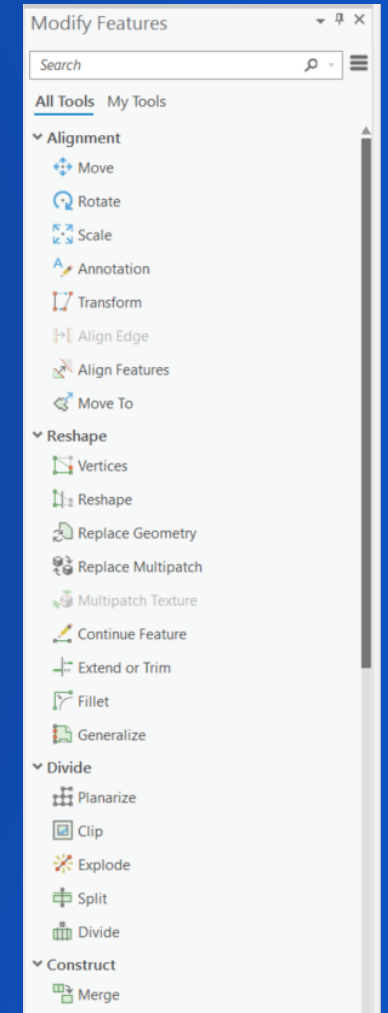
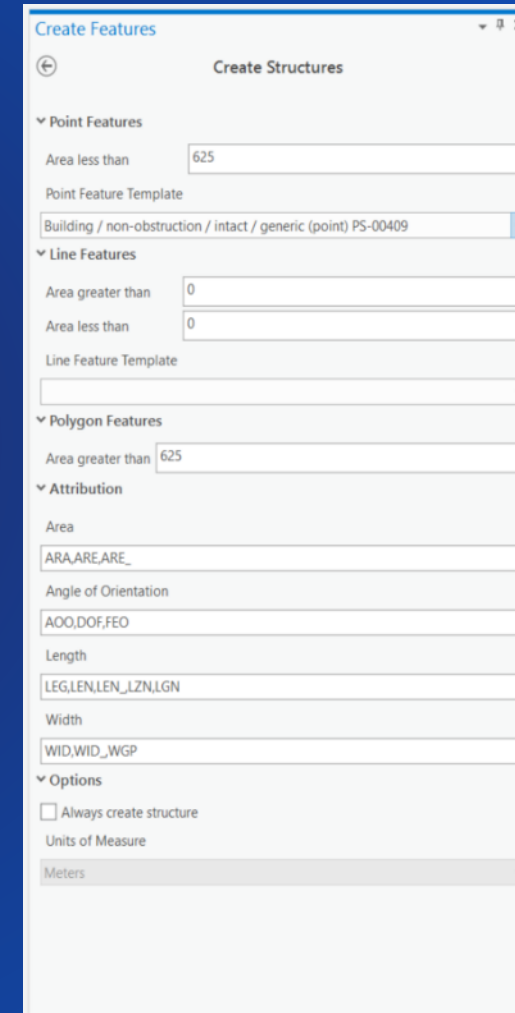
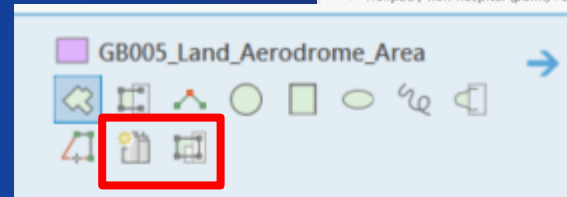
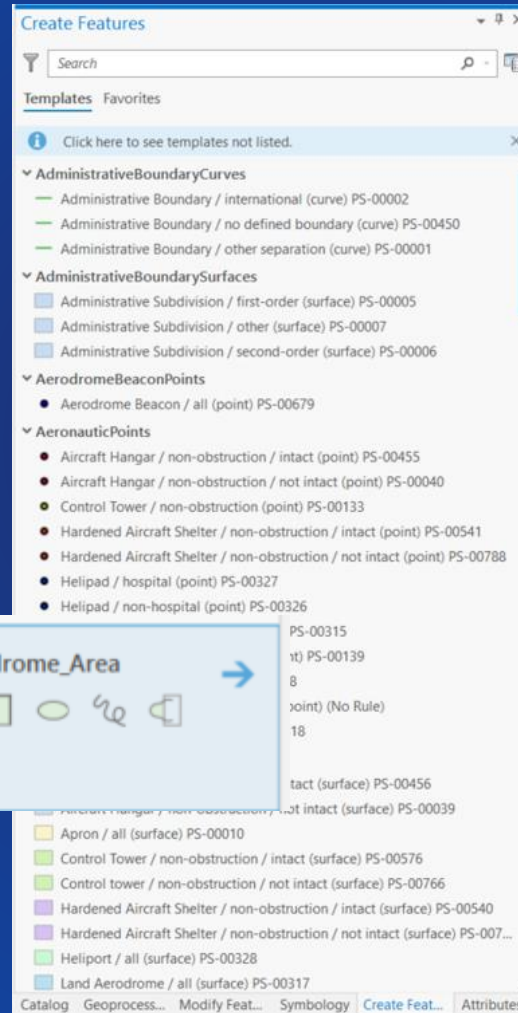
Topographic Map Production: Data Collection / Data Quality

- Common editing tools
- Common modify tools
- Data Reviewer
 - Rule-based automated validation
 - Semi-automated workflows
 - Track and report quality



Topographic Map Production: Data Collection

- Predefined Edit Templates
- Construction Tools
 - Create Structure tool
 - Difference Polygon
- Modify Tools



Topographic Map Production: Geoprocessing Tools

Topographic Production Tools

- ▶ Cartography
- ▶ Data Management
- ▶ Workflow

Cartography

- ▶ Banding
 - Generate Elevation Bands
- ▶ Cartographic Refinement
 - Apply Building Offsets
 - Apply Masks From Rules
 - Apply Visual Specification To Map
 - Calculate Bridge Offsets
 - Make Masks From Rules
 - Thin Spot Heights
- ▶ Features
 - Generate Adjoining Sheets Features
 - Generate Elevation Guide Features
 - Generate Spot Heights
 - Generate Topographic Contours
 - Identify Contours
- ▶ Layout
 - Make Grids And Graticules Layer
 - Populate Map Sheet Info

Data Management

- ▶ Features
 - Calculate Default Values
 - Calculate Metrics
 - Remove Cutback Vertices
 - Repair Self Intersection
 - Split Features
 - Update GeoNames
- ▶ Generalization
 - Eliminate Polygon
 - Export Generalized Data
 - Fill Gaps
 - Identify Narrow Polygons
 - Import Generalization Data
 - Polygon To Centerline
 - Remove Small Lines
 - Thin Hydrology Lines
- ▶ Geodatabase
 - Export MGCP Metadata
 - Geodatabase To Shape
 - GeoNames To Geodatabase
 - Import MGCP Metadata
 - Load Data
 - Unzip MGCP Cell And Import
- ▶ Topology
 - Export Topology
 - Import Topology
- ▶ Validation
 - GAIT

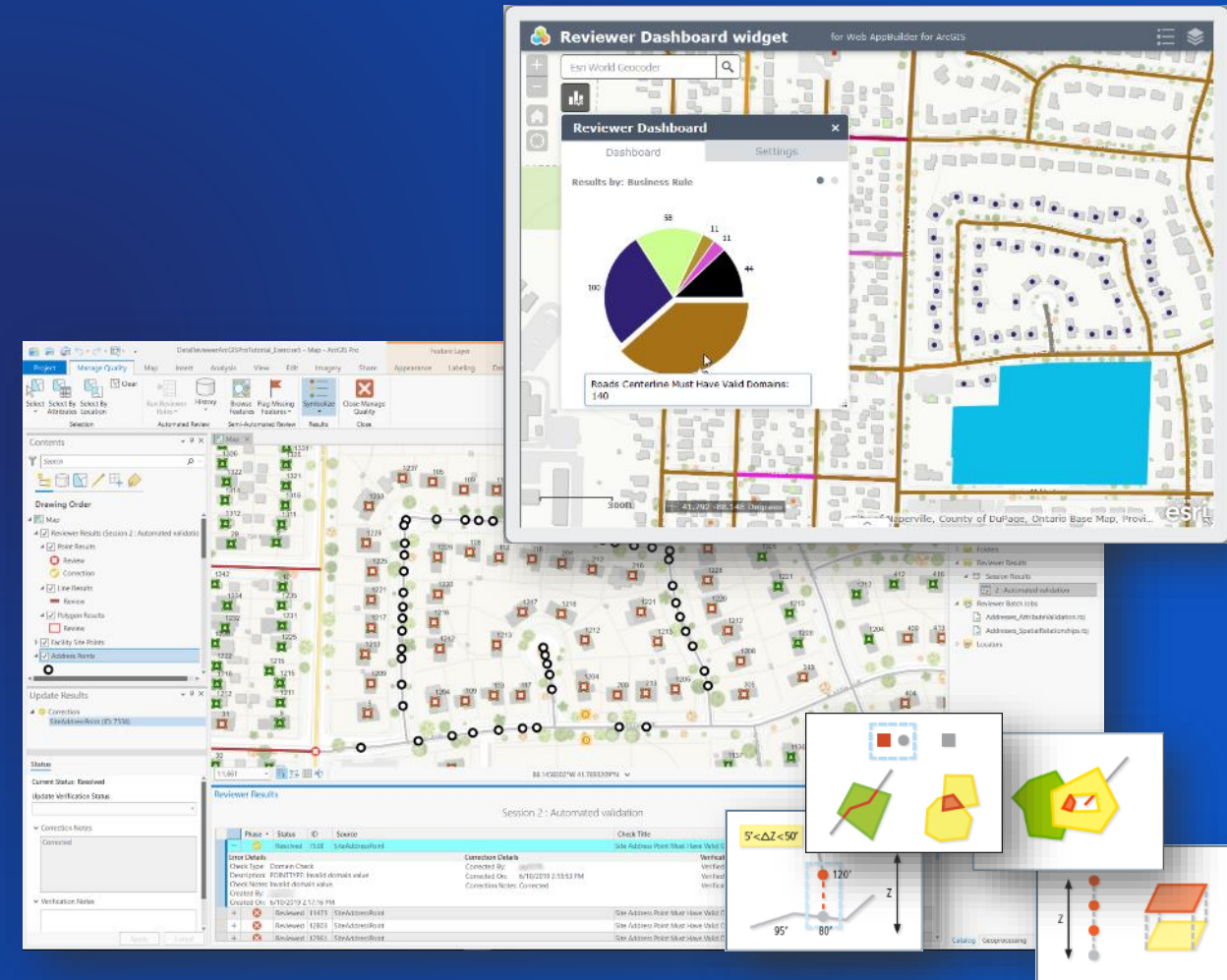
Workflow

- ▶ Properties
 - Set Data Workspace
 - Set Production Properties
 - Update Property Count
- ▶ Tasks
 - Create Job For Task
 - Insert Task Group
 - Set Next Task
 - Set Task List
 - Set Task Status



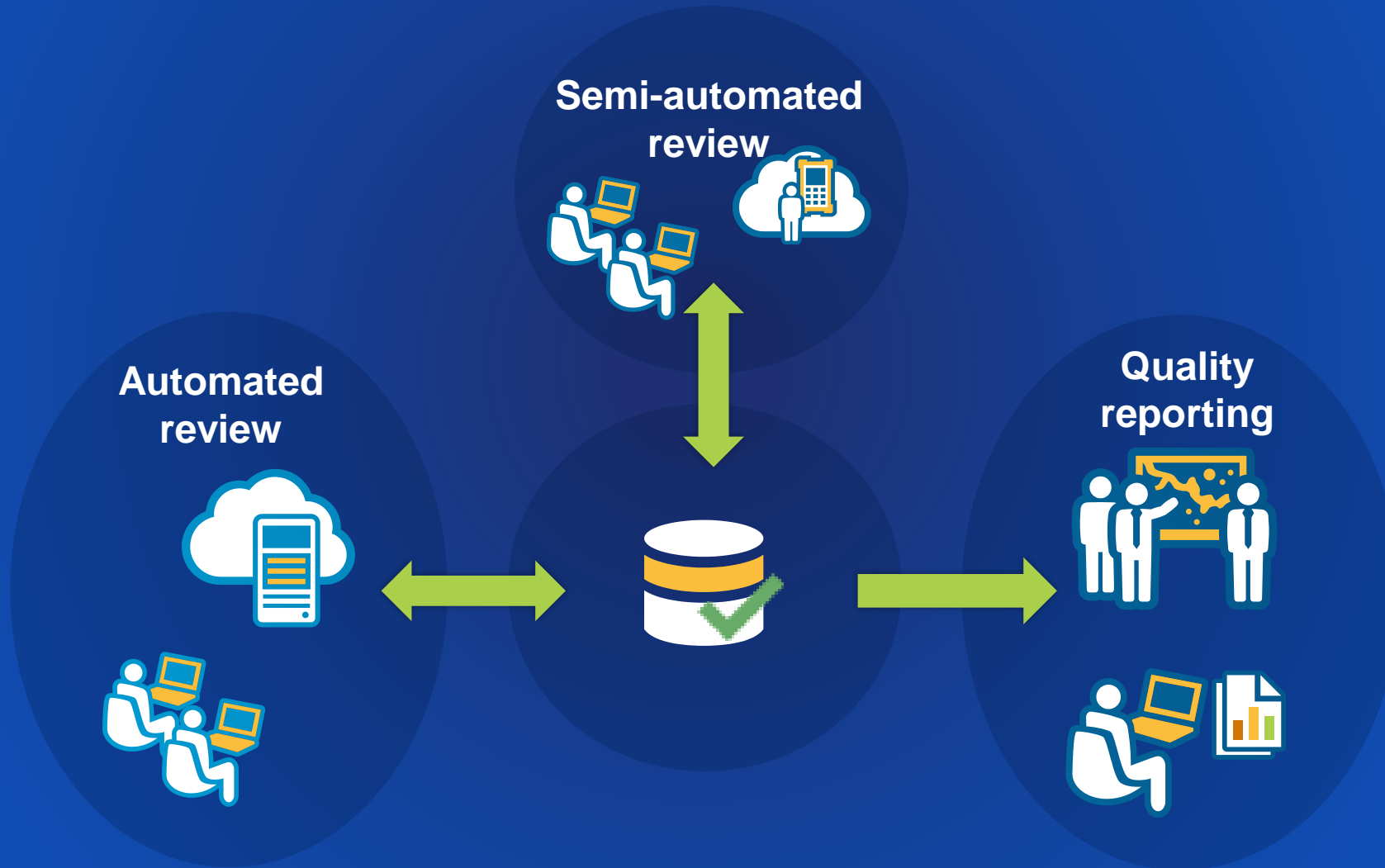
Topographic Map Production: Data Quality

- Provides
 - Rule-based automated validation
 - Semi-automated workflows
 - Track and report quality
- For individuals and enterprise
 - Saves time/money
 - Less rework
- For multiple domains
 - Configurable
 - Extendable



Topographic Map Production: Managing quality control

Quality control processes



Automating data validation

Implementing quality requirements

- 40+ configurable checks
- Feature integrity
 - Collection rules
- Attribution
 - Feature and table values
- Spatial
 - Spatial relationships

<http://esriurl.com/12379>

esri
ArcGIS® Data Reviewer Checks

Database Validation Checks

- Connectivity Rules**
Returns geometries for features that violate the geometric network connectivity rules.
- Domain**
Validates coded value and range domains to ensure that all values meet domain constraints.
- Relationships**
Searches for records that are orphans or have improper cardinality in a relationship class.
- Subtype**
Searches for feature classes with improper or null subtypes.

Default Checks

- Invalid Geometry**
Finds features whose geometry is empty, nothing, or not simple, as well as features with empty envelopes.
- Multipart Line**
Searches for polyline features with more than one part.
- Multipart Polygon**
Finds polygon features with more than one part and polygon features with holes.
- Nonlinear Segment**
Searches for nonlinear segments, such as arcs and curves, in line and polygon features.

Semi-automated review

Leveraging ArcGIS Desktop

Tools supporting semi-automated review

- Redlining missing features
- Flagging existing features in error
- Random sampling

The top screenshot shows the ArcGIS Desktop interface with the 'Browse Features' tool open. The tool displays a list of address features and their attributes. The attributes table is as follows:

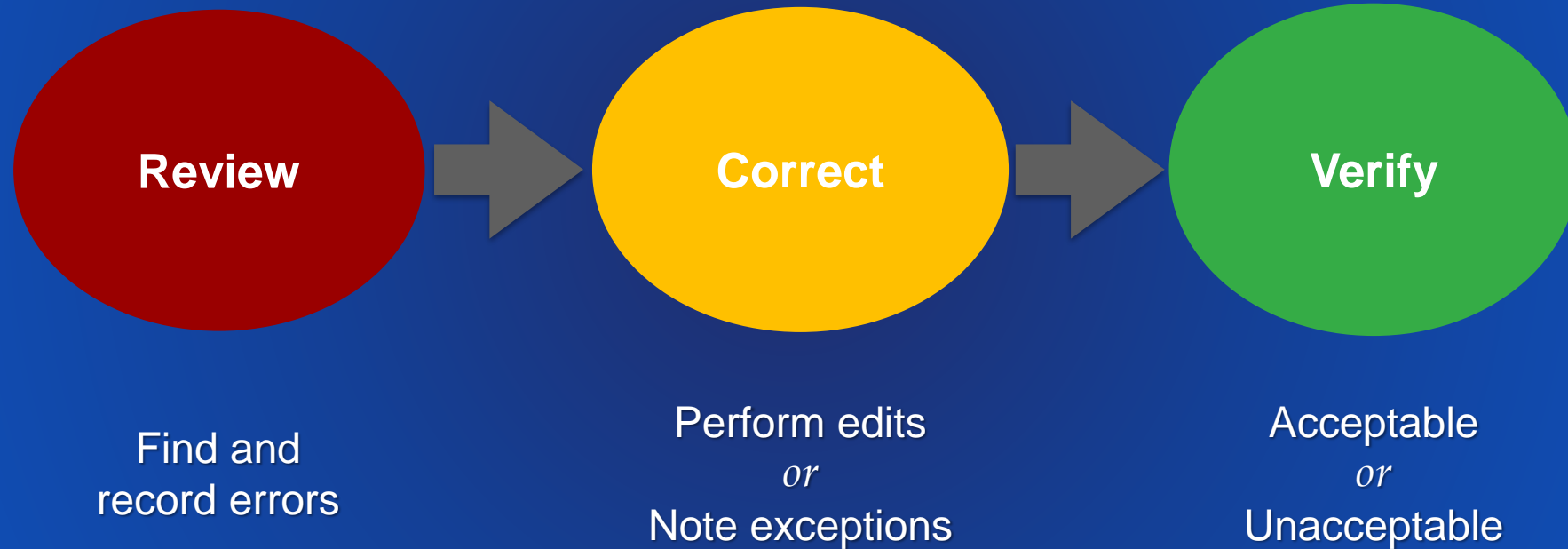
Attribute	Value
OBJECTID	50350
Site Address ID	SID-548
Address Point ID	<Null>
Address Number Prefix	<Null>
Address Number Suffix	<Null>
Full Address Number	<Null>
Address Range	<Null>
Address Unit Type	<Null>
Address Unit Number	<Null>
Alternate Address Unit Type	<Null>

The middle screenshot shows the 'Report Feature' dialog box in ArcGIS Data Reviewer for Server. The dialog box has a 'Select' tab and a 'Draw' tab. The 'Select' tab is active, showing a list of layers: 'Addresses' and 'Entrance Points'. Below the list, there is a prompt: 'Select point, line or polygon and draw the error geometry on the map.' There are several drawing tools represented by icons. A map of a residential area is visible in the background, with several green 'X' marks indicating features to be reviewed. A 'Report' button is located at the bottom right of the dialog box.

The bottom screenshot shows the 'Details' dialog box in ArcGIS Data Reviewer for Server. The dialog box displays information about a specific feature. The 'Layer Name' is 'Addresses - Entrance Points'. The 'Review Status' is 'Missing feature(s)'. There is a 'Notes' field with the text 'Enter notes'. The 'Severity' is set to '3'. A 'Commit' button is located at the bottom right of the dialog box.

Managing quality control

QC lifecycle management

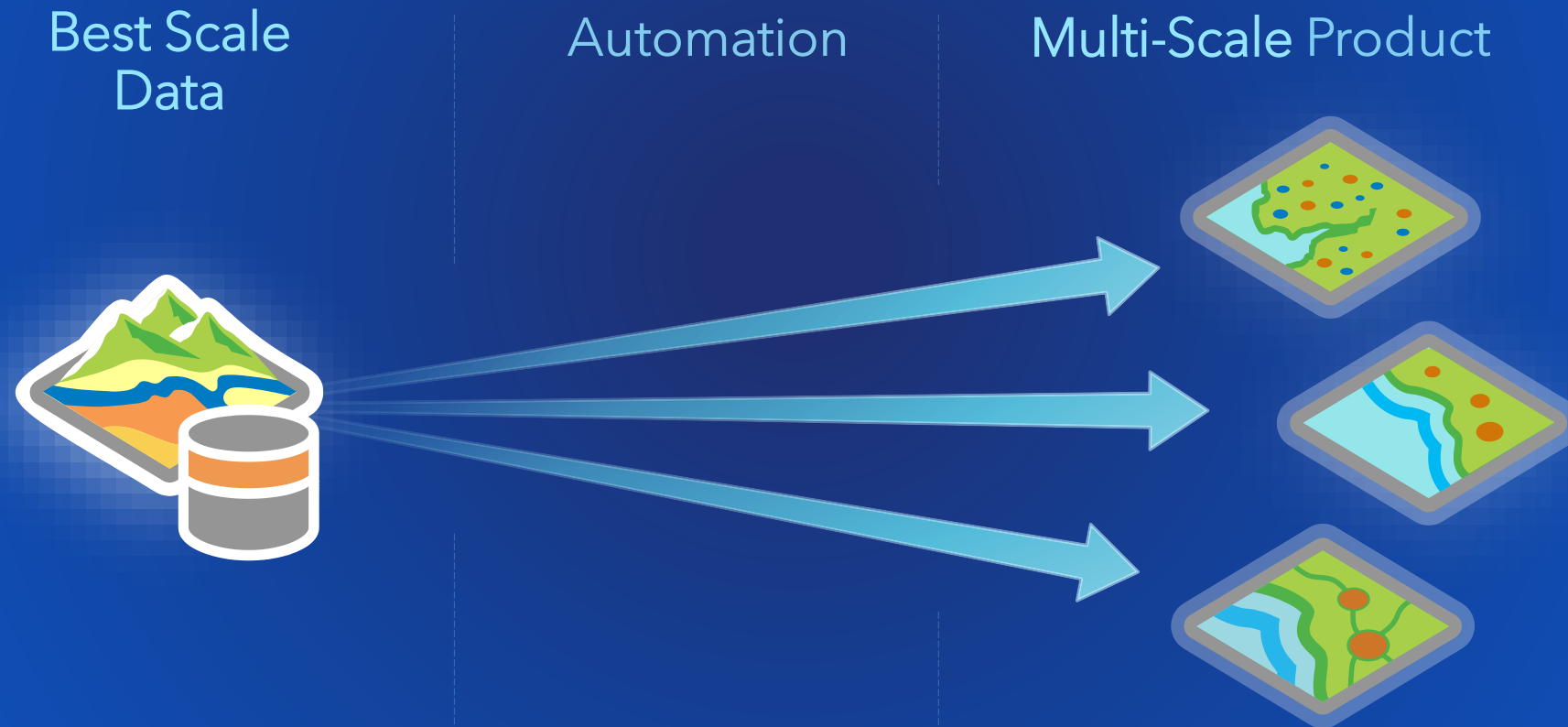




Data Collection / QC

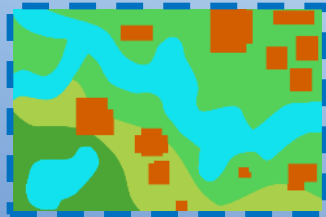
Amber Bethell

Topographic Map Production: Multi-Scale Mapping



Multi-Scale Mapping workflow

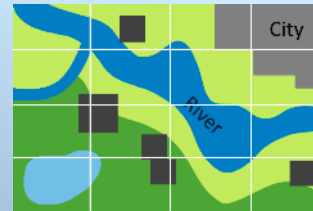
Best Scale Data



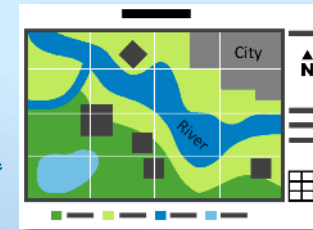
Prepare Data



Data Generalization



Prepare Cartographic Data



Cartographic Finishing

Multi-Scale Products



Data Automation

Map Automation



Generalization Themes

Transportation

- Road and Rail Networks
- Transportation structures (bridges, culverts, etc)

Structures

- Create Built-up Areas
- Thin individual point and polygon buildings

Skin-of-the-Earth (SOE)

- Maintains topology of landcover features (hydro, vegetation, bare ground, etc.)

Hydrology

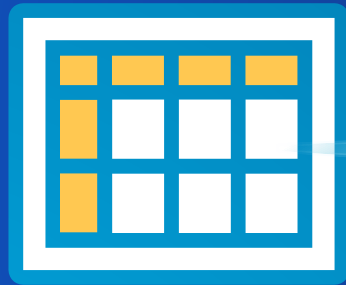
- Maintains hydrology network
- Natural and Man-made hydro features









General

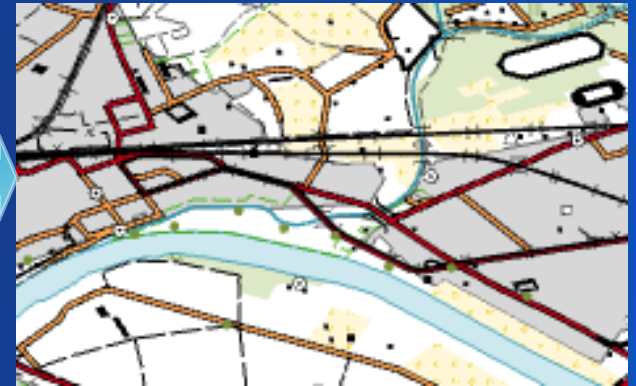
- Basic simplification and conversion of other types of features

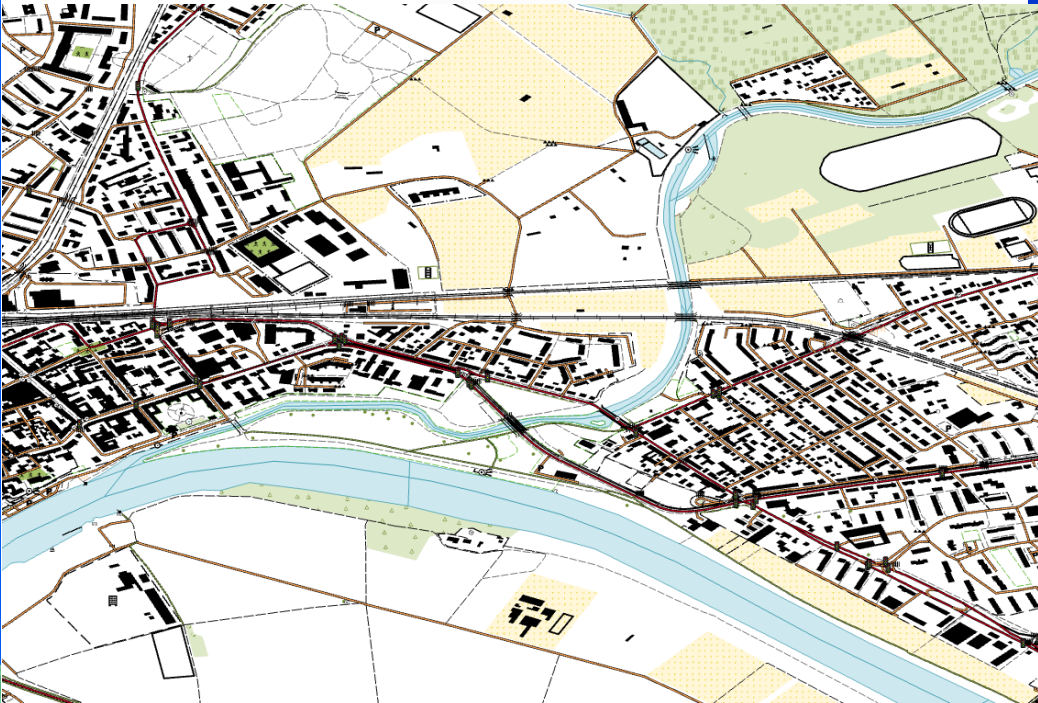


Topographic Map Production: Data Generalization

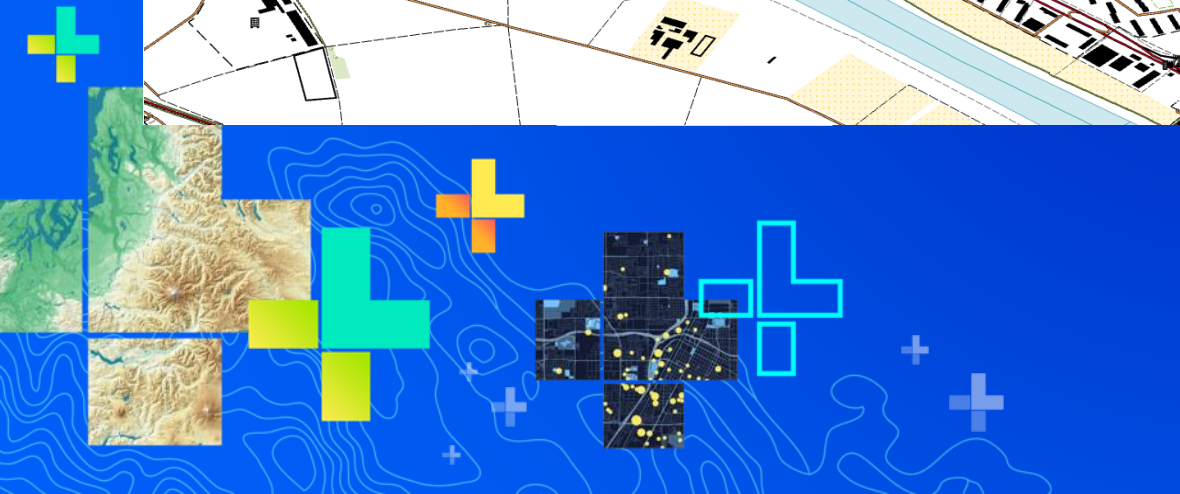


- ▷  0_Prepare.tbx
- ▷  1_Trans.tbx
- ▷  2_Struct.tbx
- ▷  3_SOE.tbx
- ▷  4_Hydro.tbx
- ▷  5_General.tbx
- ▷  6_Finalization.tbx
- ▷  Generalization Tools.tbx

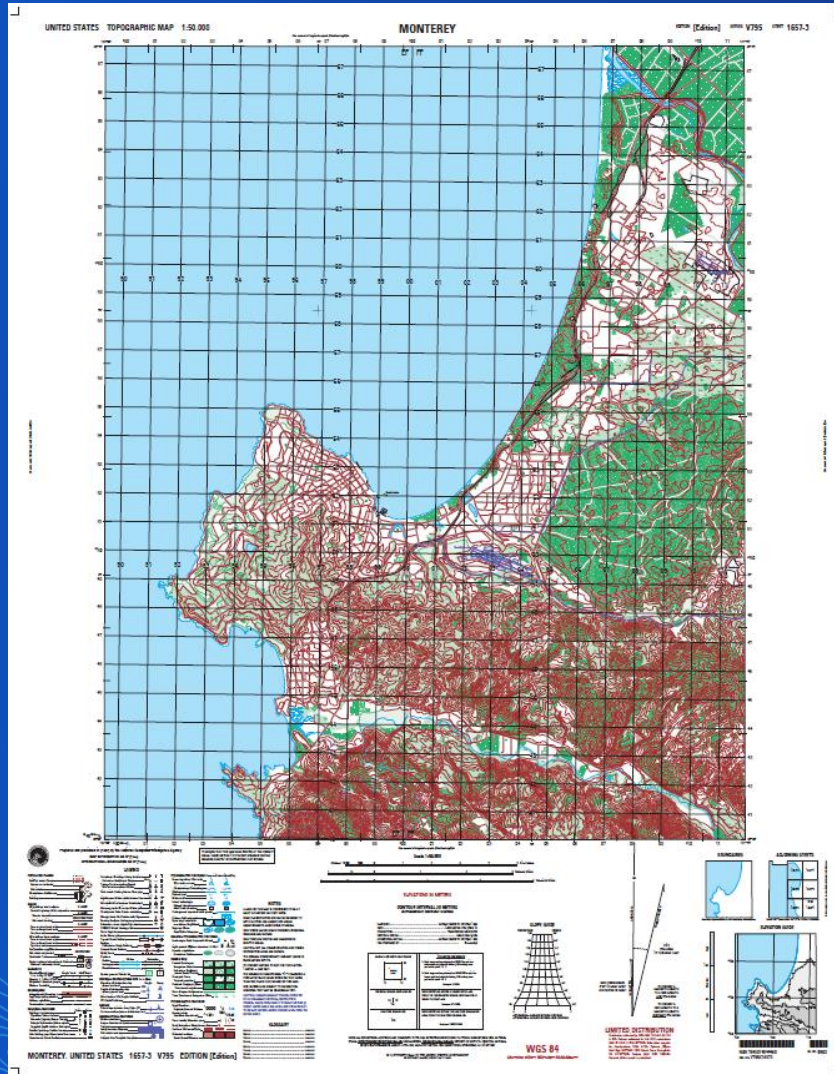




Data Generalization

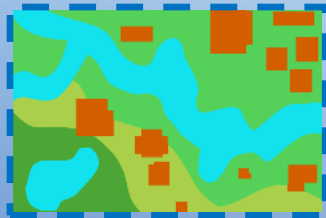


Topographic Map Production: Cartography



Multi-Scale Mapping workflow

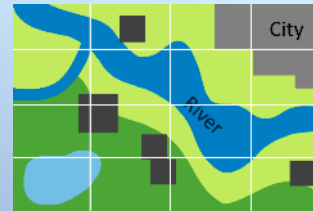
Best Scale Data



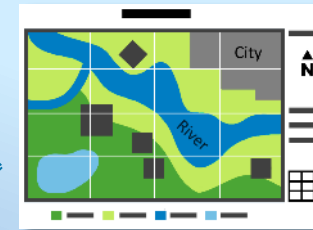
Prepare Data



Data Generalization



Prepare Cartographic Data



Cartographic Finishing

Multi-Scale Products



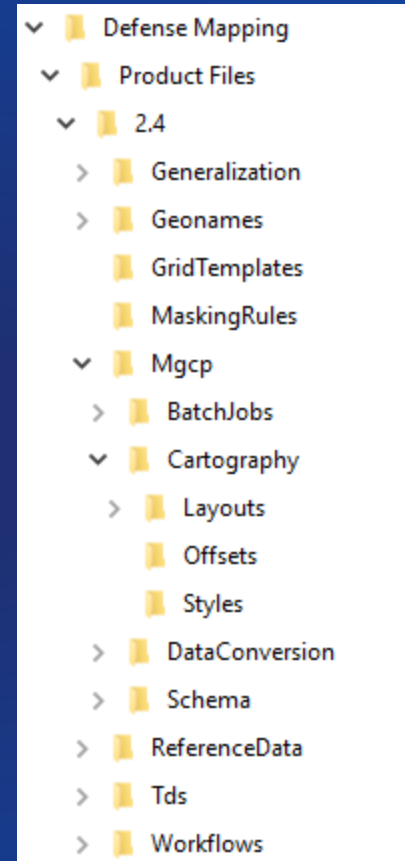
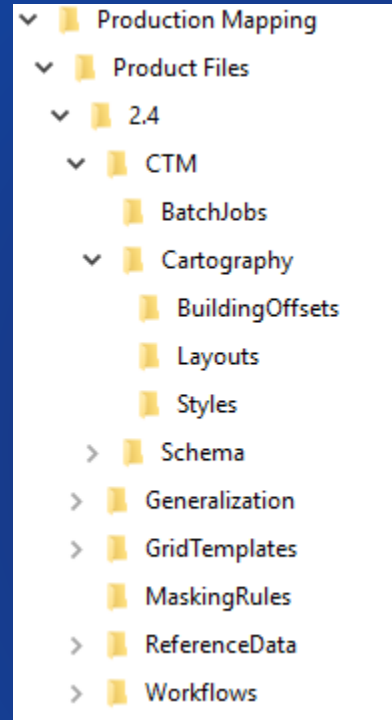
Data Automation

Map Automation



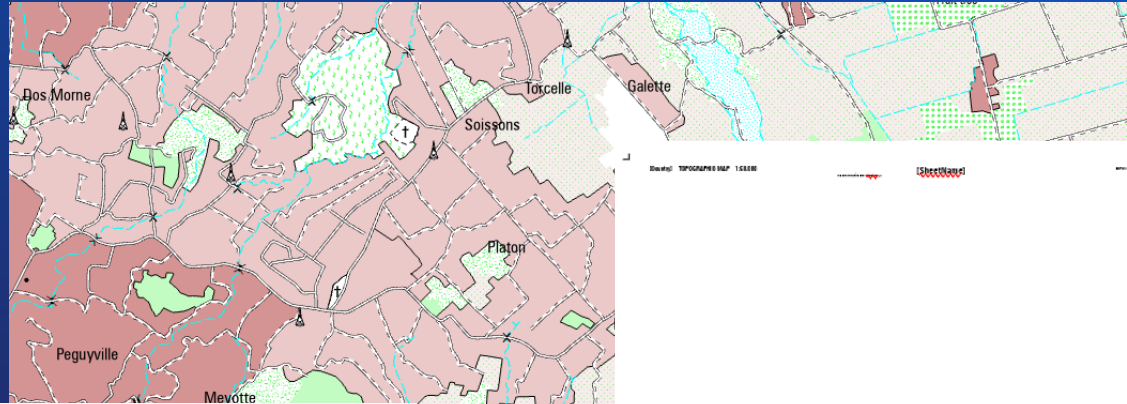
Topographic Map Production: Cartography Product Files

- **Layout file (pagx)**
 - Maps
 - Symbology
- **Offset files**
- **Grids**
- **Masking rules**
- **Schemas**
- **Reference Data**



Topographic Map Production: Preparing the Data

- Layout
 - Symbolize
 - Maps
- Create Grids
- Create Annotation



Expression Builder

Language:

Title:

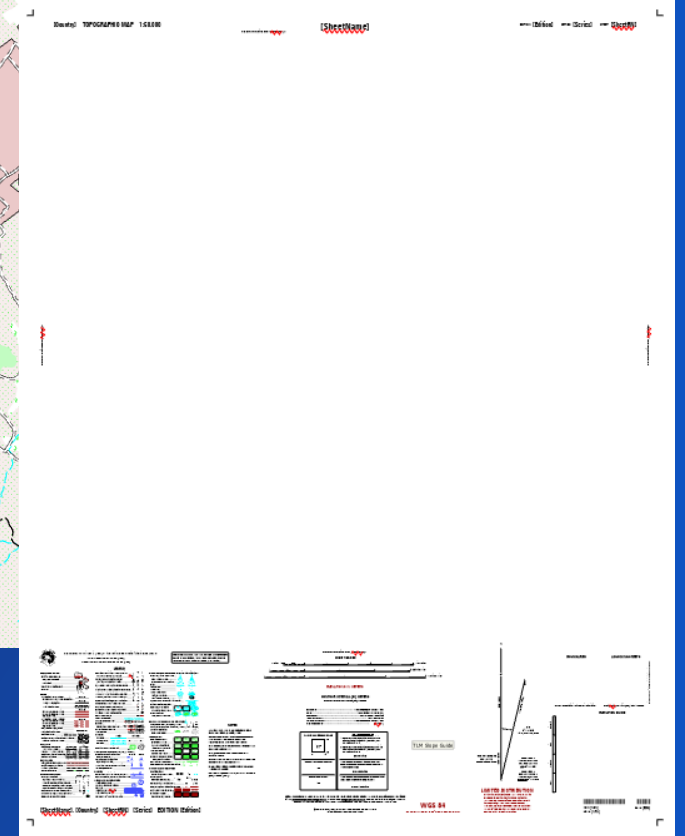
Fields	Functions
ObjectID	Abs()
Feature Code	Acos()
Feature Code Subtype	Asin()
Angle of Orientation	Atan()
Area	Atan2()

Insert Values

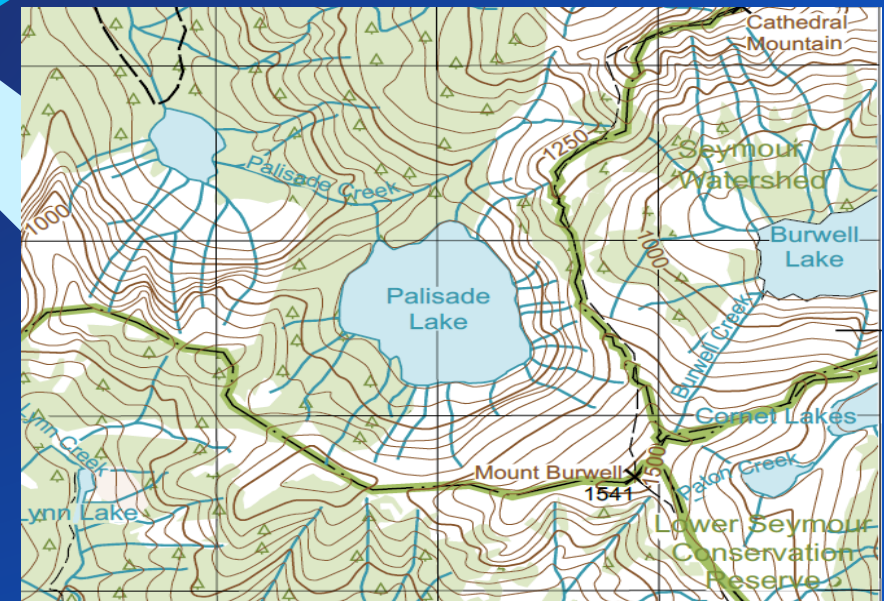
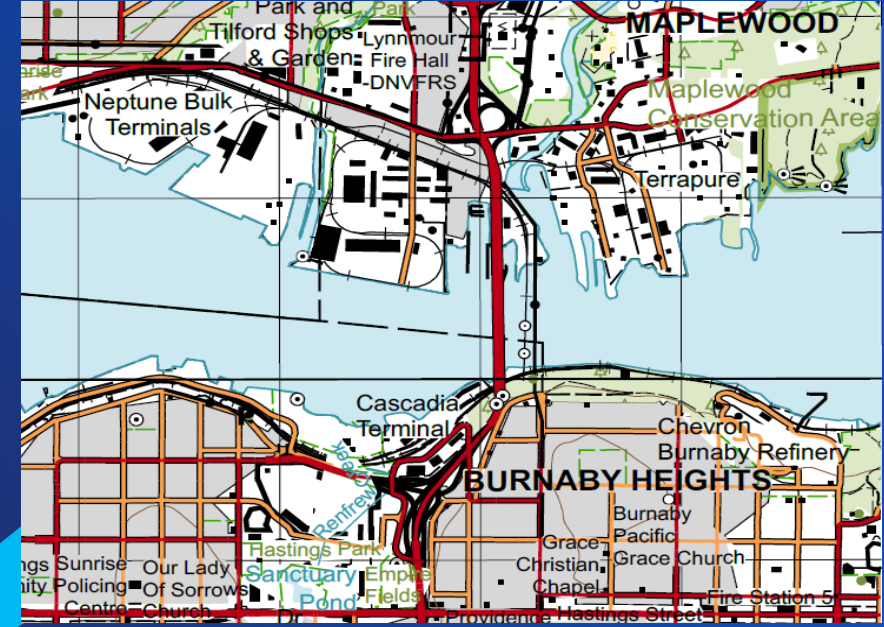
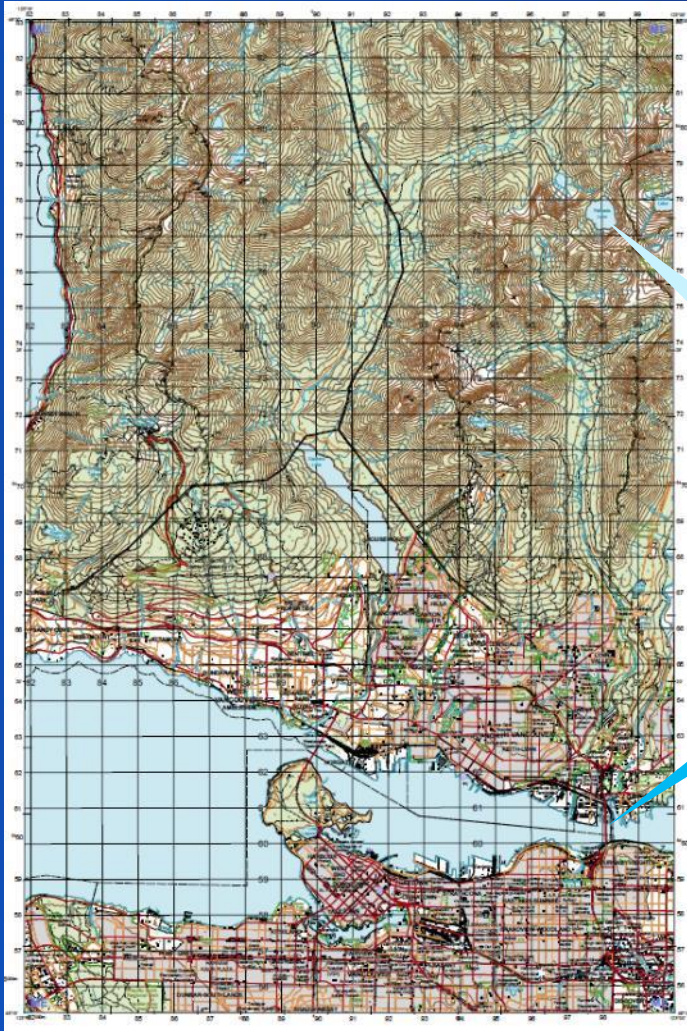
Expression

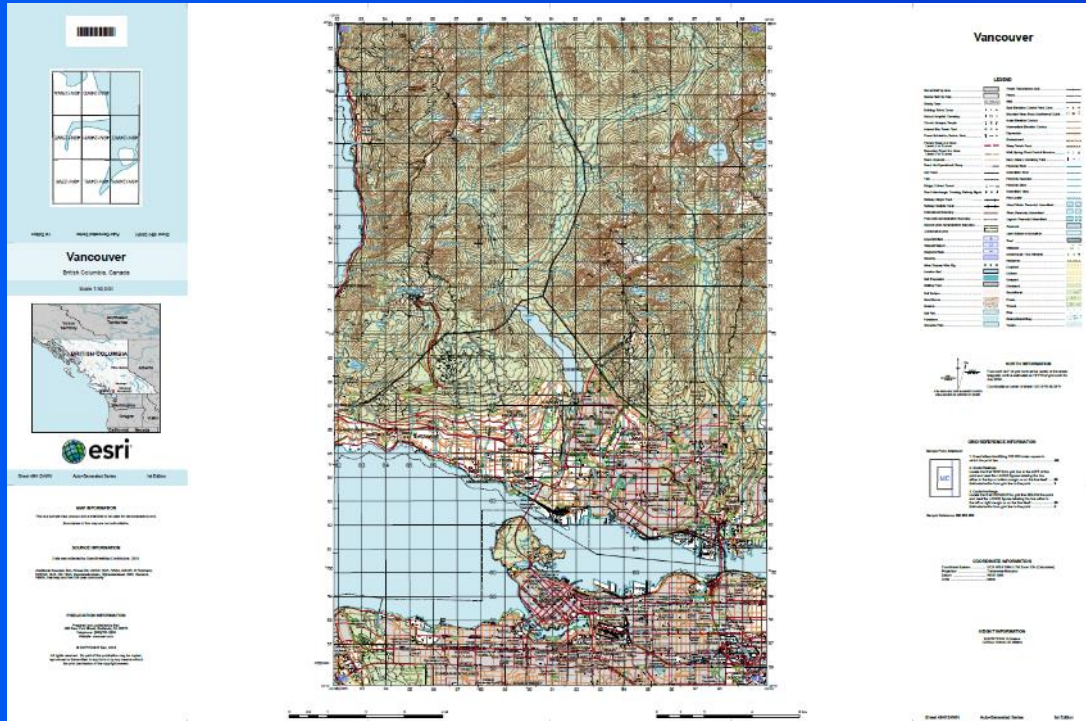
```
if ( $feature.F_CODE == "BH010" && IndexOf([2,-999999], $feature.PCF) != -1 && $feature.HGT < 46 )
    return "Aqueduct / intact (surface) PS-00461";
else if ( $feature.F_CODE == "BH010" && IndexOf([1,4,6,5,3], $feature.PCF) != -1 && $feature.HGT < 46 )
    return "Aqueduct / not intact (surface) PS-00462";
else if ( $feature.F_CODE == "BI020" && IndexOf([9,21,62,107], $feature.MCC) != -1 && $feature.HGT < 46 )
    return "Dam / hand (surface) PS-00214";
else if ( $feature.F_CODE == "BI020" && IndexOf
```

OK Cancel



Topographic Map Production: Cartographic Refinement



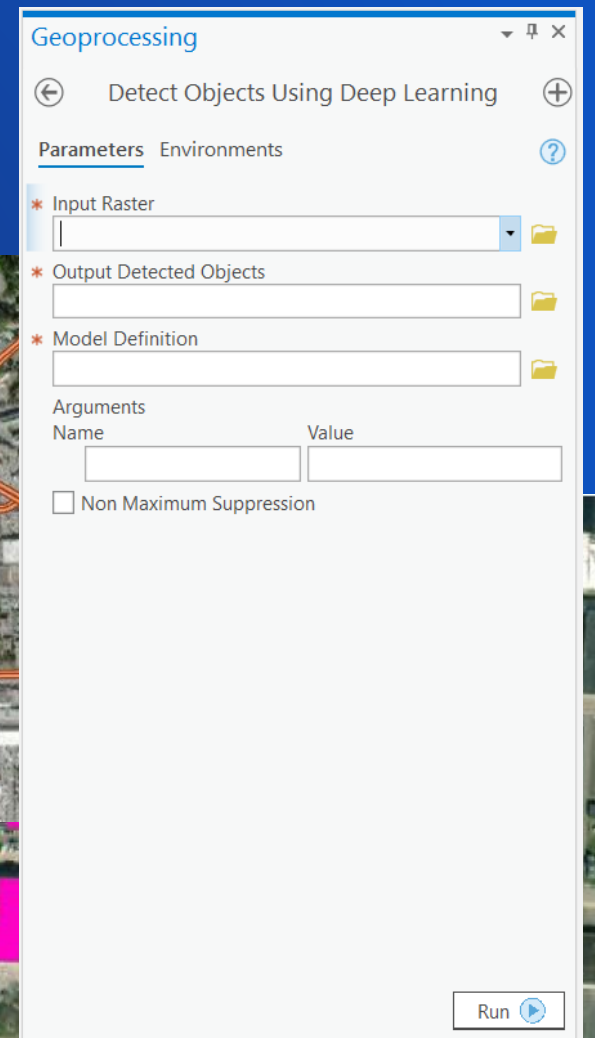
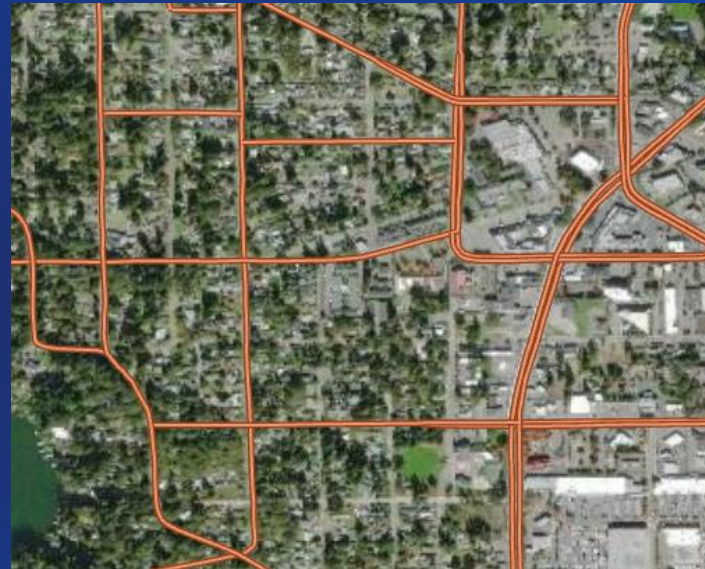


Cartography



Topographic Map Production: Road Ahead

- Geodatabase Replication
- Cartographic Automation
- Semi-automated feature extraction
 - Roads
 - Buildings



Questions

Thank You



Presentations

Tuesday

Topographic Data Generalization for Multi-scale Mapping	Room 30 E	04:00 PM– 05:00 PM
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Wednesday

ArcGIS Server Extensions: Configuring Product-on-Demand for Topographic Map Production	Room 05 B	01:00 PM – 02:00 PM
--	-----------	---------------------

Esri Defense Mapping: Cartographic Map Production	Room 05 A	02:30 PM – 03:30 PM
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ArcGIS Data Reviewer: An Introduction (Offering #2)	Room 30 E	08:30 AM - 09:30 AM
---	-----------	---------------------

ArcGIS Data Reviewer: Implementing Ready-to-Use Rules across the platform	Demo Theater 4	10:00 am - 10:45 AM
---	----------------	---------------------

ArcGIS Data Reviewer: Deploying Data Quality Web Services	Demo Theater 5	11:15 AM - 12:00 AM
---	----------------	---------------------

ArcGIS Data Reviewer: Validating linear-referenced events	Demo Theater 4	11:15 AM - 12:00 PM
---	----------------	---------------------

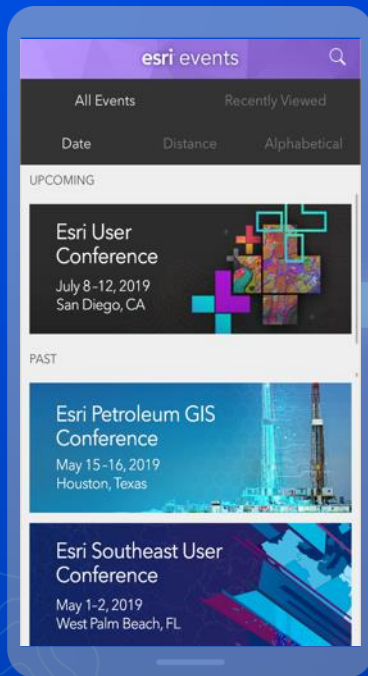
Thursday

Esri Production Mapping : Advanced Cartography	Room 30 B	02:30 PM – 03:30 PM
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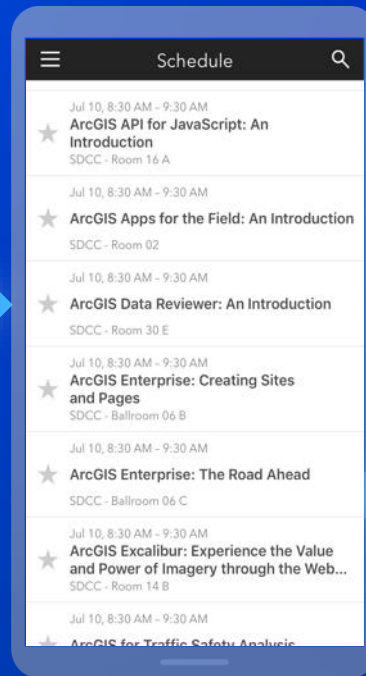
ArcGIS Data Reviewer: Advanced Data Validation	Room 30 E	08:30 AM - 09:30 AM
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Please Share Your Feedback in the App

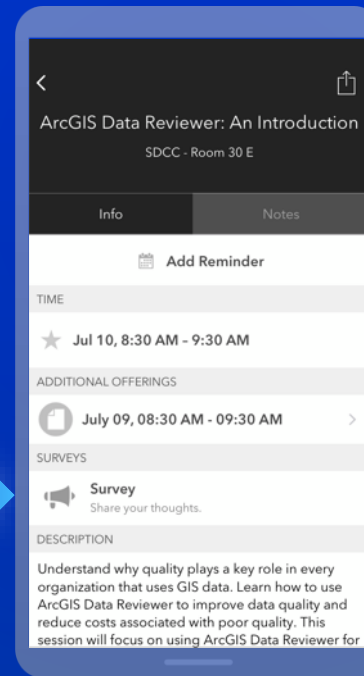
Download the Esri Events app and find your event



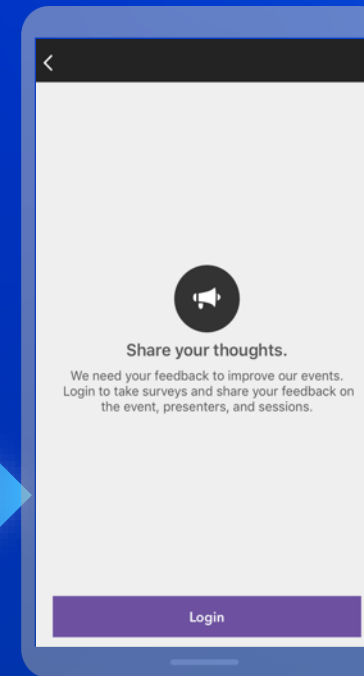
Select the session you attended



Scroll down to "Survey"



Log in to access the survey



Complete the survey and select "Submit"

