QA/QC For Your GIS Data

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SEE
WHAT
OTHERS
CAN'T

Overview

QA/QC

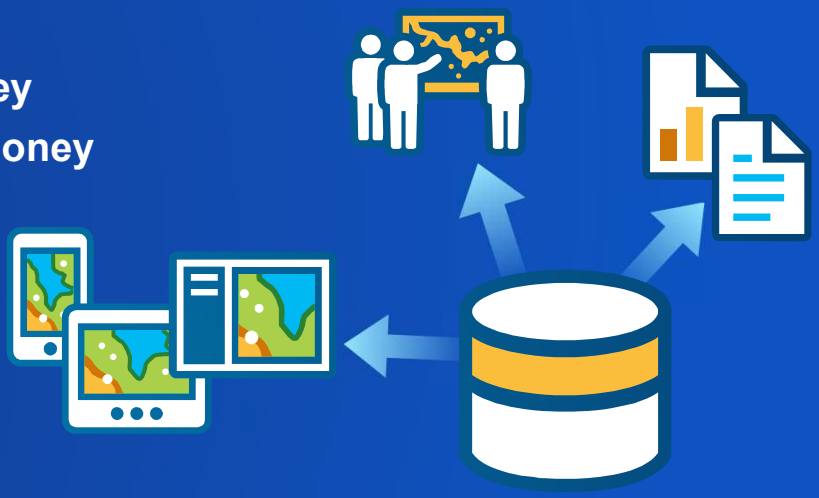
Understand **Document** **Implement**

Understanding QA/QC

Understanding QA/QC

- **Fit For Use**
  - support your GIS applications?
  - support your Business Systems?
- **Decision-making**
  - Good data → good decisions → save time & money
  - Bad data → bad decisions → more time & more money
- **Reporting**
  - Accuracy & Accountability

Why is it important?



Understanding QA/QC

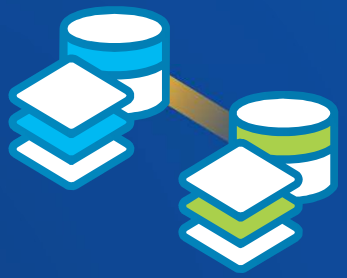
Who does it impact?

GIS Technician	Manager	Executive	Knowledge Workers
• Frees up time • Less rework • Focus elsewhere	• Effective data stewardship • GIS productivity • Increased GIS usage	• Confidently make decisions • Reduce financial risk • Optimize performance	• Confidence in GIS • Increase efficiencies

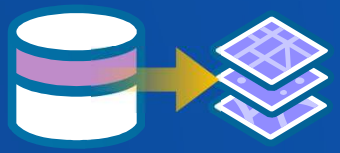
Understanding QA/QC

When should I do it?

Daily
Maintenance



Data Conversion/
Migration



Acquisition of Data
(Free or Purchase)

Annual
Data Revisions

Understanding QA/QC

What's the difference?

QA

Quality Assurance– **Processes or methods to help prevent errors from being introduced into the data.**

- Examples:
  - Data Model, Industry-specific Editing Templates, Attribute Assistant/Attribute Rules, data-specific editing tools

QC

Quality Control– **Processes or tools to identify errors that are already in the data.**

- Examples:
  - GP tools (Select by Attribute, Select by Location), GP Model, Data Reviewer Batch Jobs

6 Elements of Data Quality

Positional Accuracy	The accuracy of the position of features within a spatial reference system.
Completeness	The presence and absence of features, their attributes and relationships.
Temporal Quality	The quality of the temporal attributes and temporal relationships of features
Thematic Accuracy	Classification correctness related to features and their attributes
Logical Consistency	Adherence to logical rules of data structure, attribution, and relationships (documented in data product specifications).
Usability	The data adhering to the user requirements for its intended use

(ISO-19157:2013 Geographic Information – Data Quality)

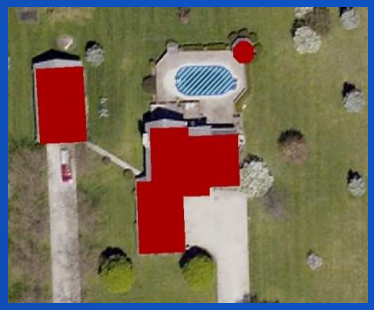
Name the Data Quality Issue

Which Element of Data Quality?

- Positional Accuracy
- Completeness
- Temporal Quality
- Thematic Accuracy
- Logical Consistency
- Usability

Issue

- **Land use polygon coded as residential instead of commercial**
  - **Impact: Business was not granted a timely permit**
- **River captured as seasonal as opposed to perennial**
  - **Impact: River is not symbolized as having constantly flowing water, which could lead to believe it can easily be crossed in dry season**



Swimming pool captured as wetland

Which Element of Data Quality?

- Positional Accuracy
- Completeness
- Temporal Quality
- Thematic Accuracy
- Logical Consistency
- Usability

Issue

- **Missing building footprints**
  - **Impact: Inaccurate impervious surface calculations**
- **Water mains containing blank or null diameter attribute values**
  - **Impact: Water utility crews may not have proper equipment for the job**

Neighborhood with missing building footprint

Which Element of Data Quality?

- Positional Accuracy
- Completeness
- Temporal Quality
- Thematic Accuracy
- Logical Consistency
- Usability

Issue

- **Misplaced or misaligned features**
  - **Impact: Can cause construction problems**
- **Inaccurate coordinate values**
  - **Impact: Could navigate to incorrect location**

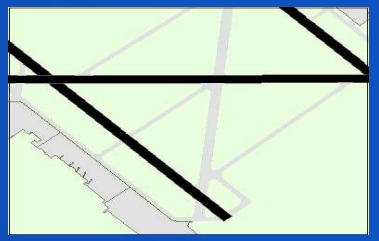
Lake feature has been shifted

Which Element of Data Quality?

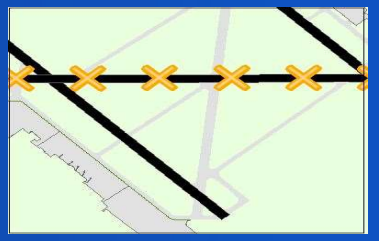
- Positional Accuracy
- Completeness
- Temporal Quality
- Thematic Accuracy
- Logical Consistency
- Usability

Issue

- **Incorrect time or date for discrete events**
  - **Hydrant status not updated**
    - **Impact: Could affect firefighters' response time**
  - **Navigational charts**
    - **Impact: Plane could fly into closed airspace**



Outdated chart showing open runway



Updated chart should show closed runway

Which Element of Data Quality?

- Positional Accuracy
- Completeness
- Temporal Quality
- Thematic Accuracy
- Logical Consistency
- Usability

Issue

- **Street centerline data contains street names, but no address ranges**
  - **Impact: Not enough information for geocoding**
- **Inappropriate scale**
  - **Impact: Cannot be used for intended purpose**

Used to route emergency vehicles

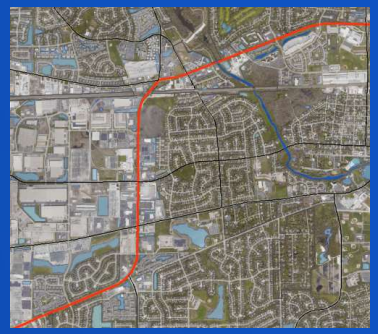
Used to map National Parks

Which Element of Data Quality?

- Positional Accuracy
- Completeness
- Temporal Quality
- Thematic Accuracy
- Logical Consistency
- Usability

Issue

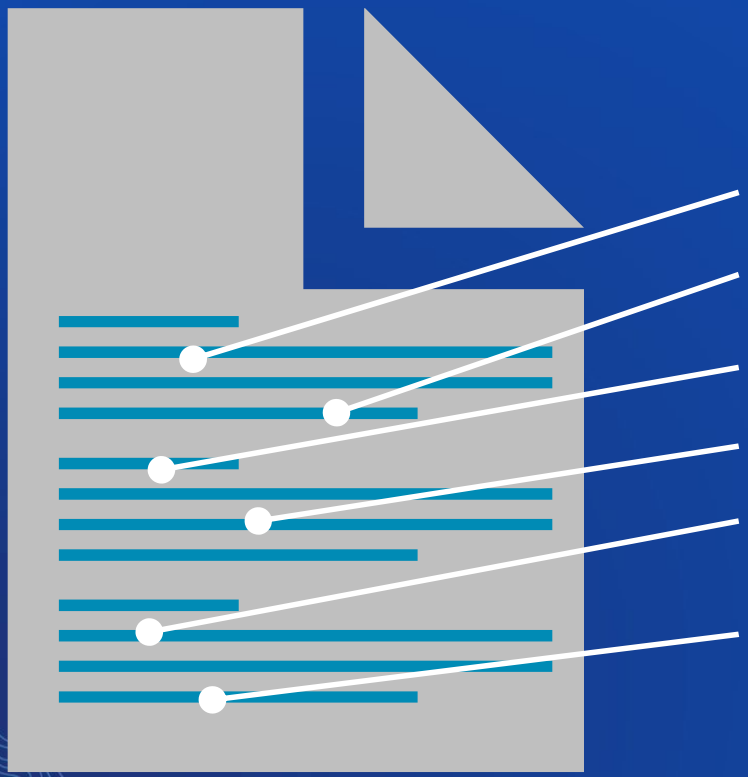
- **Reducer connects two pipes with same diameter**
  - **Impact: Could affect hydraulic modeling results**
- **Road surface type attributed incorrectly**
  - **Impact: Could affect routing and drive times**



Highway with road surface type gravel

Documenting QA/QC

Documenting QA/QC



Develop a QA Plan

- Purpose & Scope
- Roles & Responsibility
- Testing Environment
- Requirements & Acceptance Criteria
- QC Workflow
  - Processes & Tools
- Reporting & Addressing Errors (high-level)

Understanding QA/QC

- GIS Applications, Business Systems
  - Required fields, feature connectivity, topological relationships
- What can be automated?
- What will need to be checked manually/visually?
  - Data Reviewer Sampling
  - Systematic QC using grids

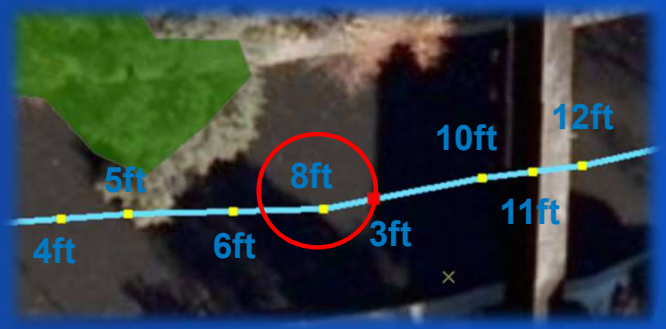
Identify Requirements

Industry Examples

Industry: Hydrography

- Rule: Lakes and/or ponds must be individual features
- Tool: Data Reviewer Multipart Polygon Check
  Add Geometry Attributes GP tool

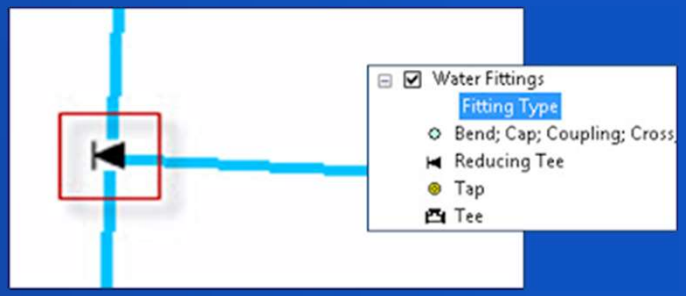
- Rule: Rivers must flow downhill
- Tool: Data Reviewer Monotonicity Check



Industry: Water Utilities

- Rule: Tee fitting must be connected to 3 water lines
- Tool: Data Reviewer Valency Check

  Select Junction by Edge Count (Water Utility Network Reporting toolbar)



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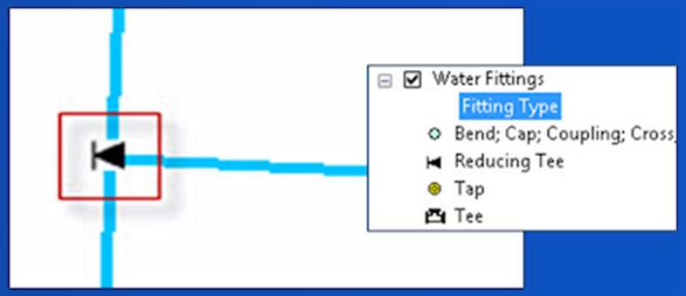
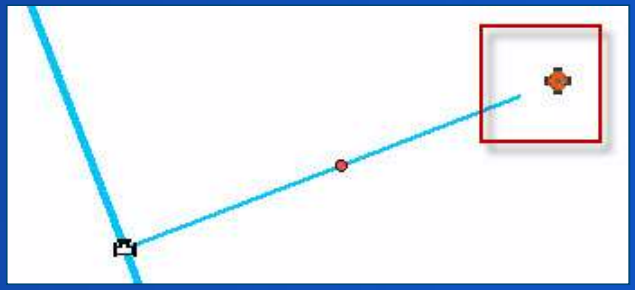


- Rule: Hydrants must be connected to hydrant laterals
- Tool: Data Reviewer Geometry on Geometry Check

  Find Disconnected Features in Geometric Network GP Tool

  Select By Location GP tool



Industry: Facility Management

- Rule: Building Facility Site Identifier must be unique
- Tool: Data Reviewer Unique ID Check
  Frequency GP tool
  Right-click on column, select Summarize

Table

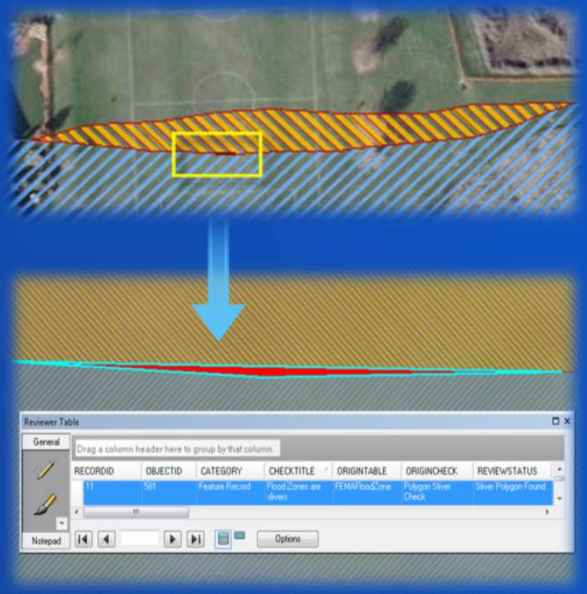
Facility Sites

OBJECTID *	SHAPE *	Facility Identifier	Name of Facility
1	Polygon	FAC-1	Future Third Library
2	Polygon	FAC-2	95th Street Property
3	Polygon	FAC-3	Naper Blvd Library
4	Polygon	FAC-3	Riverwalk
5	Polygon	FAC-5	Von Oven Scout Camp

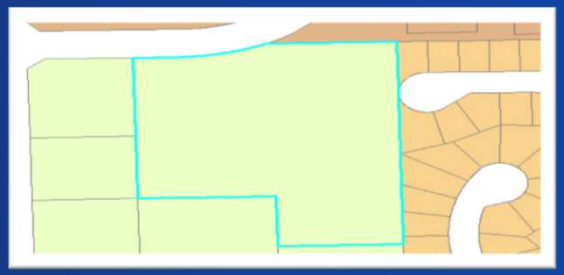
- Rule: Buildings must be greater than a certain size
- Tool: Data Reviewer Evaluate Polygon Perimeter and Area Check
  Select by Attribute

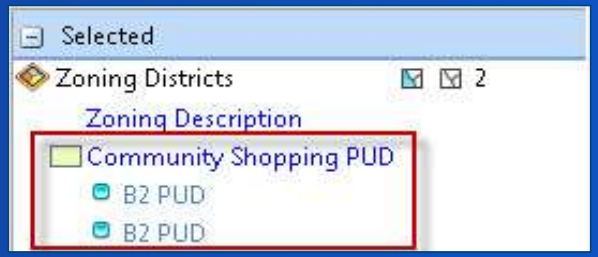
Industry: Land Use Planning

- Rule: Flood zones should not be slivers
- Tool: Data Reviewer Polygon Sliver Check



- Rule: Zoning district polygons should not be duplicates
- Tool: Data Reviewer Duplicate Geometry Check
  Find Identical GP tool





Implementing QA/QC

Implementing QA/QC

- Data model
- Industry-specific editing templates
- Attribute assistant/Attribute Rules
- Data-specific editing tools

Attribute Assistant - Overview

- Increases productivity
- Reduces button clicks
- Ensures data entry
- Simplifies complex operations
- Standardize editing procedures

Attribute Assistant Add-in

- Four key components
  - Attribute Assistant Toolbar
  - Dynamic Value Table
  - Generate ID Table
  - Configuration File

GenerateId

OBJECTID *	Sequence Name	Sequence Counter	Interval Value	Comments
1	WHYDRANT	1439	1	<Null>
2	MANHOLE	2493	1	<Null>
3	WSYSTEMVALVE	4823	1	<Null>
4	WMETER	8193	1	<Null>
5	WCONTROLVALVE	6	1	<Null>
6	PICLEANOUT	36	1	<Null>
7	WATERMAIN	4281	1	<Null>
8	WATERLATERAL	19660	1	<Null>

1 (0 out of 8 Selected)

DynamicValue

OBJECTID *	Table Name	Field Name	Value Method	Value Info	On Create	On Change	On Change	Manual Only	Rule Weight	Comments
8	*	LASTUPDATE	TIMESTAMP	<Null>	True	True	True	False	<Null>	<Null>
9	*	LASTEDITOR	CURRENT_USER	<Null>	True	True	True	False	<Null>	<Null>
10	wHydrant	FACILITYID	GENERATE_ID	WHYDRANT|0|HYD-[seq]	True	False	False	False	<Null>	<Null>
11	wSystemValve	DIAMETER	INTERSECTING_FEATURE	wMain|DIAMETER	True	False	True	True	<Null>	<Null>
12	ssGravityMain	SHAPE	SET_MEASURES	<Null>	True	True	False	False	<Null>	<Null>
13	ssGravityMain	FROMMH	FROM_JUNCTION_FIELD	FACILITYID	True	True	False	False	10	<Null>
14	ssGravityMain	TOMH	TO_JUNCTION_FIELD	FACILITYID	True	True	False	False	10	<Null>
15	ssManhole	FACILITYID	GENERATE_ID	MANHOLE|0|MH-[seq]	True	False	False	False	<Null>	<Null>
16	ssGravityMain	FACILITYID	EXPRESSION	replace(([FROMMH] & "-" & [TOMH]),"MH-","")	True	True	False	False	1	<Null>
17	wSystemValve	FACILITYID	GENERATE_ID	WSYSTEMVALVE|0|WSVAL-[seq]	True	False	False	False	<Null>	<Null>
18	wServiceConnection	FACILITYID	GENERATE_ID	WMETER|0|WSRV-[seq]	True	False	False	False	<Null>	<Null>
19	wControlValve	DIAMETER	INTERSECTING_FEATURE	wMain|DIAMETER	True	False	True	False	<Null>	<Null>
20	wControlValve	FACILITYID	GENERATE_ID	WCONTROLVALVE|0|WCVAL-[seq]	True	False	False	False	<Null>	<Null>
21	wSystemValve	LOCDESC	INTERSECTING_FEATURE_DISTANCE	wMain|FACILITYID	True	False	True	True	<Null>	<Null>
22	wCurbStopValve	DIAMETER	INTERSECTING_FEATURE	wLateralLine|DIAMETER	True	False	True	False	<Null>	<Null>
23	wCurbStopValve	LOCDESC	INTERSECTING_FEATURE_DISTANCE	wLateralLine|FACILITYID	True	False	True	False	<Null>	<Null>
24	wPump	INLETDIAM	FROM_EDGE_FIELD	DIAMETER	True	True	False	False	<Null>	<Null>

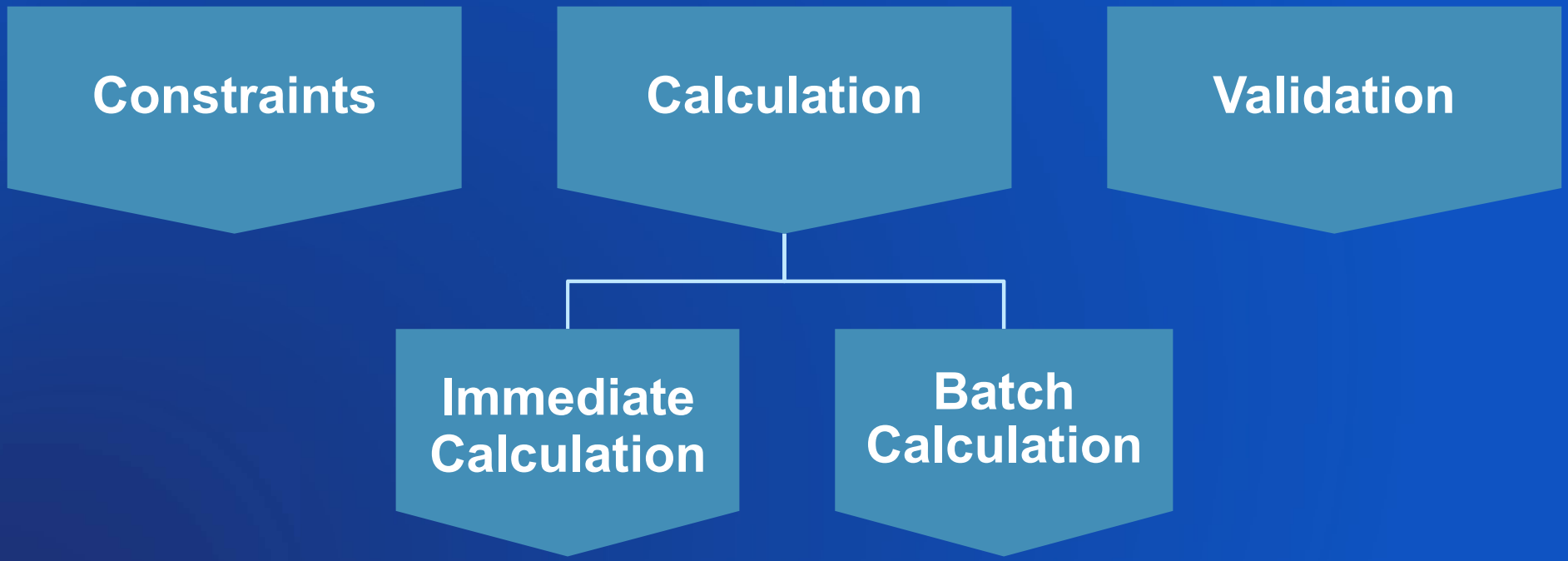
1 (0 out of 38 Selected)

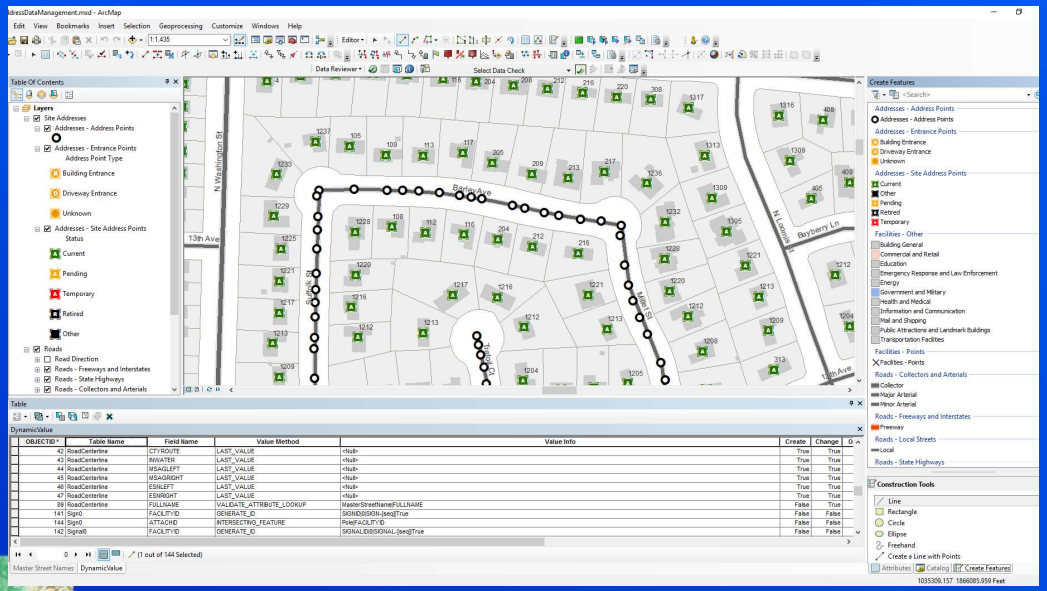
```
| Unless required by applicable law or agreed
| distributed under the License is distributed
| WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND
| See the License for the specific language go
| limitations under the License.
-->

<configuration>
  <Name>Attribute Assistant Release</Name>
  <appSettings>

    <!--Options for the Attribute Assistant-->
                                                    ue" />
                                                     the Attribute Assistant-->
                                                    lue" />

                                                    ="GenerateId" />


                                                    name.  The default location is %USERPROFILE%\ArcGISSolutions -->

                                                    on and off-->
                                                    e" />
                                                    " />

                                                    -->
                                                    gis/rest/services/World/GeocodeServer/"/>

    <!--Option to delete features without AA processing related records. If True, delete operations will be much quicker when AA is enabled.-->
    <add key="BypassEditOperationCheck" value="True"/>
  </appSettings>

</configuration>
```

Attribute Rules - Overview

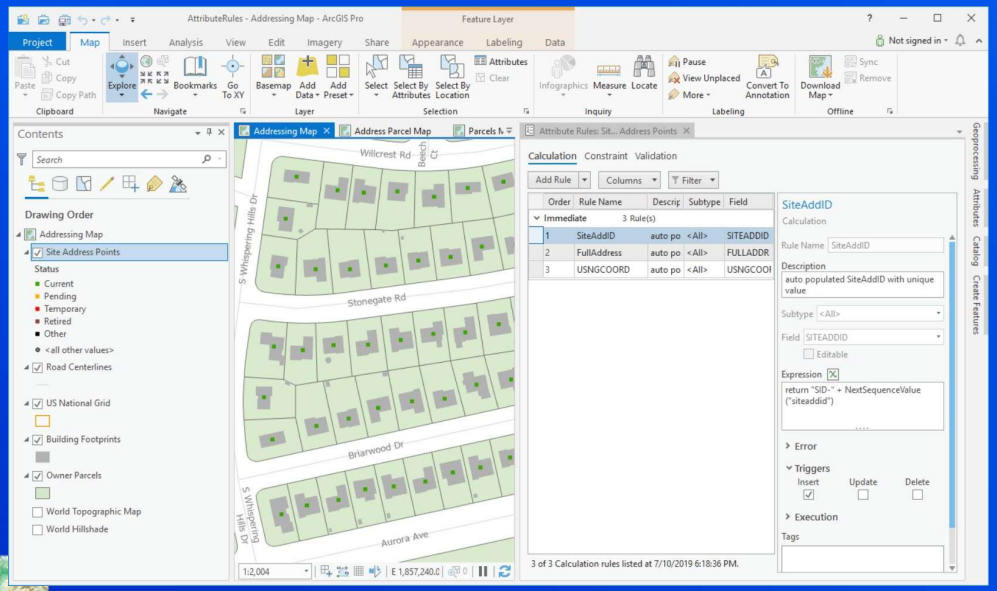
- User defined rules for simple features using Arcade scripting
- Ensures data quality during data collection and maintenance
- Enforces data integrity
- Defined in feature classes or tables
- Supported across the ArcGIS platform

Attribute Rules - Types





Feature Templates & Attribute Assistant



Attribute Rules

Implementing QA/QC

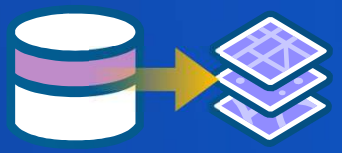
- Automated Data Validation
  - Geoprocessing Tools & Models (Toolbox)
  - Python Scripts
  - ArcGIS Data Reviewer
- Manual Data Validation
  - ArcMap Document
  - ArcGIS Data Reviewer
  - Checklist

Implementing QA/QC

Performing QC

- **Daily or when editing**
  - Step in a workflow
  - Current extent

- **Periodically (weekly or monthly)**
  - Scheduled, automated
  - Full database



- **New or Updated Dataset**
  - When received
  - Full dataset

Automated Data Validation

Summary

- QA/QC is important & perform regularly
- Create a QA Plan & define QC requirements
- Develop a repeatable, automated process

Resources

- LGIM data model
- Industry-related Editing Templates
  - Tools
  - Attribute assistant
- Industry-related Data Reviewer Templates
  - Sample Reviewer Batch Jobs

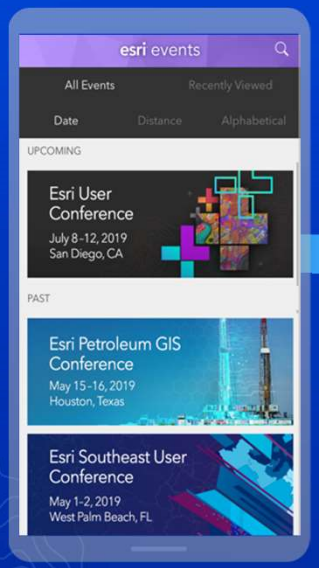
QA

QC

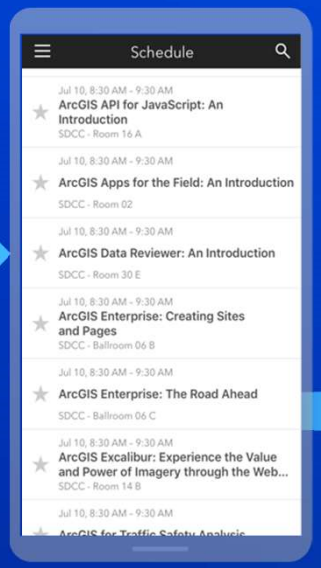
http://solutions.arcgis.com/

Please Share Your Feedback in the App

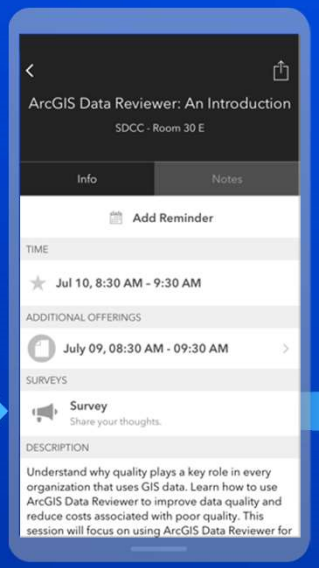
Download the Esri Events app and find your event



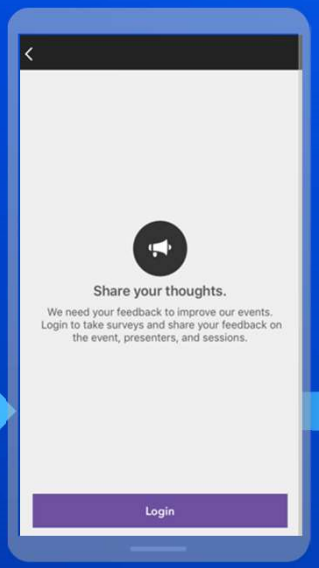
Select the session you attended



Scroll down to "Survey"



Log in to access the survey



Complete the survey and select "Submit"