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THE ANALYTICS EVENT

JLL's Journey to Data-Driven Precision with Alteryx, Databricks, and Power BI

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Global Internal Audit

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Overview

- Jones Lang LaSalle (NYSE: JLL), is a leading global commercial real estate and investment management company.
- Dating back to 1783, JLL has helped clients buy, build, occupy, manage and invest in a variety of property types, including commercial, industrial, hotel, residential and retail properties.
- A Fortune 500® company with an annual revenue of $23.4 billion revenue and operations in over 80 countries.
- Our more than 112,000 employees bring the power of a global platform with local expertise.
- Clients: real estate owners, occupiers, investors, developers, and tenants for various property types.
- Services: Leasing Advisory, Capital Markets Services, Real Estate Management Services, Software and Technology Solutions, and Investment Management through our LaSalle business.

Global Awards and Recognition

- World's Most Ethical Companies®, Ethisphere Institute for 18th consecutive year
- Fortune – World's Most Admired Companies (2008-2009, 2011-2012, 2015, 2017-2025)
- Newsweek America's Most Responsible Companies (2020-2024)
- Barron's -- America's 100 Most Sustainable Companies – 2020 (#66); 2021 (#67), 2022 (#20), 2023 (#6), 2024 (#7)
- U.S. News & World Report Best Companies to Work For (2023-2024)
- Forbes America's Best Employers for Diversity (2019-2023)
- The Drucker Institute / WSJ Management Top 250 (2017, 2018, 2020, 2021, 2022, 2023, 2024)
- One of the Best Places to Work for Disability Inclusion, Disability Equality Index for 5th consecutive year
- WEConnect International 2023 Global Champion for Supplier Diversity and Inclusion under platinum category for the 2nd consecutive year
- Every year since 2020, Bloomberg Gender Equality Index
- TIME/Statista - World's Best Companies (2024 rank: 441)
- Energy Star – Partner of the Year Award: 2007, 2010-2022; Partner of the Year Sustained Excellence Award: 2012-2024 (2024 is 13th consecutive year)
- Barron's -- America's 100 Most Sustainable Companies – 2020 (#66); 2021 (#67), 2022 (#20), 2023 (#6), 2024 (#7)
- Middle East Consultant Awards – Gender and Ethical Employment Champion of the Year
- Just 100 – America's Most JUST Companies and Industry Leaders in Real Estate
- P&G Supplier Impact Award (2024)
- Best Workplaces in Real Estate – India's Best Workplaces for Women Top 50 Large Organization
- The Drucker Institute / WSJ Management Top 250 (2017, 2018, 2020, 2021, 2022, 2023, 2024)
- Institute for Workplace and Facilities Management (IWFM) Impact Awards 2023

Seramount:

- Best Companies for Multicultural Women (2022 - 2023)
- Inclusion Index (2018-2020; 2022-2024)
- Top Companies for Executive Women (2023 - 2024)

JLL’s Global Internal Audit Function

VISION

To protect the brand and enable the business to thrive through superior curated internal audit services

MISSION

To enhance our business and safeguard the future of JLL for the benefit of our clients, our people, our communities, and our shareholders. We help drive enterprise value.

DATA ANALYTICS OBJECTIVE

Enhance auditing precision to support data-driven decision making and optimize organizational function.

GIA Data Analytics Use Cases

Dynamic Risk Sensing

Employ emerging technologies and automated methods to enable Continuous Monitoring of business operations, to reveal trends, outliers, and anomalies that inform internal audit planning and identify adverse risk events.

Audit Analytics

Increase auditing precision by leveraging data-focused techniques to explore diverse data sources; identify patterns and trends not visible through tradition audit methods, enabling targeted fieldwork and more effective testing of internal controls and compliance

Audit Operations

Curate system-of-record data with critical datasets to wholistically monitor engagement health and ensure IIA standards compliance, supporting stakeholder reporting and operations management.

Findings Management Use Case

PROBLEM STATEMENT

As an audit manager, I need to present open findings to accountable board members, ensuring they are informed of the status, aware of risk exposure, and can take appropriate remedial actions.

CHALLENGES

- Lack of confidence in existing dashboards
- Complex data structure
- Inconsistent naming conventions
- Reporting API limitations
- Time-sensitive reporting deadline

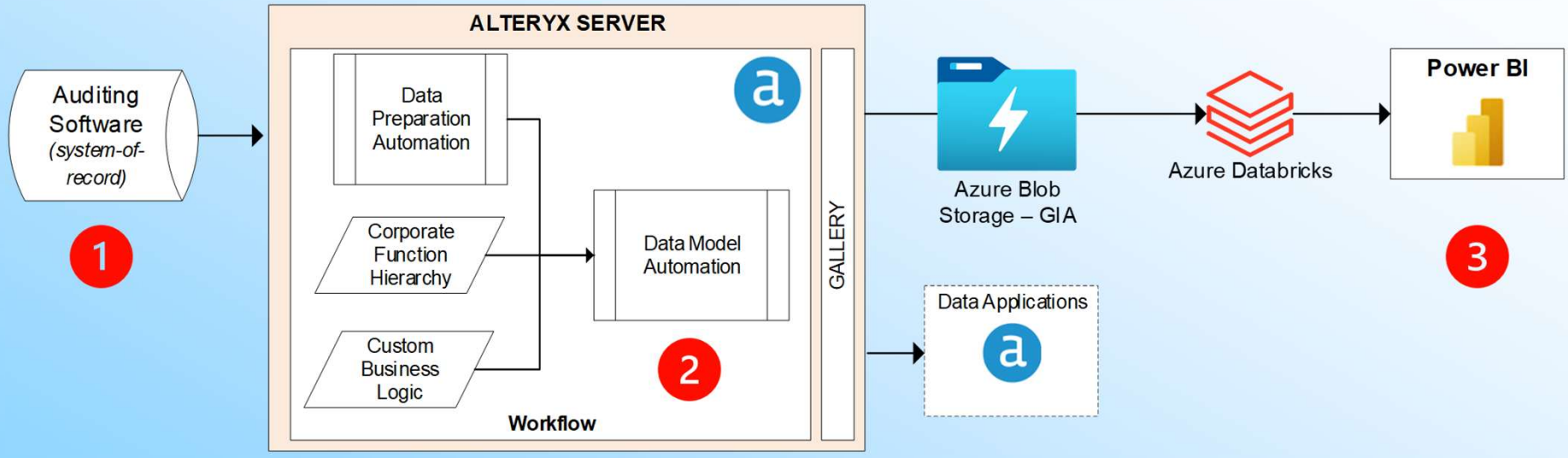
OPPORTUNITIES

- Certified, reporting-reporting ready data model
- Scalable analytics framework
- Unified data architecture
- Alteryx integration for streamlined data integration
- Power BI integration for customized visualizations

IMPACT INDICATORS

- ✓ Rejuvenated Executive-level report
- ✓ Confidence in the data
- ✓ New data-driven insights readily available
- ✓ Faster data retrieval and transformation.

Reporting Data Flow



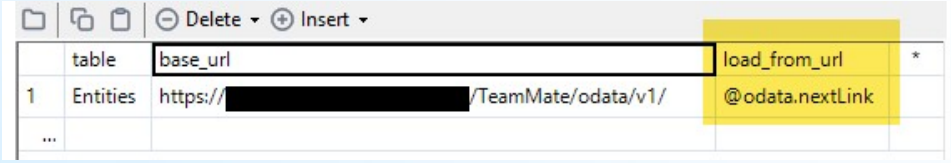
DESIGN DECISIONS (Lessons Learned):

- Data Modeling in Alteryx vs Power BI vs Databricks
- Alteryx Power BI Output Connector
- Power BI: Direct Query vs Import mode
- Reporting data staging zone: Database Table vs Network Drive flat file vs sFTP

Audit System Data Extractor

ITERATIVE MACRO nested in a STANDARD MACRO

- Iterative Macro used for GET calls in iterations of 2k records.
- Standard Macro used for standardized Alteryx workflow applicaiton



REPORTING SERVICES API Contextual Data: https://yourservername/teammate/odata/v1/tablename

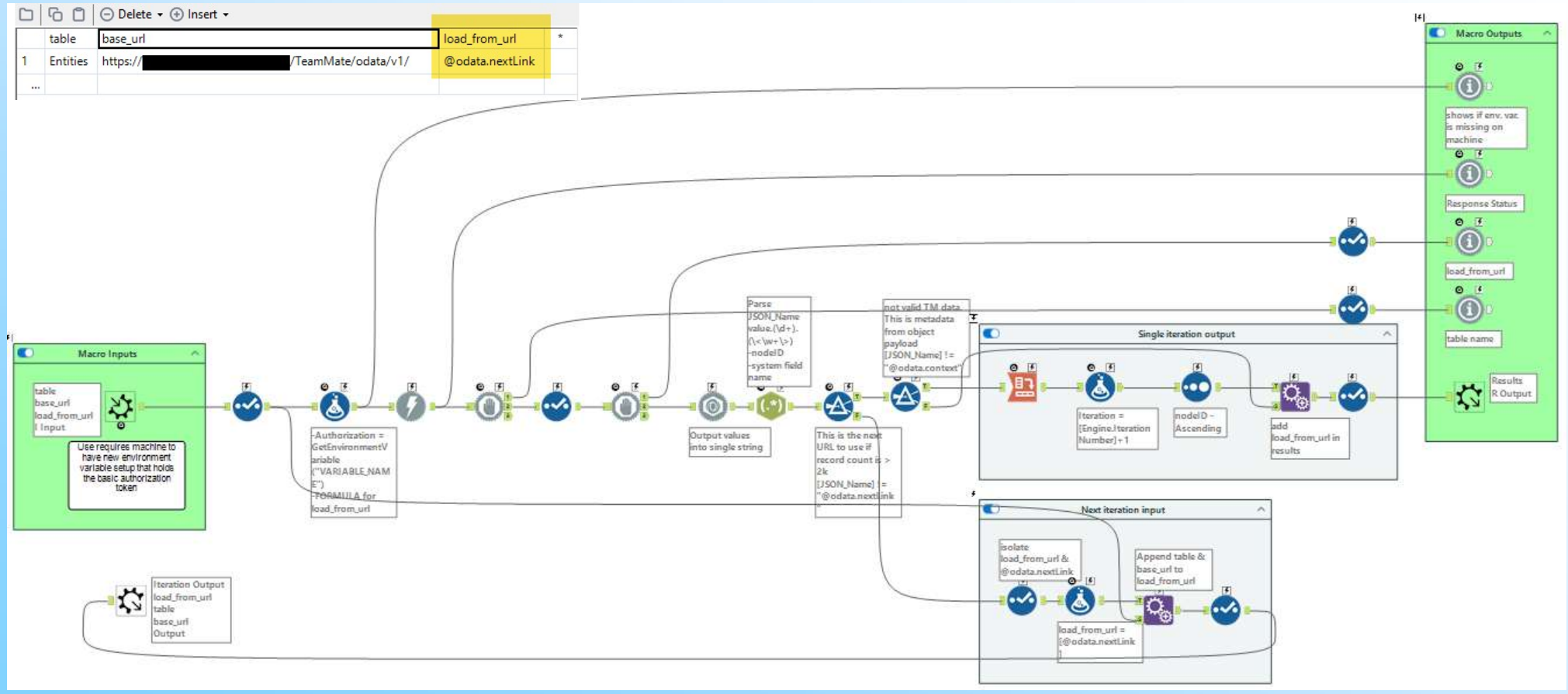
Required Header -> **Authorization**: Basic abc123…

base URL *object name*

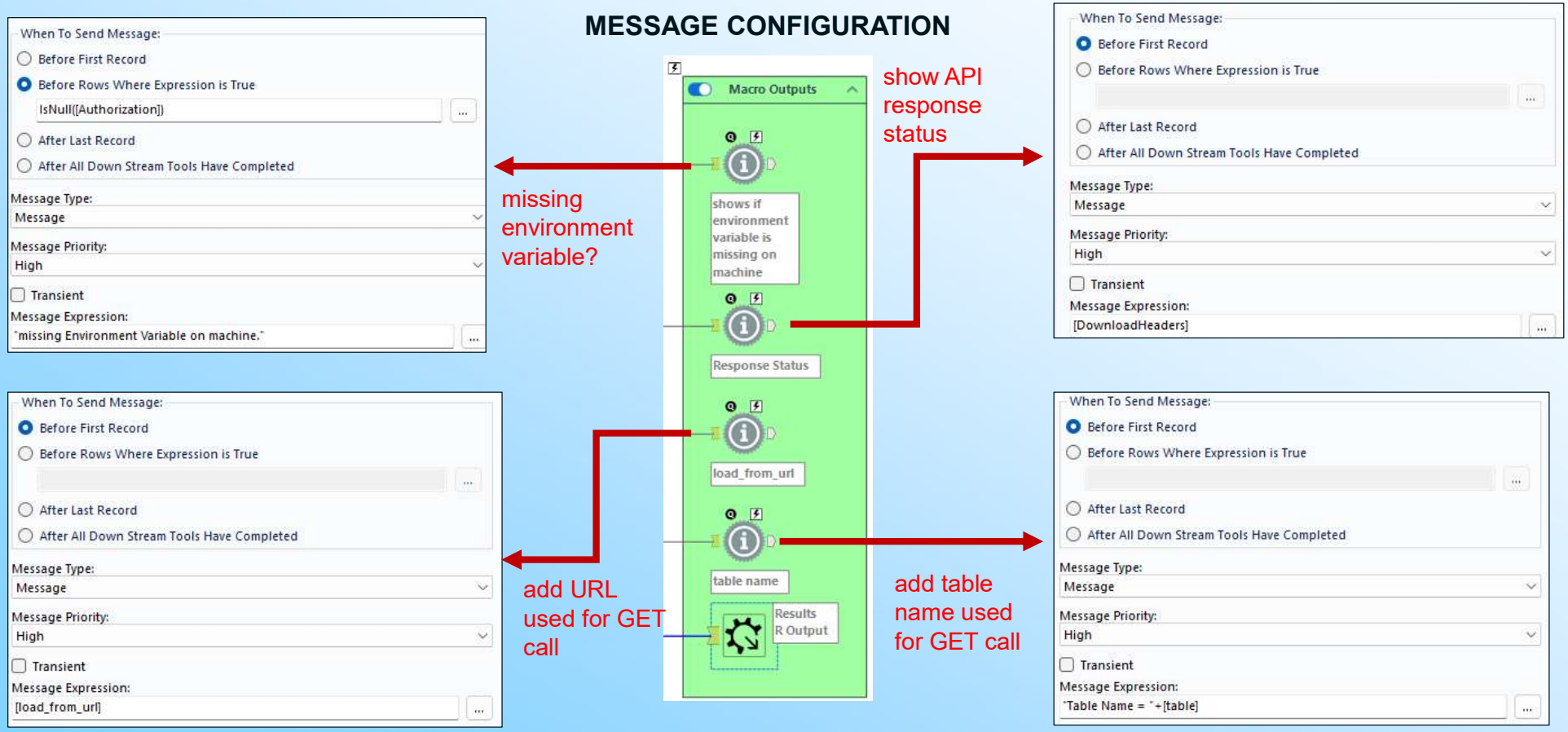
RECOMMENDED APPROACH:

- Always start with **Postman** when working with APIs and the Alteryx Download Tool.
- Store Authorization token as an environment variable. Use **GetEnvironmentVariable**("variable_name") in formula tool
- **[Engine.IterationNumber]** is your friend.
- Use Message **IsNull([Authorization])** to identify if error is caused by missing environment variable on designer/server machine.
- Use Message Expression **[DownloadHeaders]** to show response status in results messages
- When executing multiple GET calls, 2 message expressions will assist with problem-solving future connection issues.
  - "Table Name = "+[table]
  - [load_from_url]

Audit System Data Extractor (Iterative Macro)



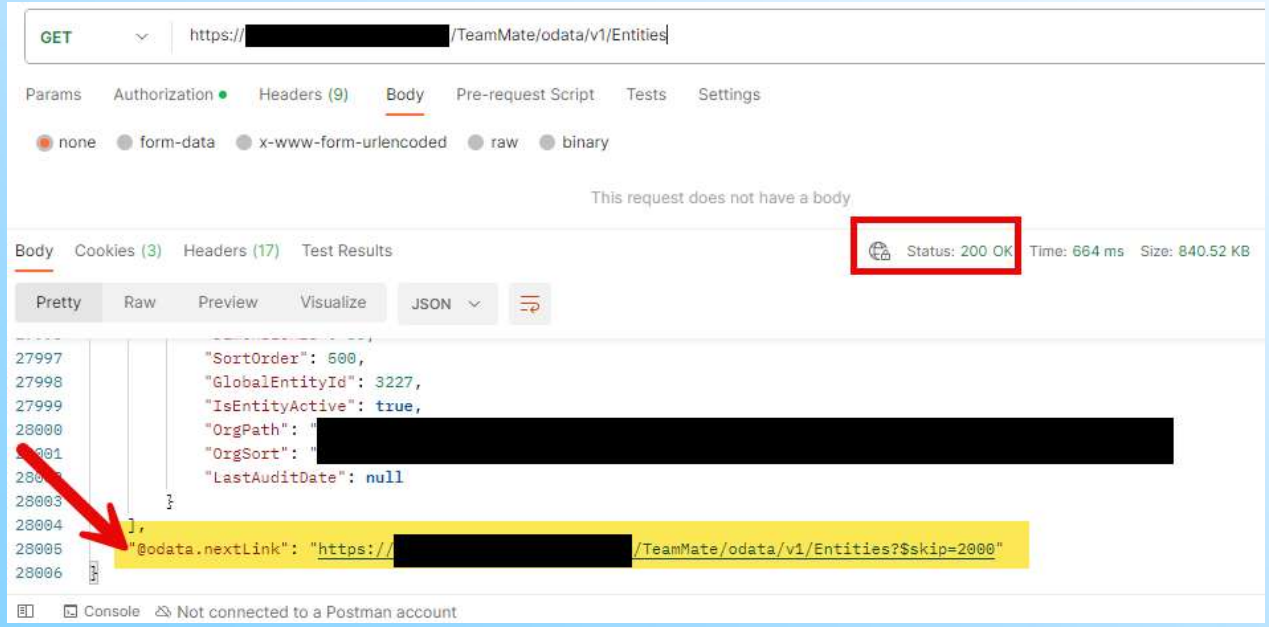
Audit System Data Extractor (Iterative Macro)



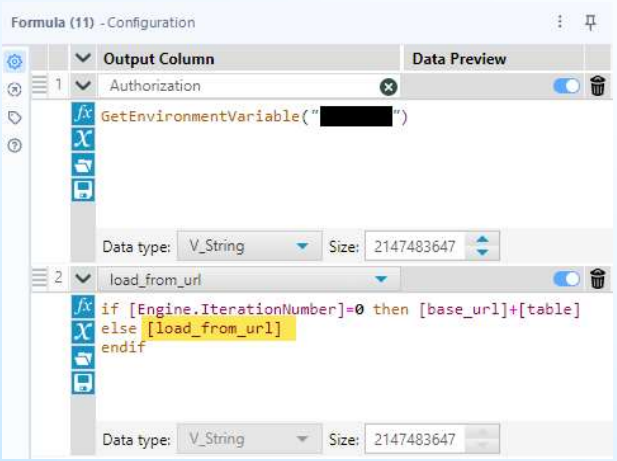
Audit System Data Extractor (Iterative Macro)

What is @odata.nextLink?

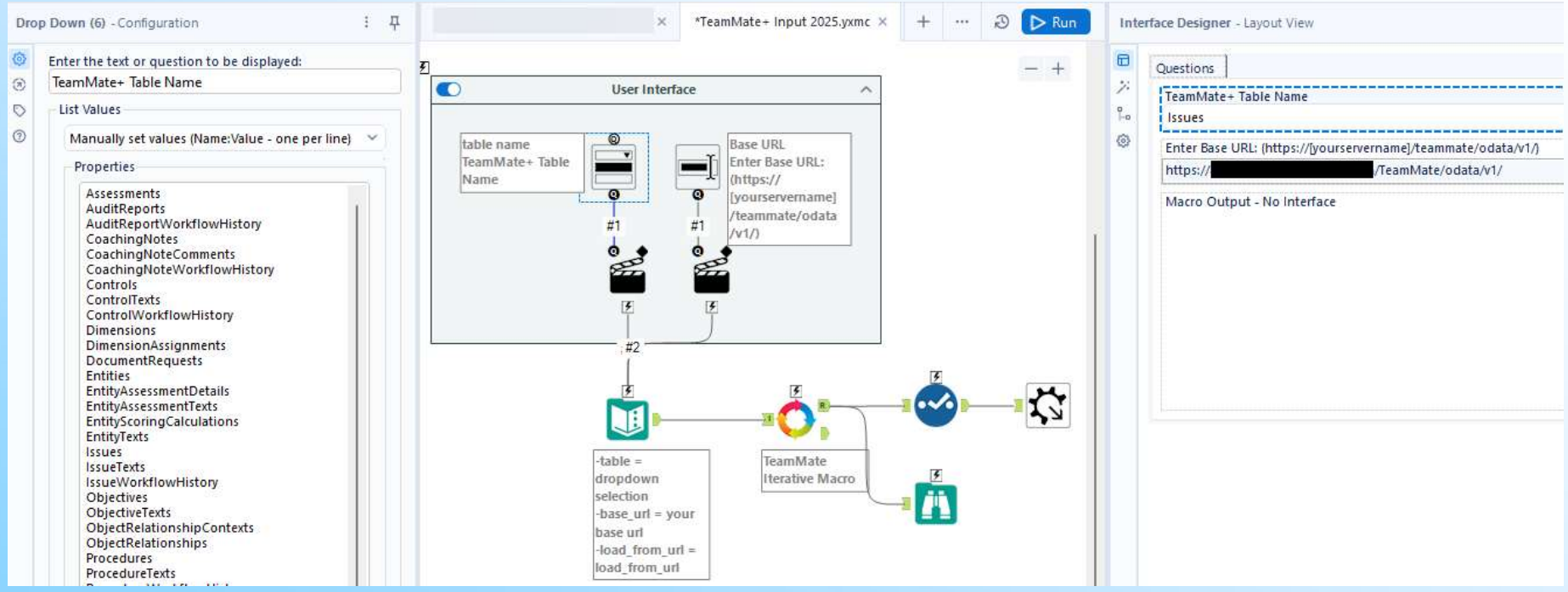
Postman GET call output example:



Alteryx formula tool:



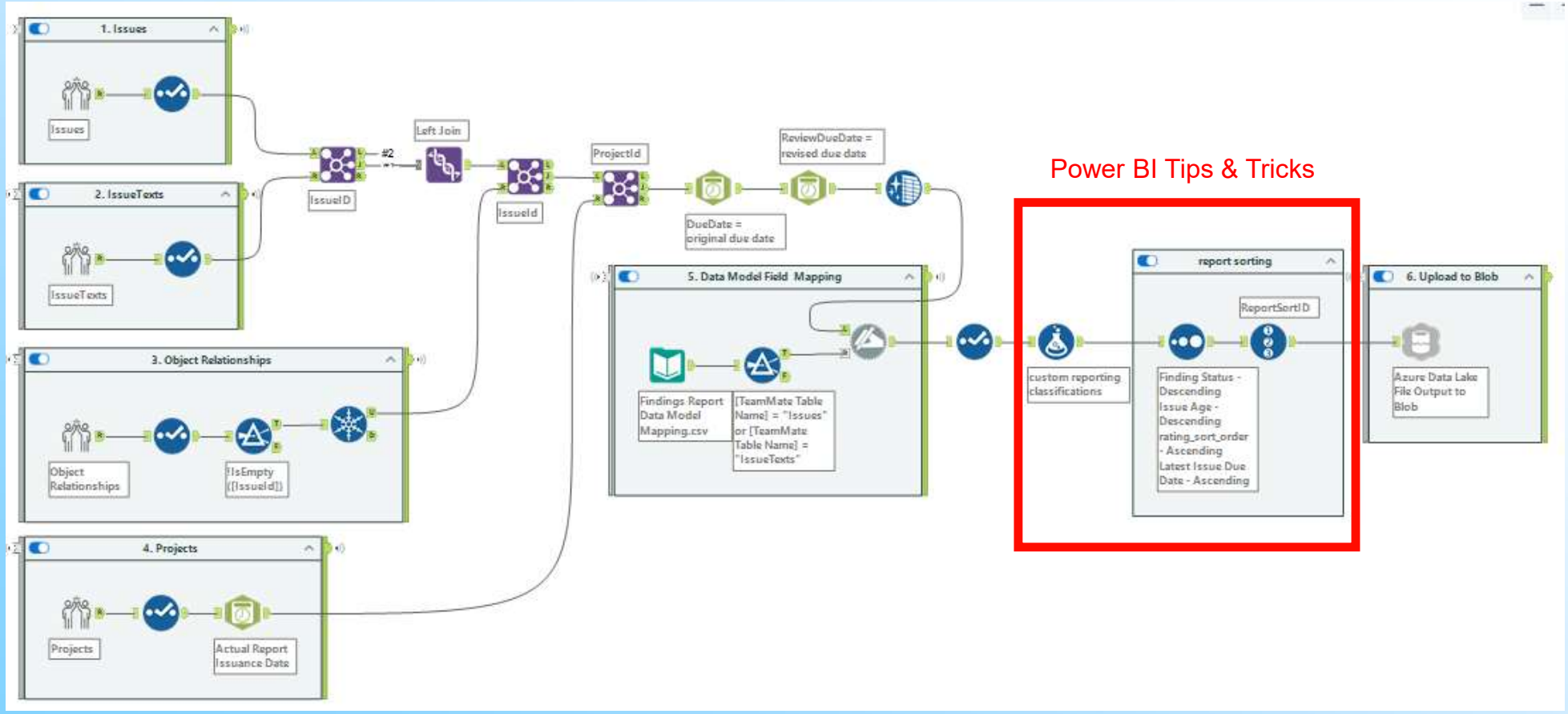
Audit System Data Extractor (Standard Macro)



RECOMMENDED APPROACH:

- Store team macros on a network drive with **relative paths**.
- Check your Workflow Dependencies!
- Document your version control IN the workflow using comment boxes.
- Document your process with tool annotations, containers, and process narratives.

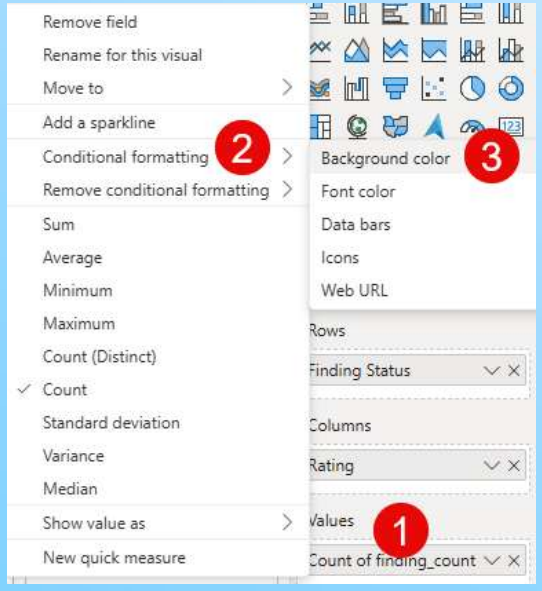
Reporting Workflow (demo sample)



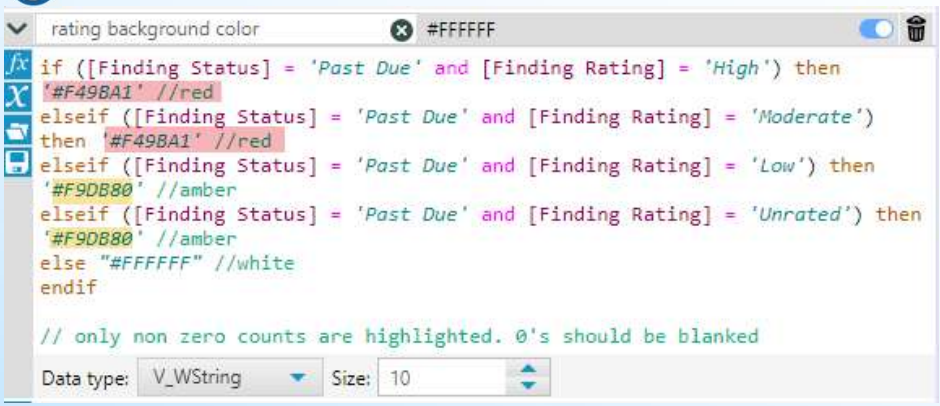
Power BI / Alteryx – Conditional Formatting

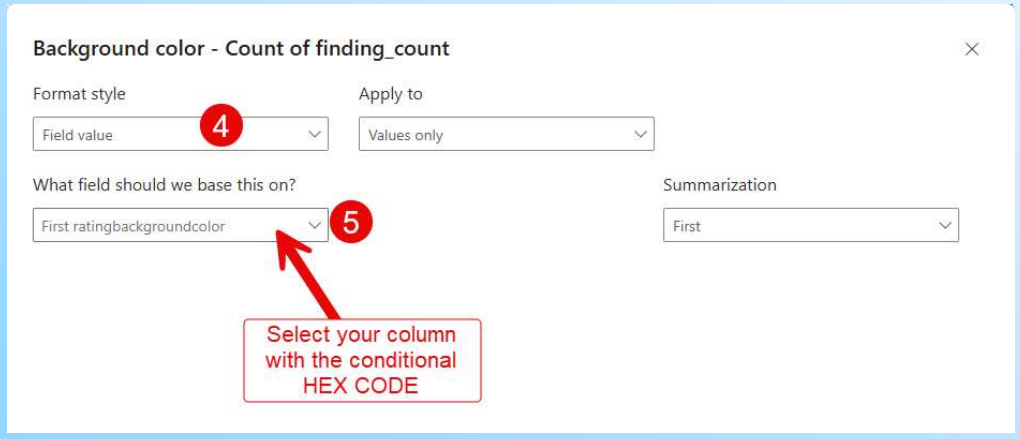
POWER BI MATRIX OUTPUT:

Finding Status	High	Moderate	Low	Unrated	Total
Past Due	6	1	1	1	9
Open	3	6	1		10
GIA Validation-In Progress	1	4	3		8
Total	10	11	5	1	27



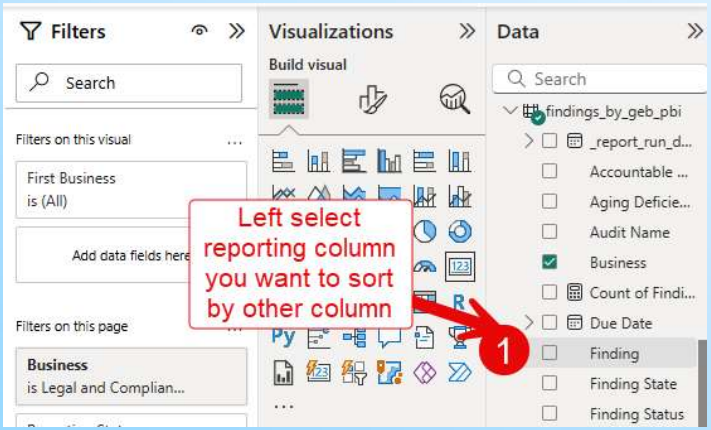
BACKGROUND COLOR HEX CODES IN ALTERYX:

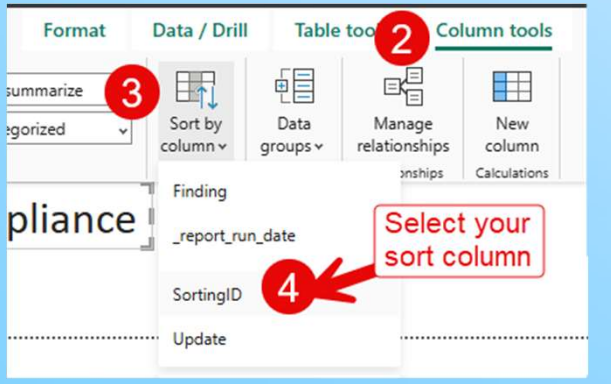




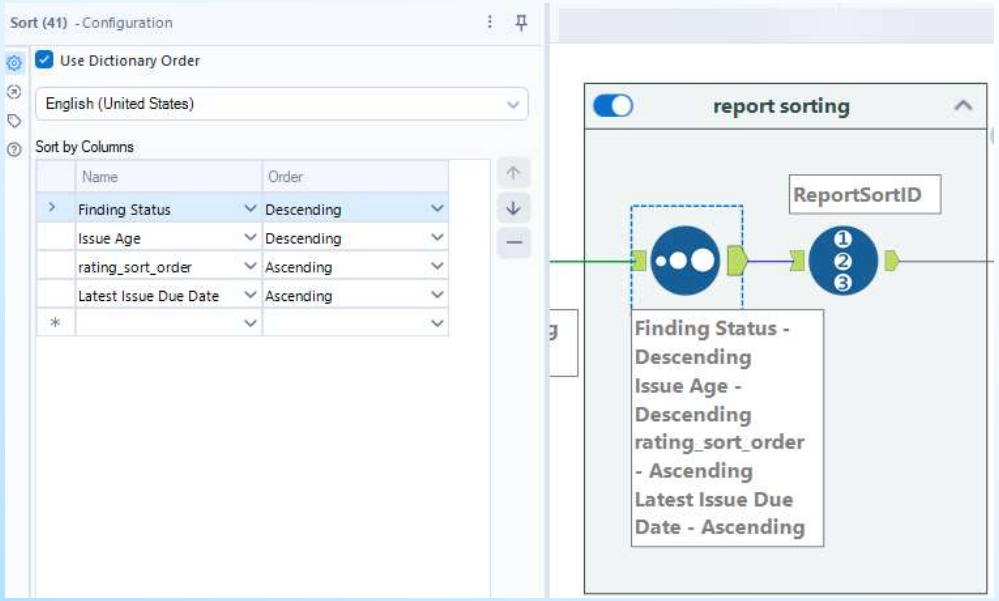
Power BI / Alteryx – Sort By Other Column

POWER BI TABLE PROCESS:





BACKGROUND COLOR HEX CODES IN ALTERYX:



POWER BI LIMITATIONS BASED ON DATA SOURCE:
Flat file => Use 'Sort by column' shown on this slide
Direct Query => Add column to table & reduce column size to bare minimum.

Data Health App Use Case

PROBLEM STATEMENT

As an auditor, I need a quick and easy way to assess the quality and completeness of data provided by stakeholders so that I can determine its reliability for audit procedures without being an expert in data analytics.

CHALLENGES

- Varying levels of data literacy among auditors
- Inconsistent data quality from stakeholders
- Time constraints in audit engagements
- Potential for overlooking critical data issues
- Difficulty in standardizing data health assessments across audits

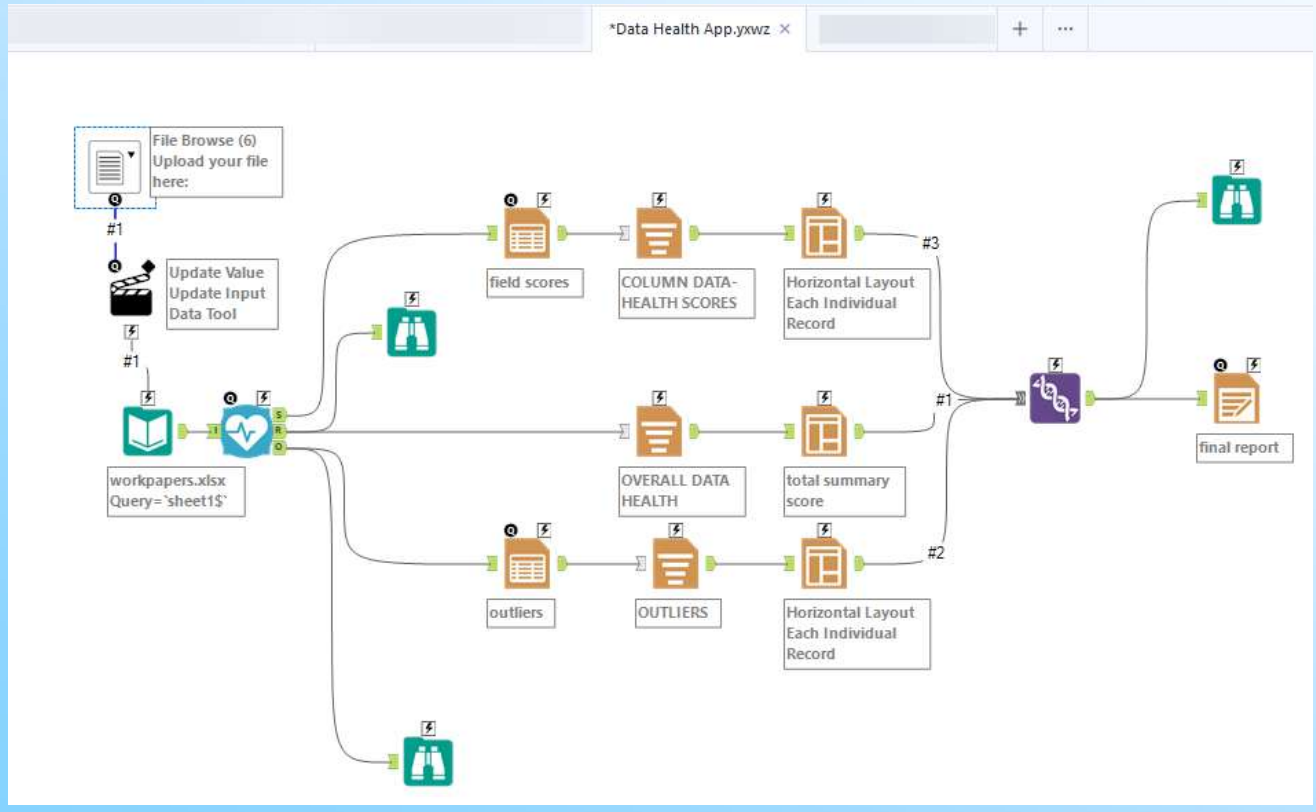
OPPORTUNITIES

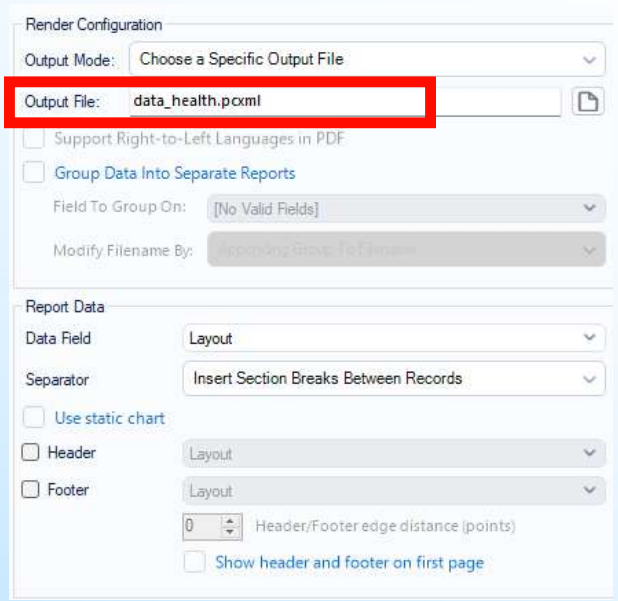
- Streamline data quality assessment process
- Empower auditors with user-friendly analytics tools
- Improve audit efficiency and effectiveness
- Enhance data-driven decision making in audits
- Standardize data health evaluation across the organization
- Foster a data-conscious culture within the audit team

IMPACT INDICATORS

- ✓ Increased confidence in data reliability
- ✓ Reduction in time spent on initial data assessment
- ✓ Improved audit quality & reduced risk of oversight
- ✓ Positive feedback from audit team on tool usability and value

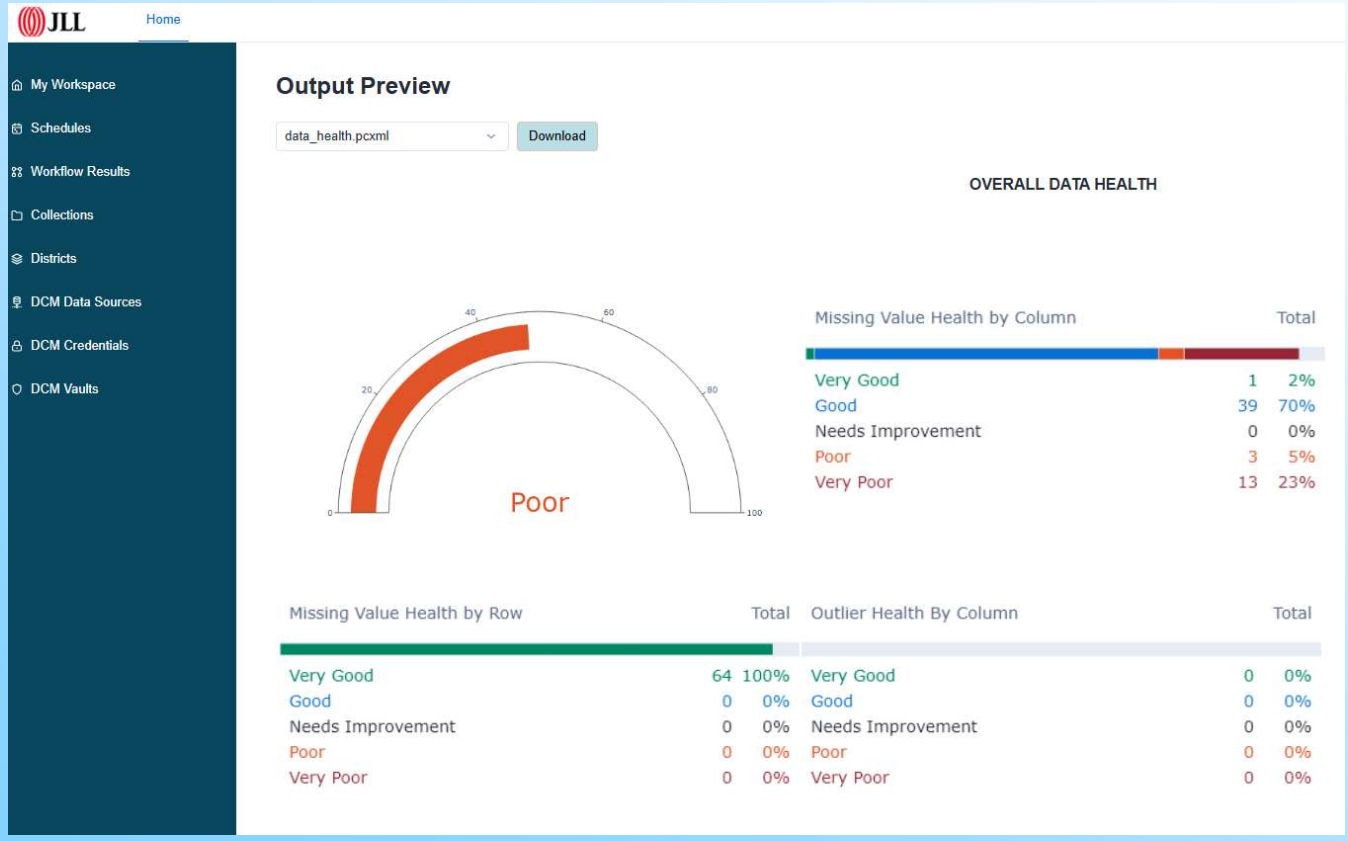
Data Health App (Intelligence Suite required on Server)



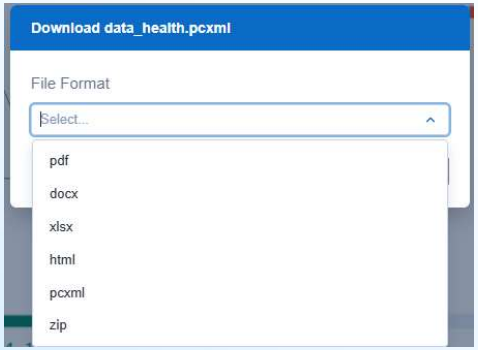


Data Health App (Intelligence Suite required on Server)

Business Users can quickly the OVERALL HEALTH before downloading:

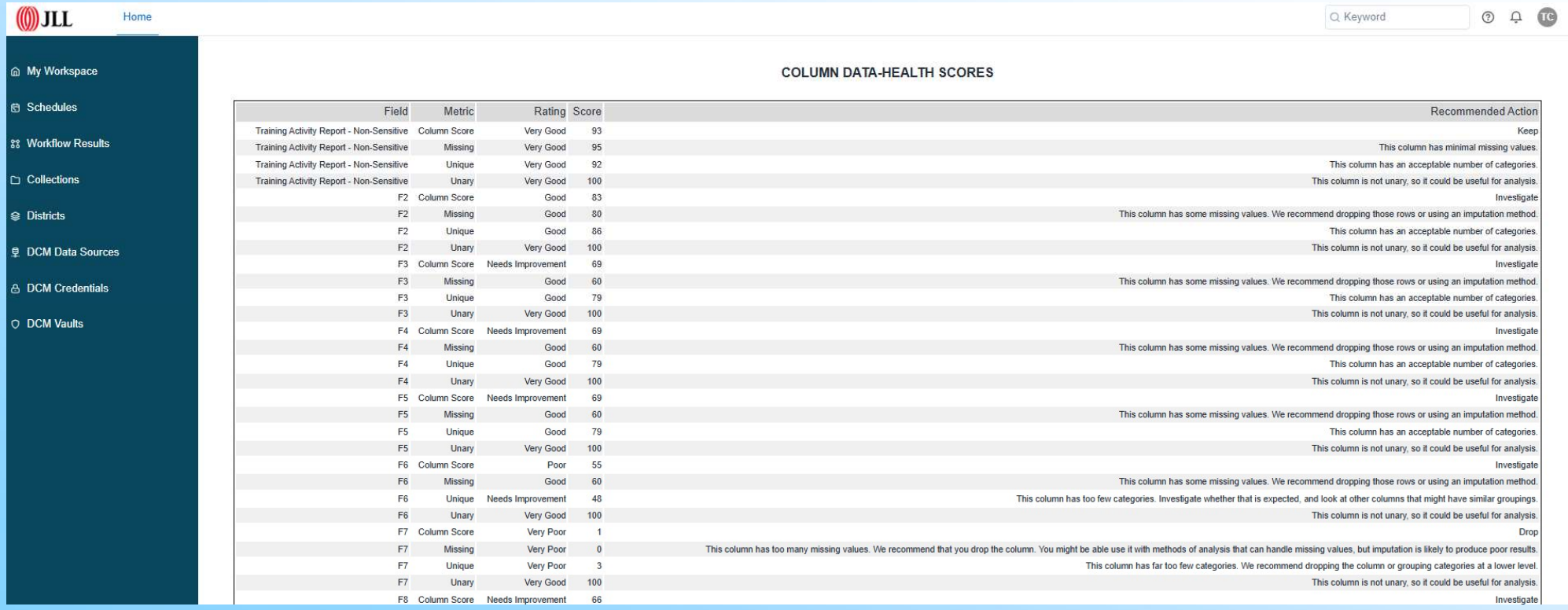


Download in any format:



Data Health App (Intelligence Suite required on Server)

Business Users can quickly the individual COLUMN HEALTH SCORES before downloading:



COLUMN DATA-HEALTH SCORES

Field	Metric	Rating	Score	Recommended Action
Training Activity Report - Non-Sensitive	Column Score	Very Good	93	Keep
Training Activity Report - Non-Sensitive	Missing	Very Good	95	This column has minimal missing values.
Training Activity Report - Non-Sensitive	Unique	Very Good	92	This column has an acceptable number of categories.
Training Activity Report - Non-Sensitive	Unary	Very Good	100	This column is not unary, so it could be useful for analysis.
F2	Column Score	Good	83	Investigate
F2	Missing	Good	80	This column has some missing values. We recommend dropping those rows or using an imputation method.
F2	Unique	Good	86	This column has an acceptable number of categories.
F2	Unary	Very Good	100	This column is not unary, so it could be useful for analysis.
F3	Column Score	Needs Improvement	69	Investigate
F3	Missing	Good	60	This column has some missing values. We recommend dropping those rows or using an imputation method.
F3	Unique	Good	79	This column has an acceptable number of categories.
F3	Unary	Very Good	100	This column is not unary, so it could be useful for analysis.
F4	Column Score	Needs Improvement	69	Investigate
F4	Missing	Good	60	This column has some missing values. We recommend dropping those rows or using an imputation method.
F4	Unique	Good	79	This column has an acceptable number of categories.
F4	Unary	Very Good	100	This column is not unary, so it could be useful for analysis.
F5	Column Score	Needs Improvement	69	Investigate
F5	Missing	Good	60	This column has some missing values. We recommend dropping those rows or using an imputation method.
F5	Unique	Good	79	This column has an acceptable number of categories.
F5	Unary	Very Good	100	This column is not unary, so it could be useful for analysis.
F6	Column Score	Poor	55	Investigate
F6	Missing	Good	60	This column has some missing values. We recommend dropping those rows or using an imputation method.
F6	Unique	Needs Improvement	48	This column has too few categories. Investigate whether that is expected, and look at other columns that might have similar groupings.
F6	Unary	Very Good	100	This column is not unary, so it could be useful for analysis.
F7	Column Score	Very Poor	1	Drop
F7	Missing	Very Poor	0	This column has too many missing values. We recommend that you drop the column. You might be able use it with methods of analysis that can handle missing values, but imputation is likely to produce poor results.
F7	Unique	Very Poor	3	This column has far too few categories. We recommend dropping the column or grouping categories at a lower level.
F7	Unary	Very Good	100	This column is not unary, so it could be useful for analysis.
F8	Column Score	Needs Improvement	66	Investigate

Text Mining & Sentiment Analysis App Use Case

PROBLEM STATEMENT

As an auditor, I need to efficiently extract and analyze data from contracts in MS Word format to test audit objectives and gain insights from unstructured text data.

CHALLENGES

- Ingesting MS Word documents into Alteryx
- Handling file path issues (backslashes vs. forward slashes)
- Implementing Python code within Alteryx workflow
- Balancing technical complexity with user-friendly interface
- Ensuring scalability for processing multiple documents

OPPORTUNITIES

- Automate text extraction from MS Word documents
- Apply advanced text mining and sentiment analysis techniques
- Visualize key themes and sentiments in contracts
- Empower auditors with self-service text analytics capabilities
- Standardize approach to unstructured data analysis in audits

IMPACT INDICATORS

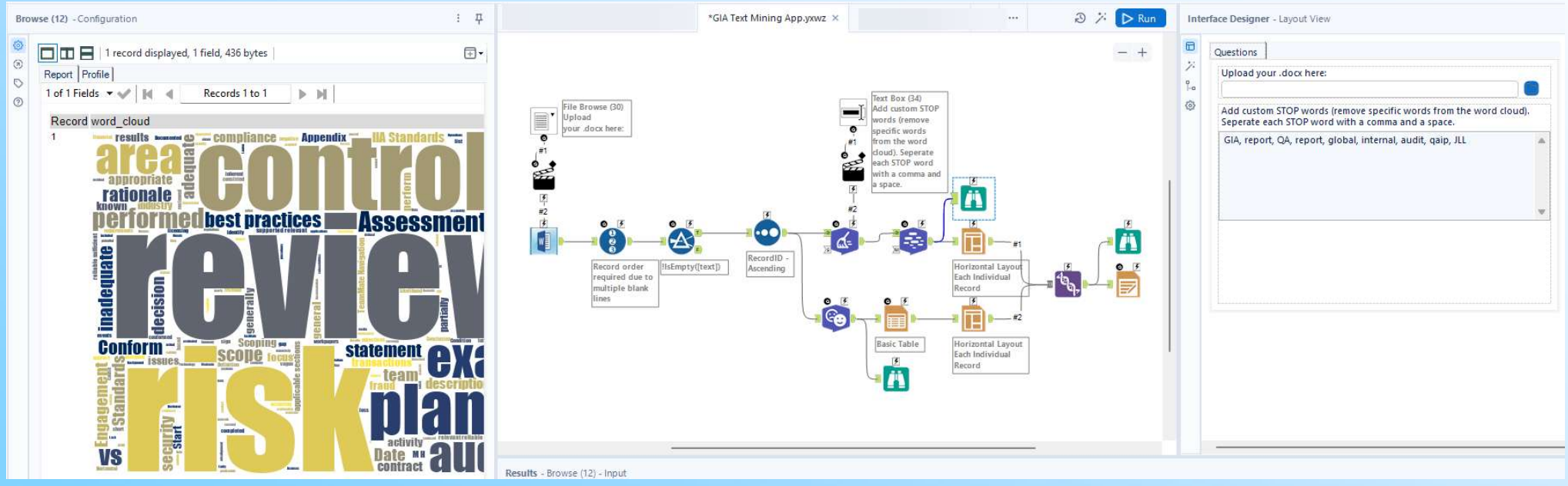
- ✓ Increased accuracy in identifying key themes and risks
- ✓ Improved decision-making based on sentiment analysis insights
- ✓ Scalable solution applicable to various document types and audit scenarios
- ✓ Enhanced audit quality through comprehensive text analysis

Text Mining & Sentiment Analysis App Overview

OVERVIEW:
Our Text Mining & Sentiment Analysis App leverages Alteryx's powerful workflow capabilities and Python integration to extract insights from MS Word documents.

INTELLIGENCE SUITE TOOLS USED:
Text Pre-Processing, Word Cloud, Sentiment Analysis

KEY COMPONENTS:
- File input and preprocessing
- Text extraction using Python (docx2txt)
- Text preprocessing (stop words removal)
- Word cloud generation
- Sentiment analysis by sentence



*Intelligence Suite required on Server

MS Word Parser Macro

OVERVIEW:
The standard macro uses custom Python code with Alteryx's native text analytics capabilities, enabling efficient processing of unstructured data in MS Word format (.docx)

Credit to @RogerS, Alteryx Solution Engineer, for the original macro concept

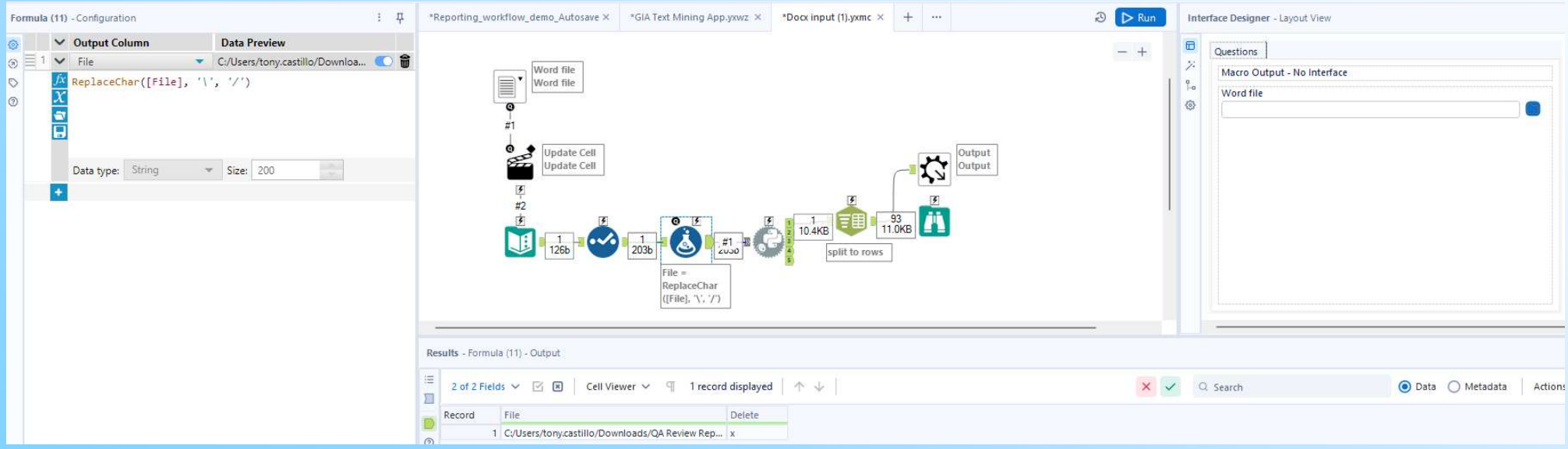
PYTHON SNIPPET:

Production Mode

```
################################
from ayx import Alteryx
Alteryx.installPackages("docx2txt")
import pandas
import docx2txt
input =  Alteryx.read("#1")
file = input.iloc[0,0]
file


################################
text = docx2txt.process(file)
df = pandas.DataFrame({"text":[text]})
Alteryx.write(df,1)
```

DOWNLOAD MACRO:



Text Mining & Sentiment Analysis App Output

Output Preview

y.pcxml Download

RecordID	text	negative_sentiment	neutral_sentiment	positive_sentiment	compound_sentiment_score	sentiment_category
1	Internal	0.00	1.00	0.00	0.00	neutral
3	Internal	0.00	1.00	0.00	0.00	neutral
7	Internal	0.00	1.00	0.00	0.00	neutral
9	Internal	0.00	1.00	0.00	0.00	neutral
13	Internal	0.00	1.00	0.00	0.00	neutral
15	Internal	0.00	1.00	0.00	0.00	neutral
17	2025 Q1 Ops Audits – Lessons Learned Recaps	0.00	1.00	0.00	0.00	neutral
19	Objective	0.00	1.00	0.00	0.00	neutral
21	To share knowledge and learn from each other, GIA will be conducting lessons learned recaps.	0.00	0.86	0.14	0.30	neutral
23	At the end of each engagement, there will be a quick call with the engagement team to capture:	0.00	0.71	0.29	0.72	positive
25	High-level understanding of the area or process reviewed.	0.00	1.00	0.00	0.00	neutral
27	Engagement findings.	0.00	0.25	0.75	0.46	neutral

*Intelligence Suite required on Server

Alteryx Integration: Key Outcomes & Benefits

1. Audit System Data Extractor
- Enabled automated data blending and transformation
- Enhanced audit precision and efficiency

2. Data Health App
- Helps auditors check the health of datasets received from the business
- Analyzes missing values, outliers, and sparsity in structured data sets

3. Text Mining & Sentiment Analysis App
- Identifies key themes and trends within MS Word (PDF documents require different app)
- Generates sentiment analysis to indicate tone of each line in documents for targeted identification.

4. Audit System Active Users App
- Generates real-time list of active users within the GIA team without administrative access needed.
- Ideal for co-sourced models

5. Findings Management Reporting
- Separate reports for Executive owners and COOs
- Communicates status of open findings and raises risk awareness

THANK YOU!

Feel free to connect via LinkedIn for additional questions or comments