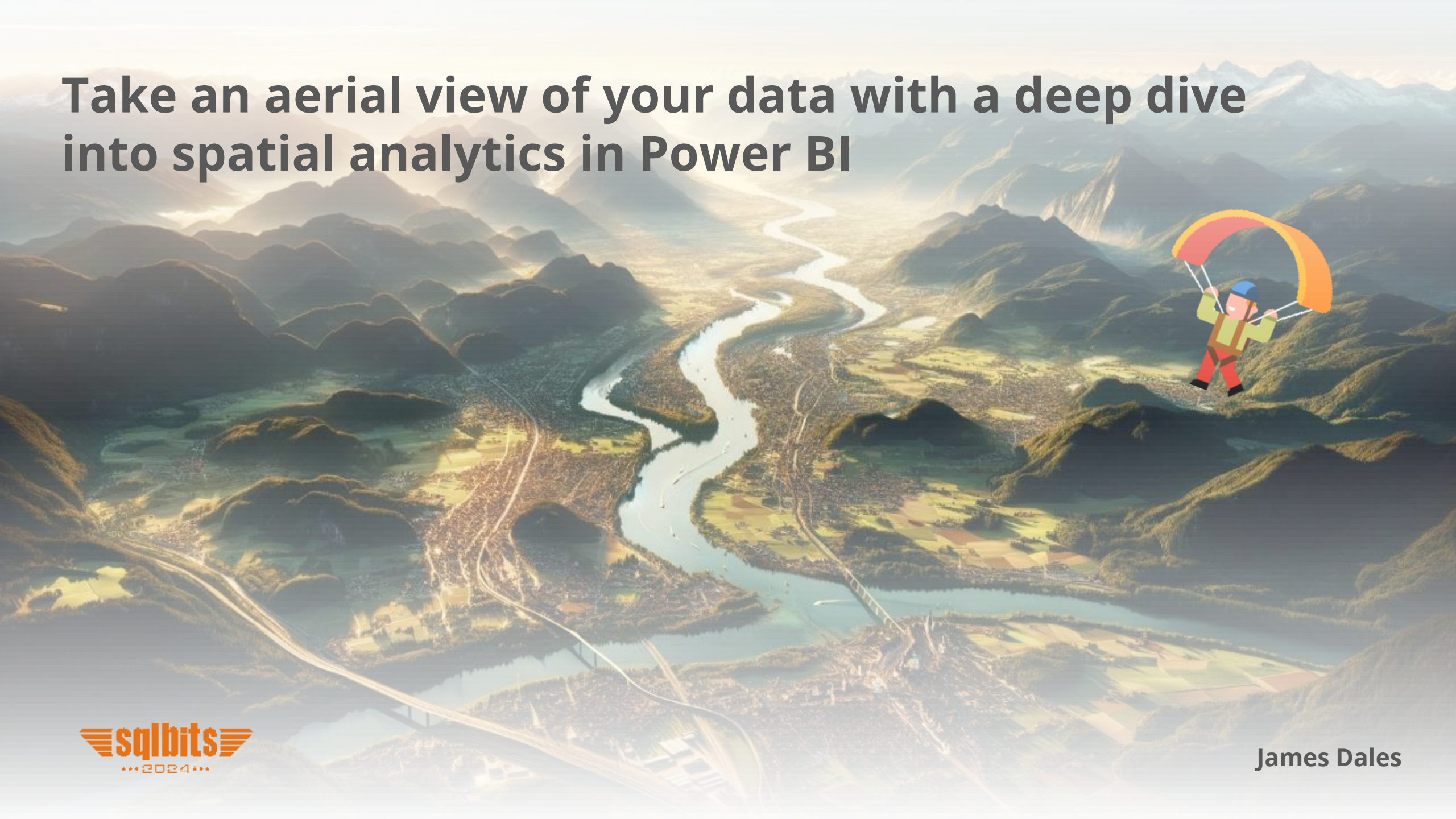
Take an aerial view of your data with a deep dive into spatial analytics in Power BI



sqlbits 2024

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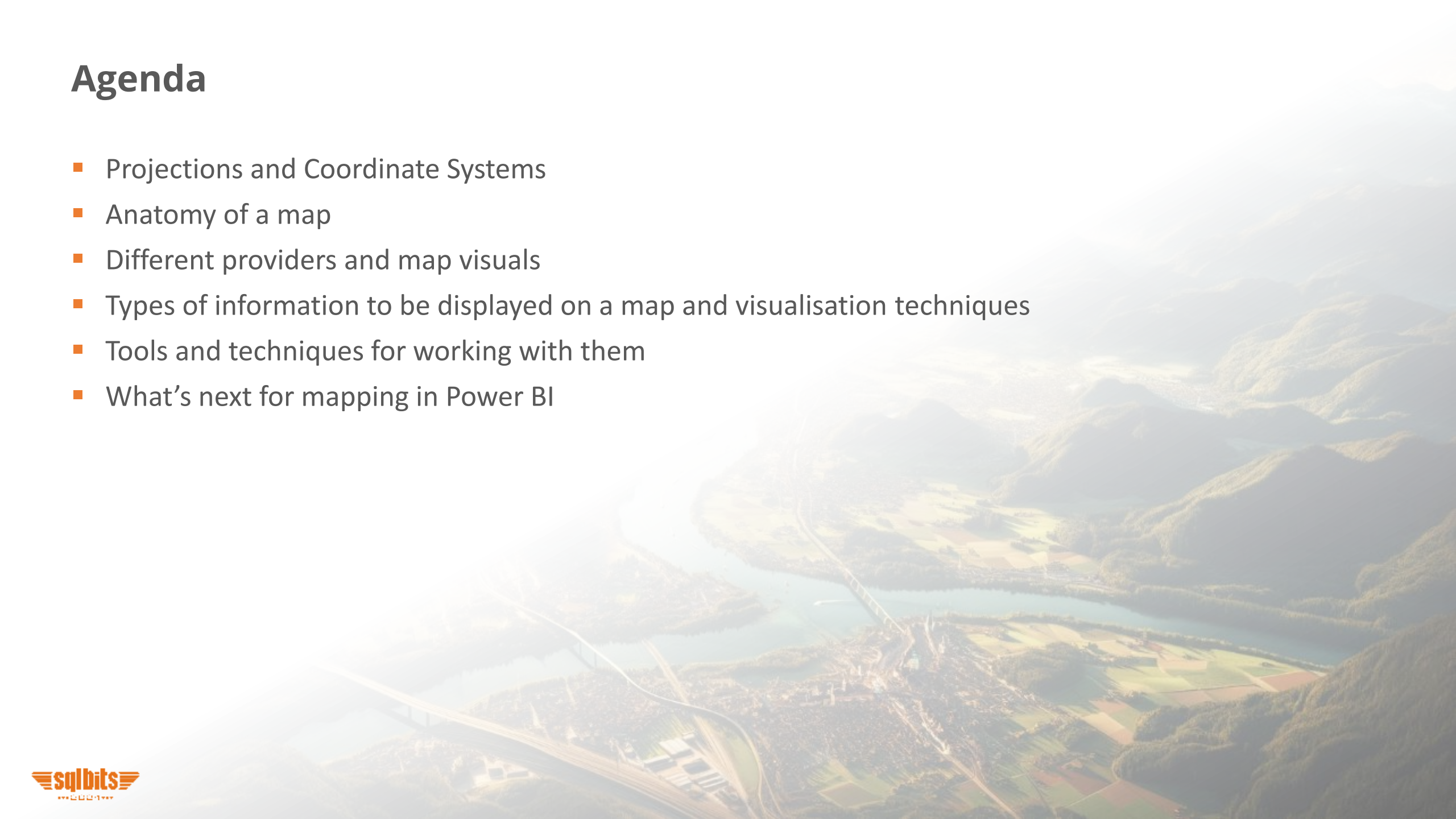
Microsoft Power Platform
FASTTRACK RECOGNIZED SOLUTION ARCHITECT
2023

MVP
Microsoft Most Valuable Professional

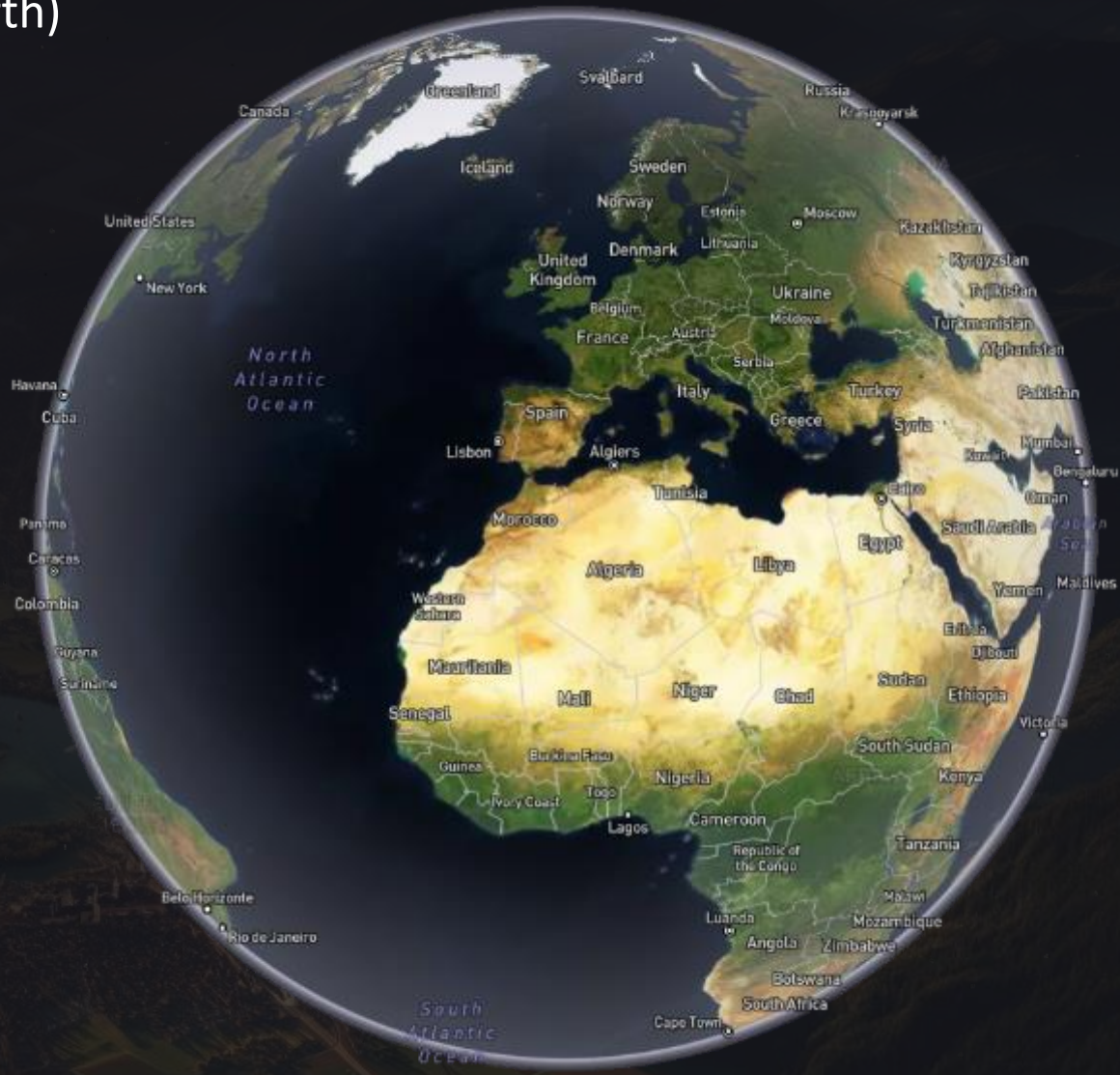
Agenda

- Projections and Coordinate Systems
- Anatomy of a map
- Different providers and map visuals
- Types of information to be displayed on a map and visualisation techniques
- Tools and techniques for working with them
- What's next for mapping in Power BI



Projections & Coordinate Systems

- We are trying to display items located on a sphere (Earth) onto a flat surface (our screens)

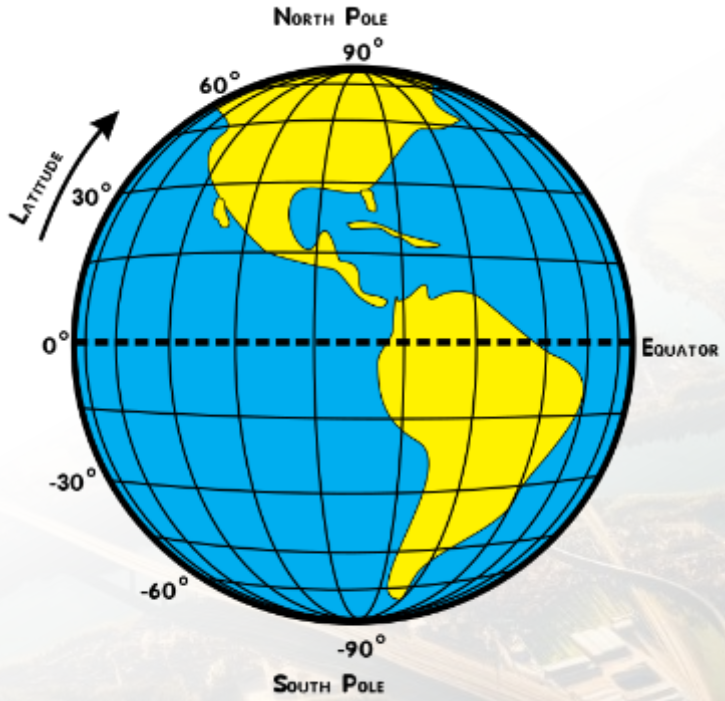


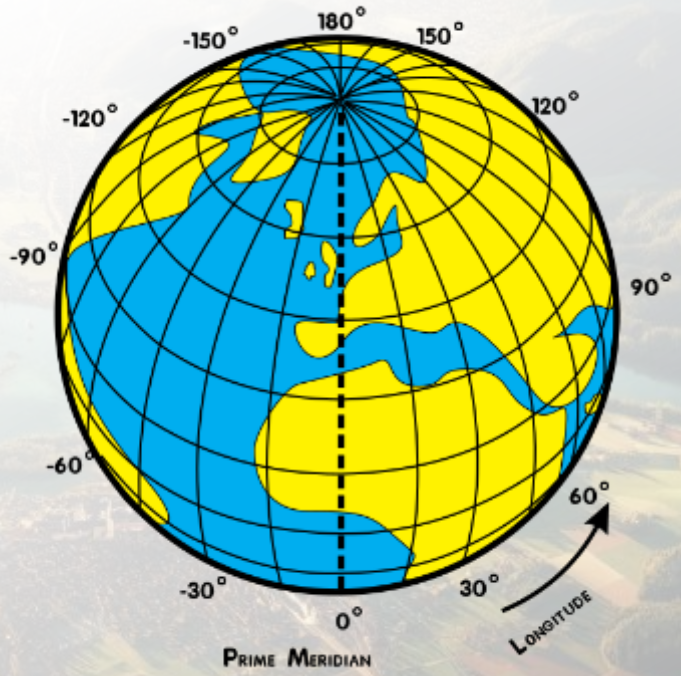
Projections & Coordinate Systems

- We are trying to display items located on an ellipsoid (Earth) onto a flat surface (our screens)
- To do this we have to stretch out the earth, projecting it onto the flat, square surface
- Most web mapping libraries
  (and therefore Power BI) use the
  Spherical Mercator, also known as Web Mercator projection
- It assumes that the Earth is a sphere which makes calculations fast
- It is identified by EPSG:3857

Projections & Coordinate Systems

- Once we have our map, we can now place items on it
- To do this we need to use coordinates
- Most web maps (and Power BI maps) use the WGS84 coordinate system for latitude and longitude
- This is also referred to by EPSG:4326





Projections & Coordinate Systems

In summary what we need to remember is:

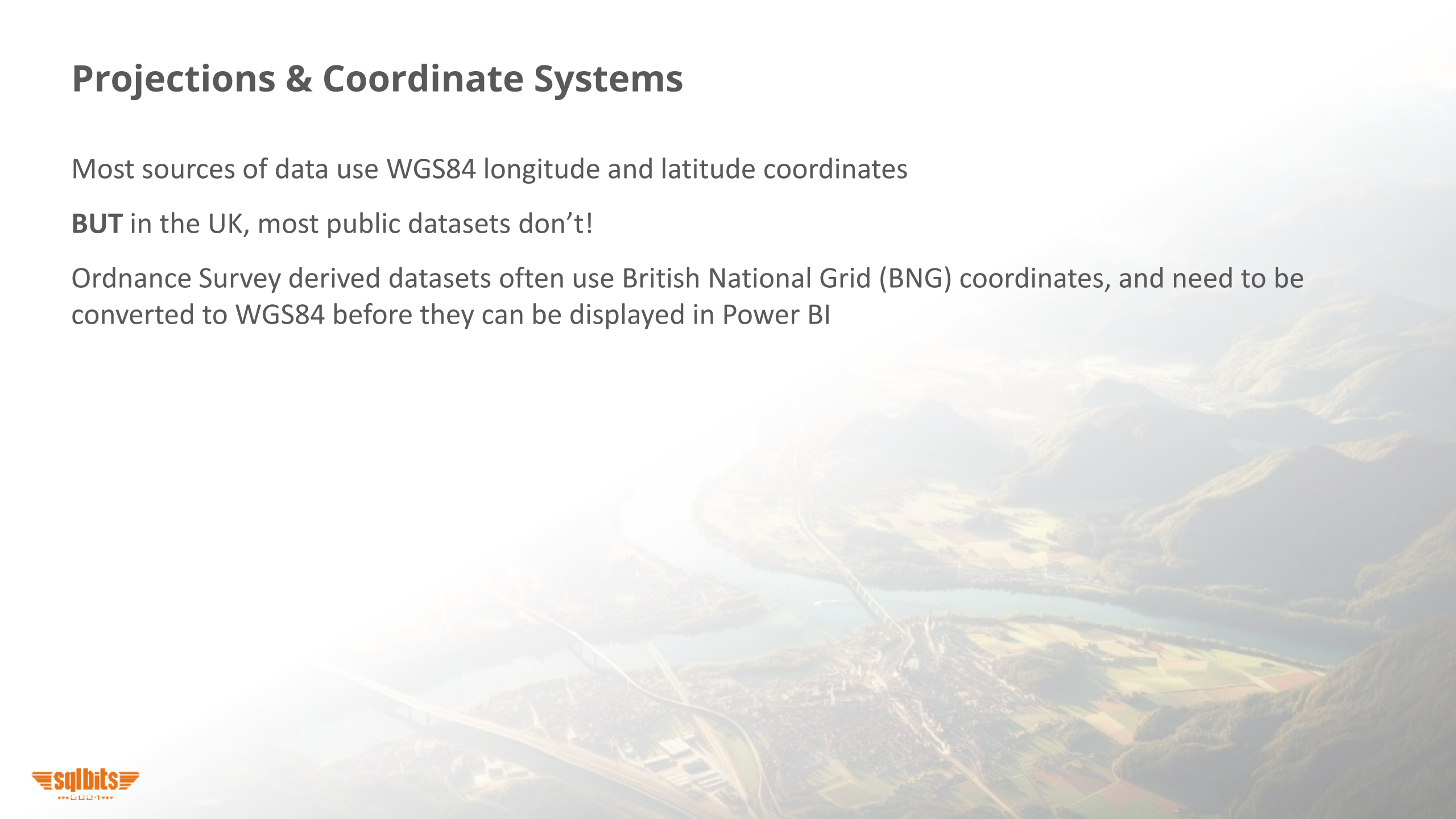
- Map tiles use EPSG:3857
- Coordinates for items displayed on the map are represented by EPSG:4326 (WGS84)

Projections & Coordinate Systems

Most sources of data use WGS84 longitude and latitude coordinates

BUT in the UK, most public datasets don't!

Ordnance Survey derived datasets often use British National Grid (BNG) coordinates, and need to be converted to WGS84 before they can be displayed in Power BI

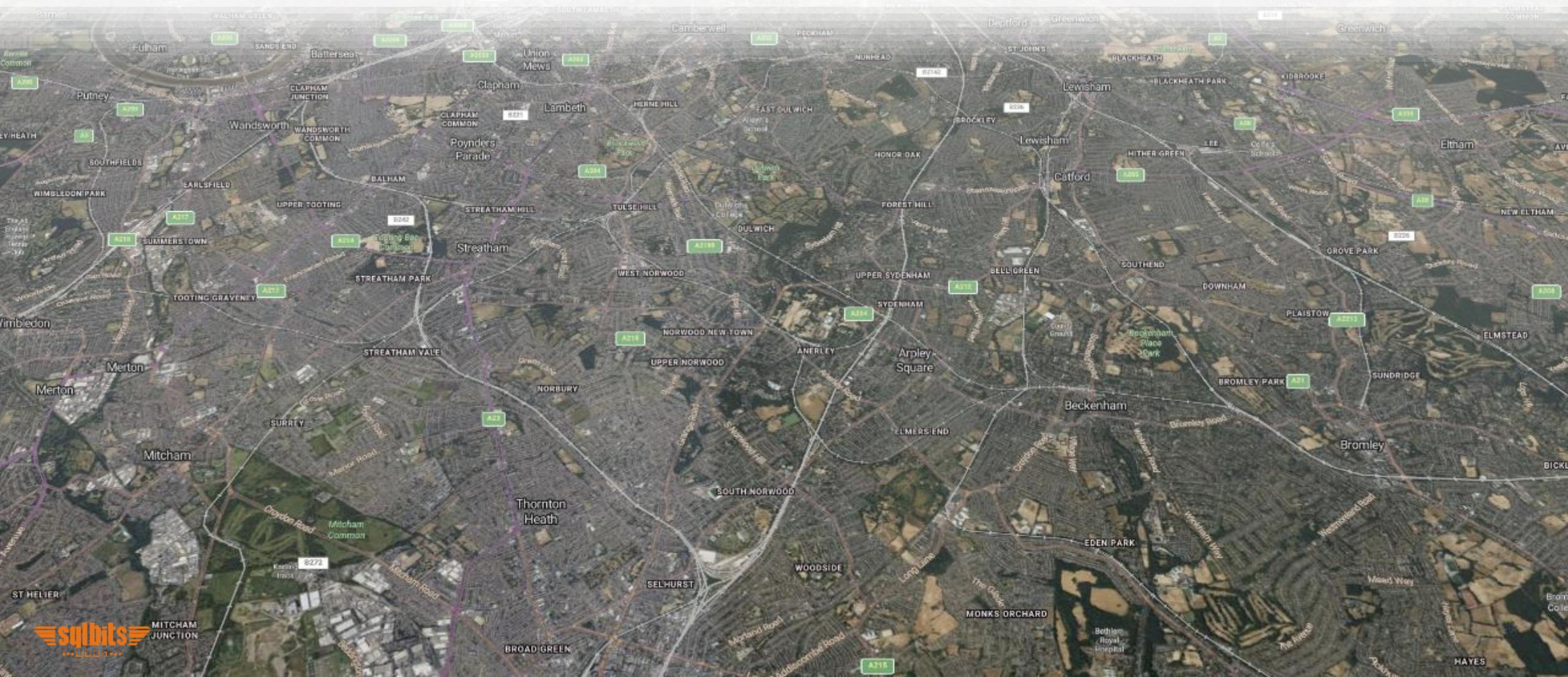


Anatomy of a map

What makes up a map?

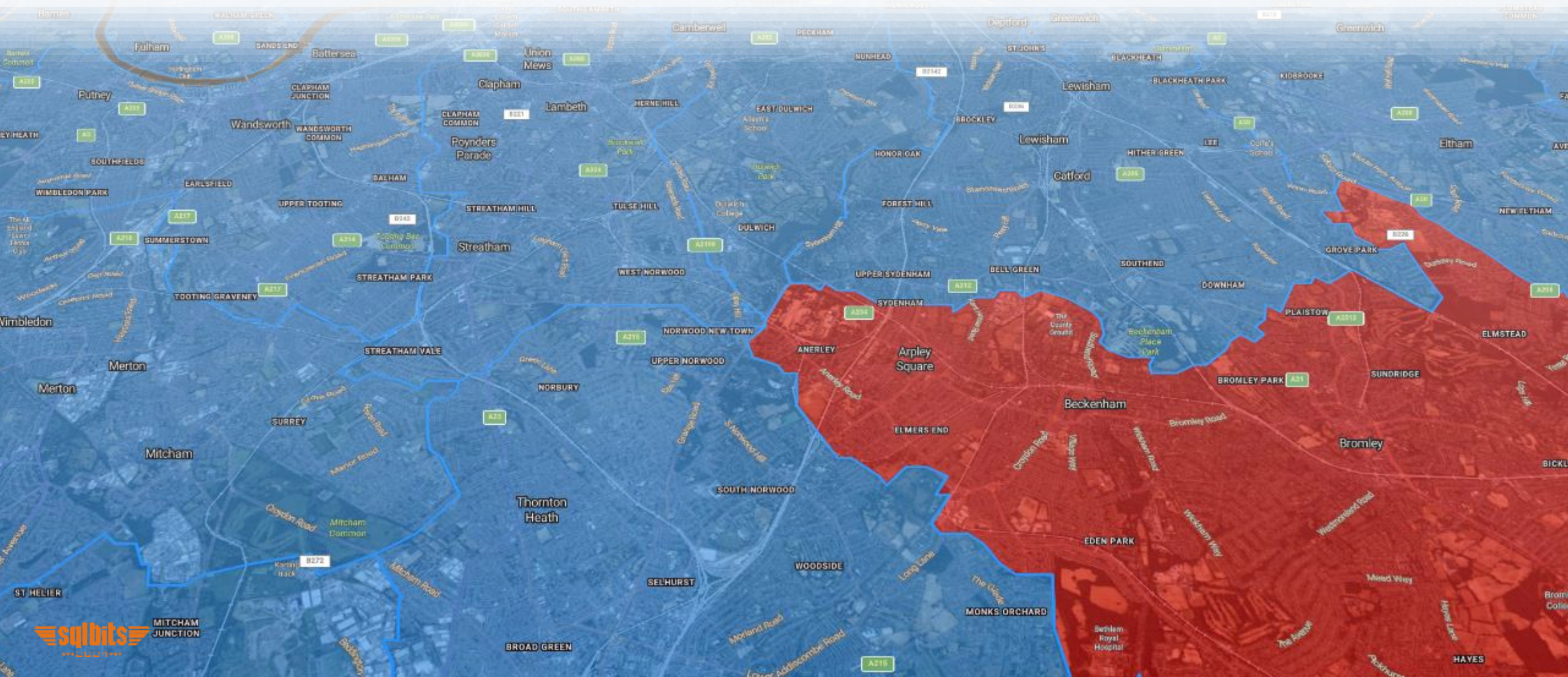
Anatomy of a map

Background



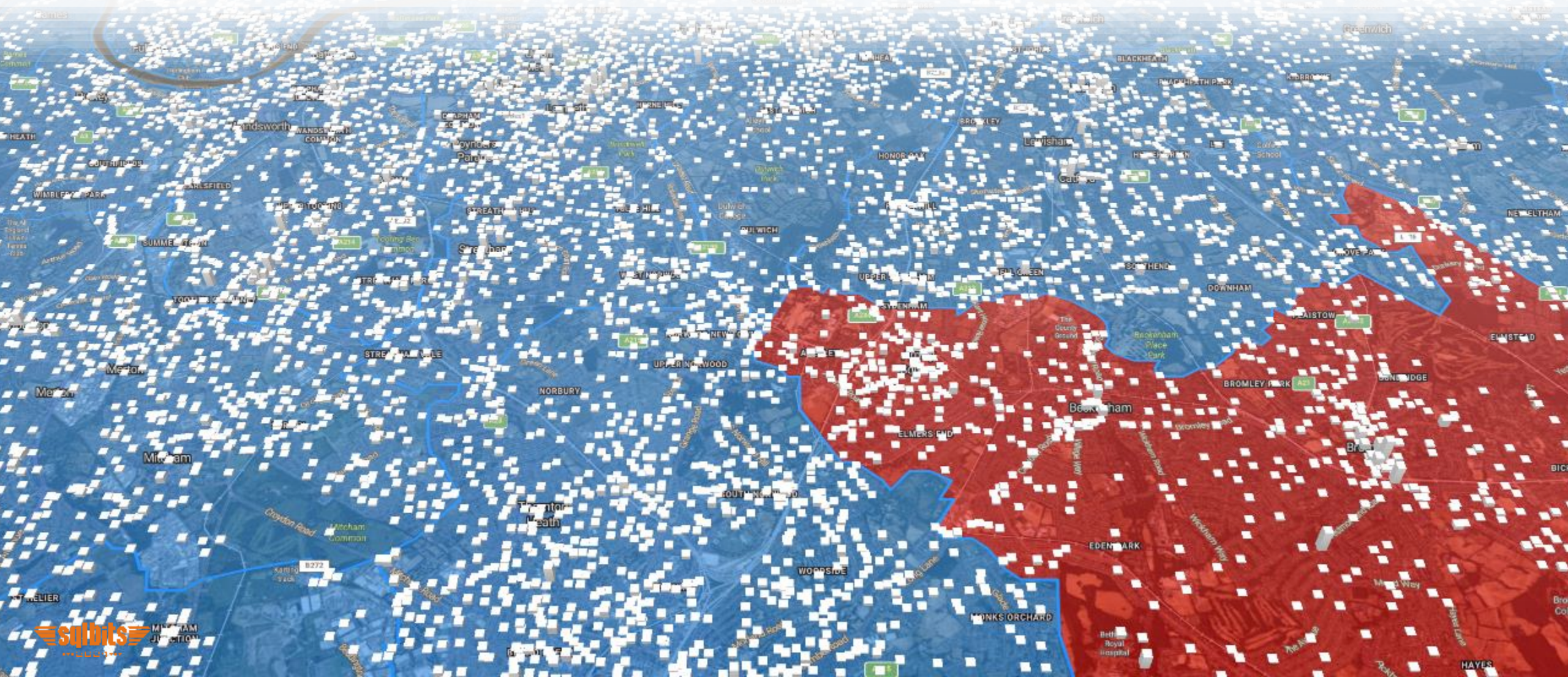
Anatomy of a map

Reference Information (not interactive)



Anatomy of a map

Interactive data from our Power BI dataset

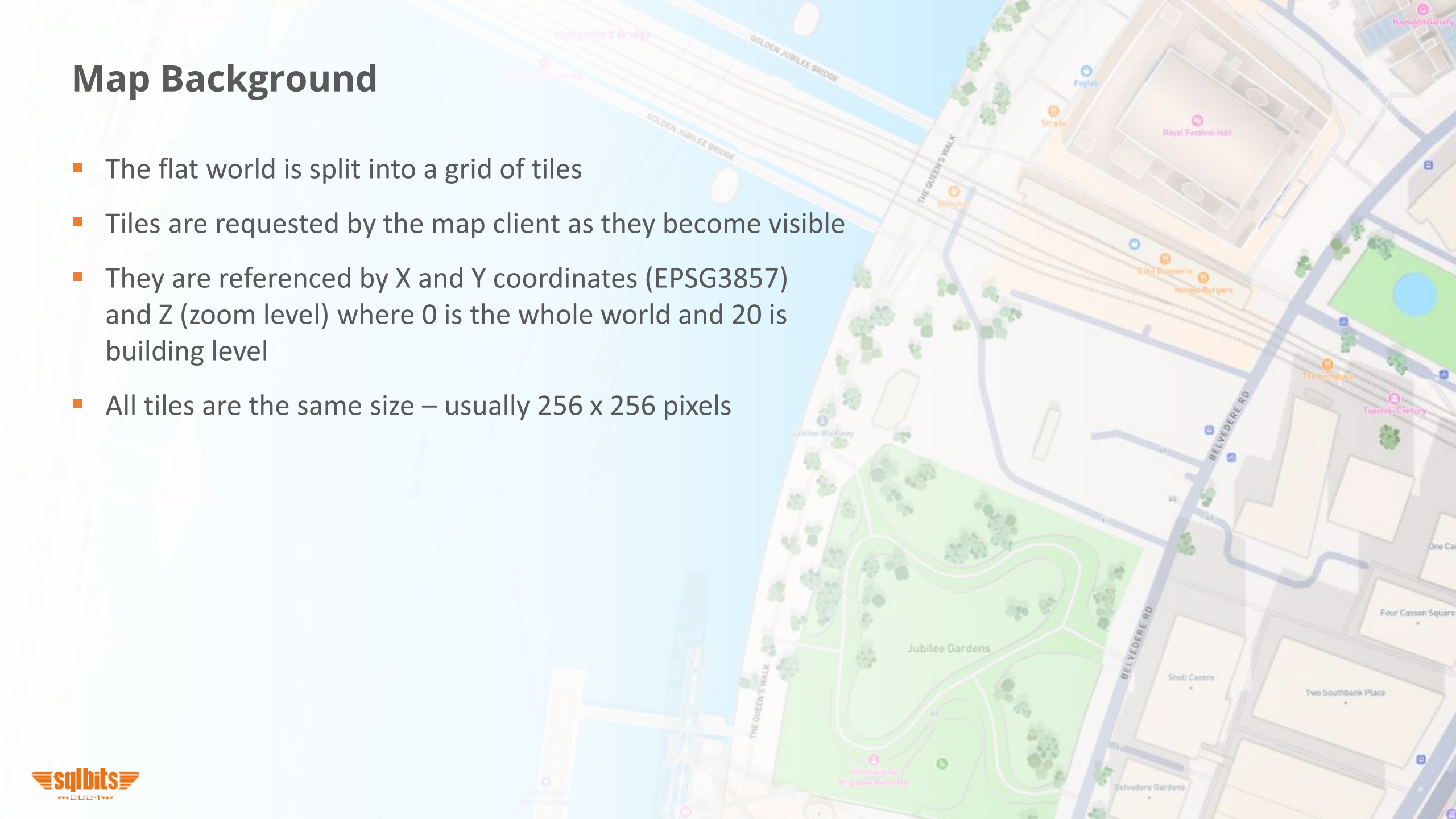


Map Background

Map Background

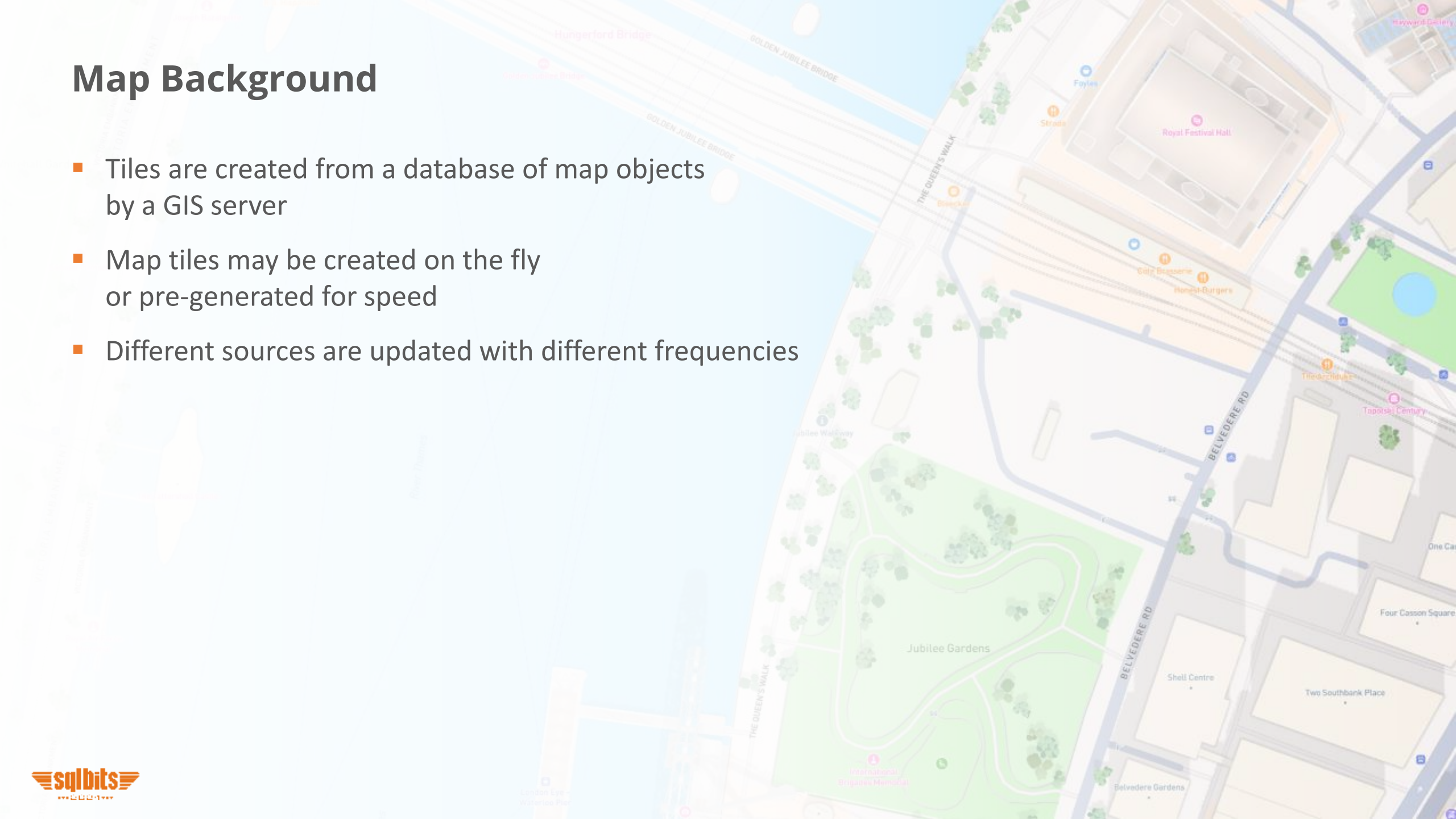
Map Background

- The flat world is split into a grid of tiles
- Tiles are requested by the map client as they become visible
- They are referenced by X and Y coordinates (EPSG3857) and Z (zoom level) where 0 is the whole world and 20 is building level
- All tiles are the same size – usually 256 x 256 pixels



Map Background

- Tiles are created from a database of map objects by a GIS server
- Map tiles may be created on the fly or pre-generated for speed
- Different sources are updated with different frequencies

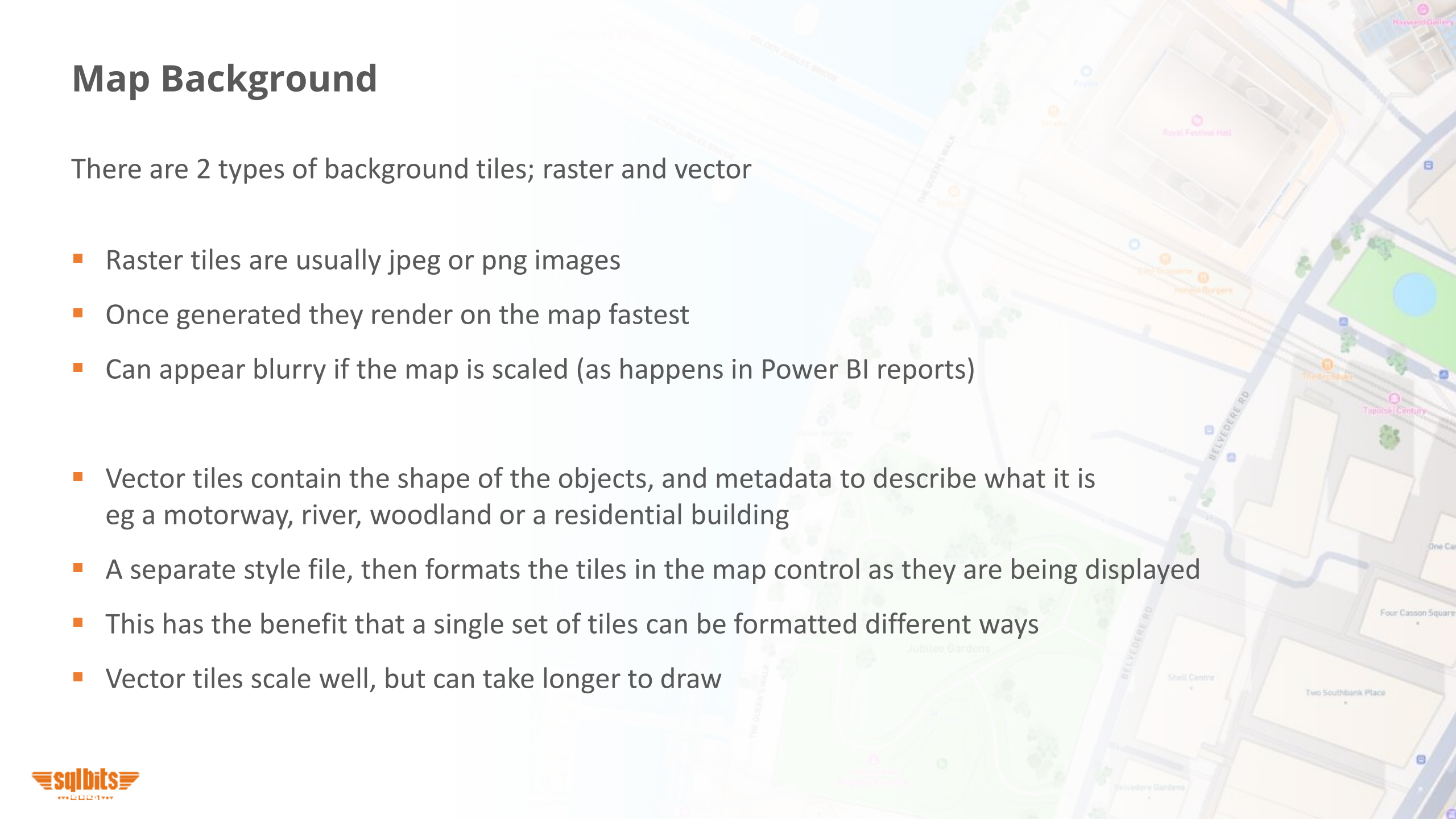


Map Background

There are 2 types of background tiles; raster and vector

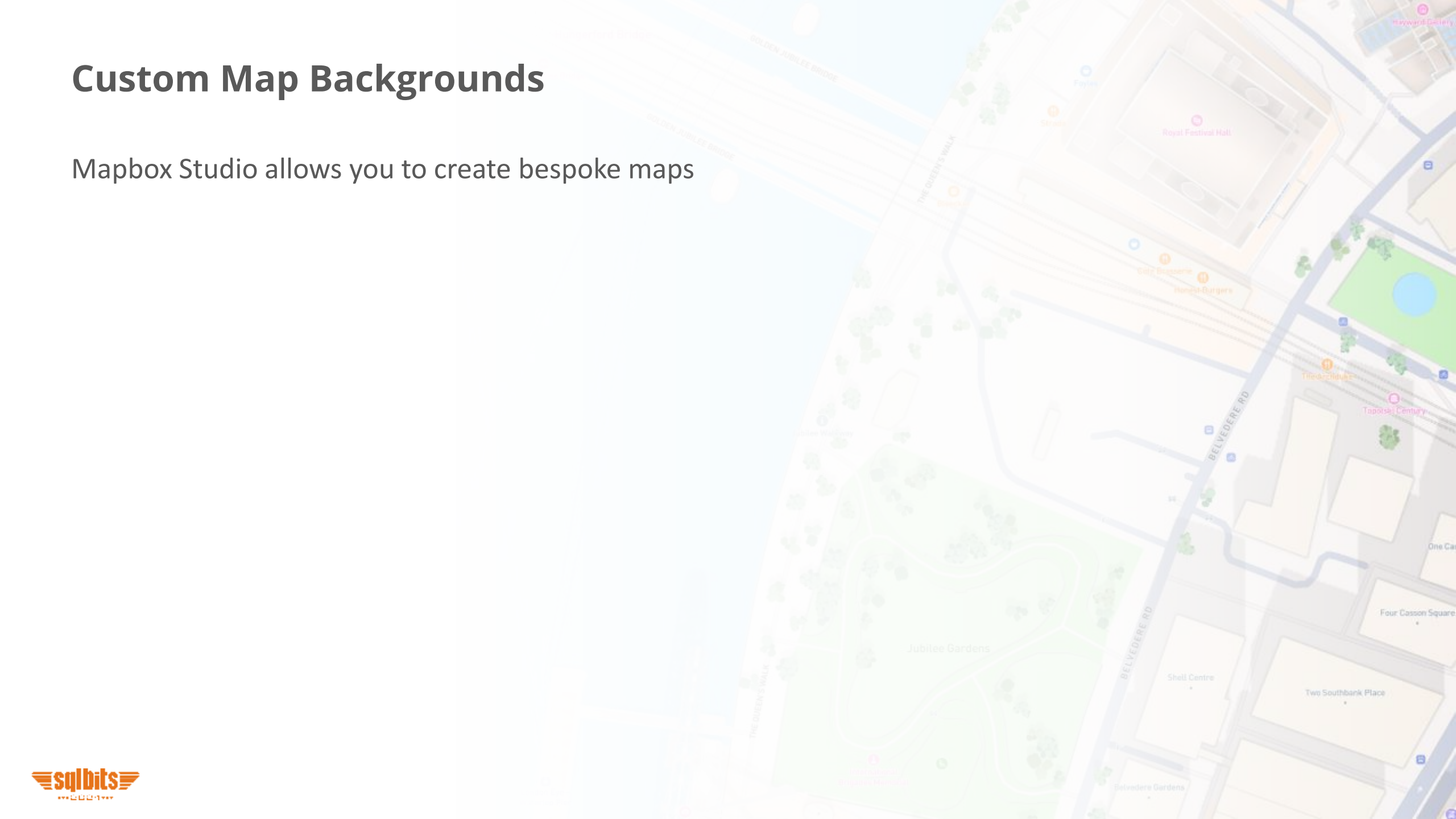
- Raster tiles are usually jpeg or png images
- Once generated they render on the map fastest
- Can appear blurry if the map is scaled (as happens in Power BI reports)

- Vector tiles contain the shape of the objects, and metadata to describe what it is
  eg a motorway, river, woodland or a residential building
- A separate style file, then formats the tiles in the map control as they are being displayed
- This has the benefit that a single set of tiles can be formatted different ways
- Vector tiles scale well, but can take longer to draw



Custom Map Backgrounds

Mapbox Studio allows you to create bespoke maps

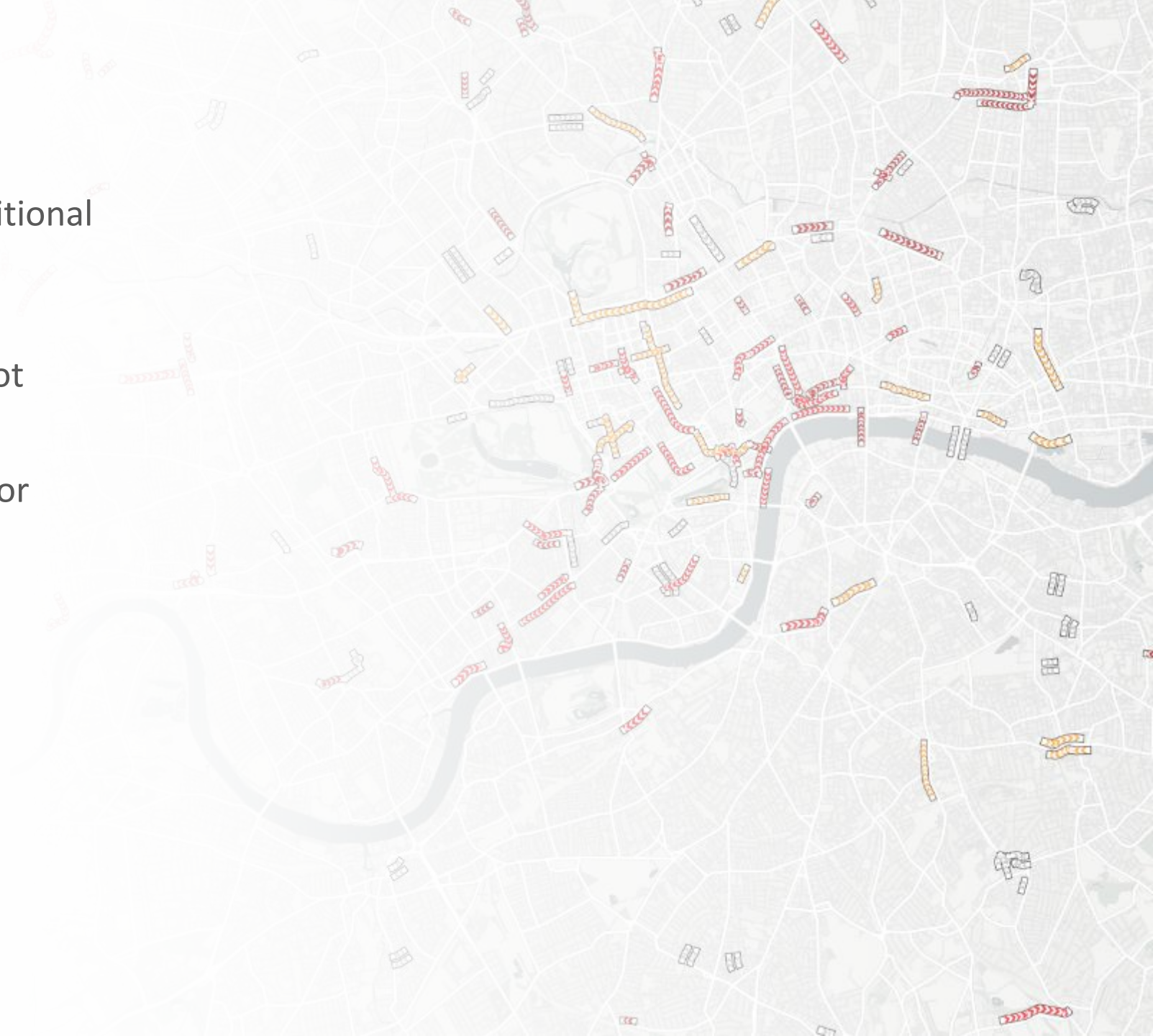


Reference Layers

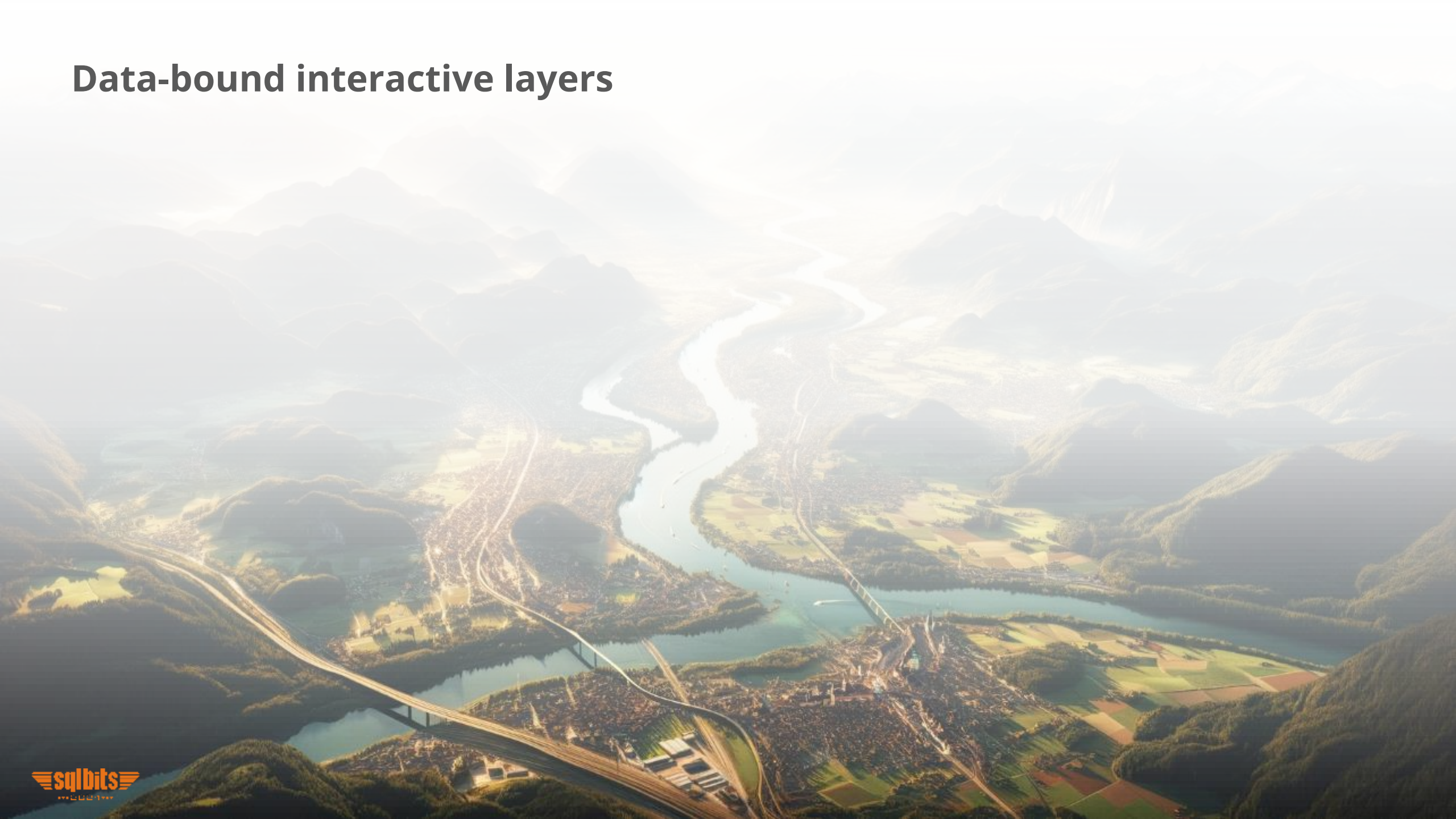
Reference layers allow you to plot additional information over the background map

This information is not part of the Power BI dataset, and is therefore is not usually interactive

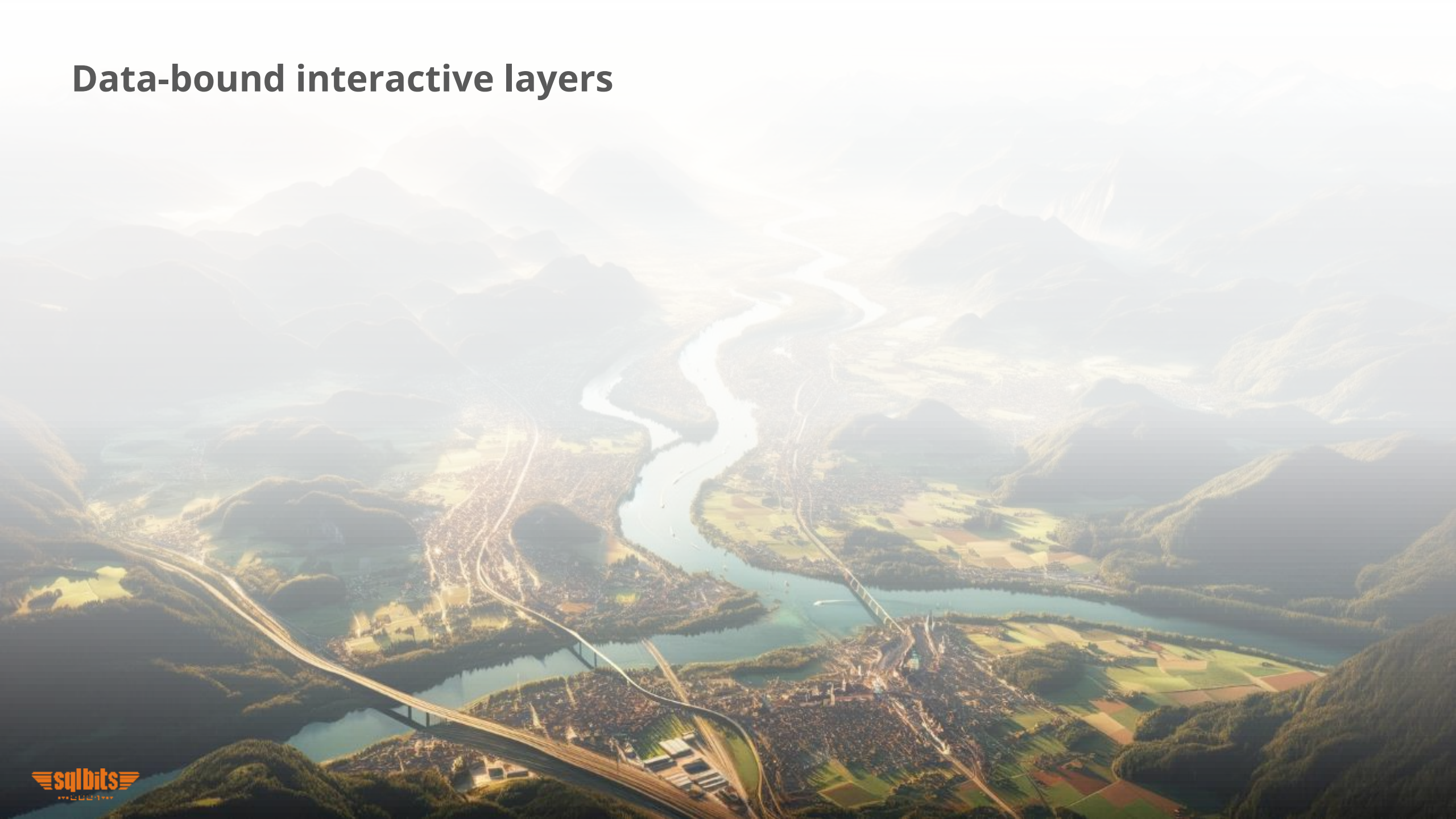
Sources include map tiles, GIS servers or static files



Data-bound interactive layers



Data-bound interactive layers



Data-bound interactive layers

Different types of interactive layers

- Point Data
  - Circles / Bubbles
  - 3D Bars
- Aggregated Data
  - Heatmap
  - Clusters
  - H3 hexagons
- Shapes
  - Lines, Polygons (and points)
  - TopoJSON, GeoJSON, KML, WKT, ESRI Features, Mapbox tilesets, vector tiles

Point Data

Types of point data

- Circles / Bubbles
- Pie Charts
- 3D Bars
- Images

Discussion Points

- Geocoding
- Maximum number of data points
- Aggregation, drill-down, clustering

Aggregated Data

- Clustered circles
- Heatmaps
- H3 hexagons

Shapes

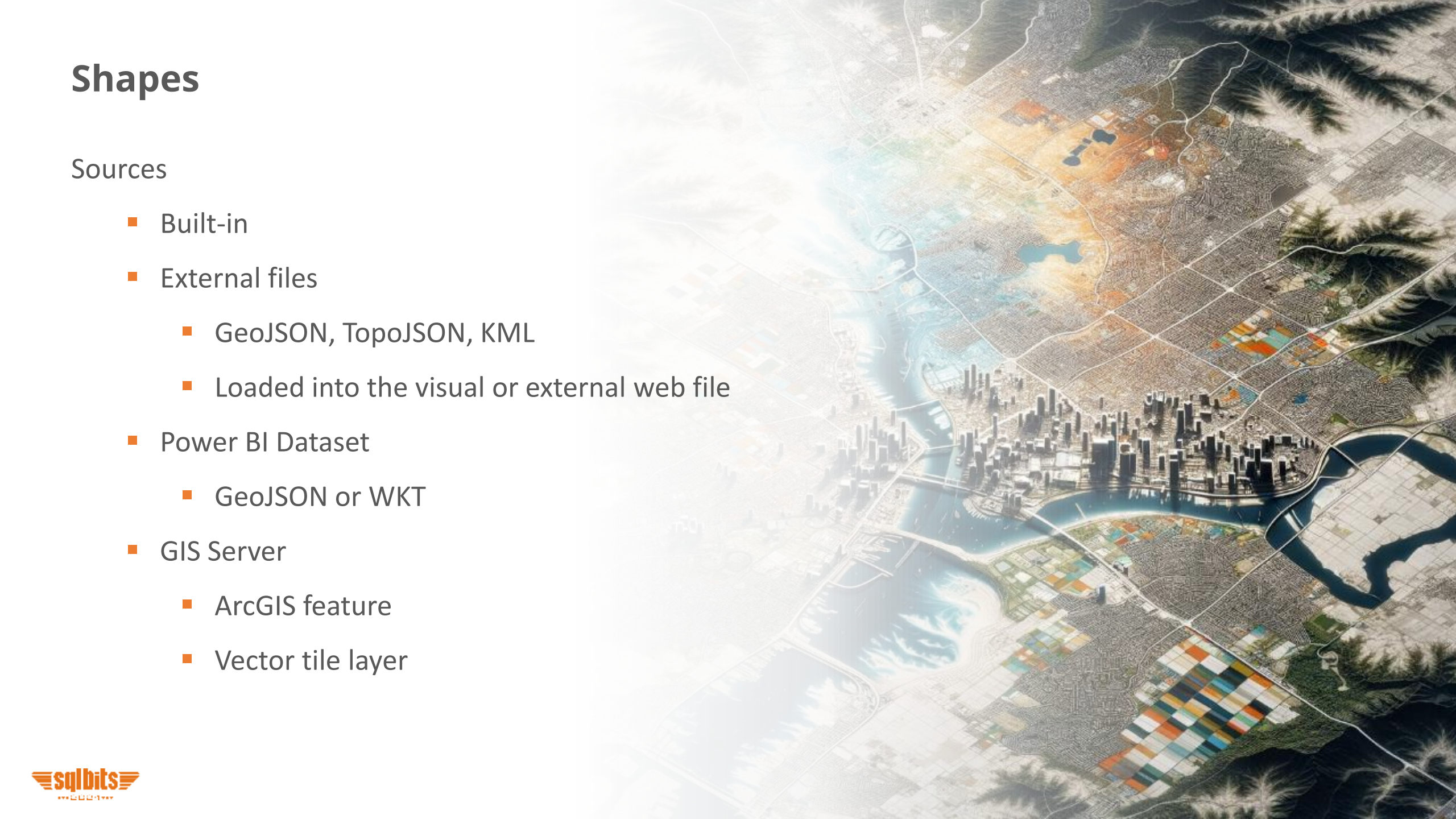
Different uses for shapes

- Choropleth Maps
- Diagrams
- Routes and tracking

Shapes

Sources

- Built-in
- External files
  - GeoJSON, TopoJSON, KML
  - Loaded into the visual or external web file
- Power BI Dataset
  - GeoJSON or WKT
- GIS Server
  - ArcGIS feature
  - Vector tile layer



Shapes

Tools for converting between coordinate systems and formats

- mapshaper.org
- QGIS
- ESRI
- Chat GPT

Shapes

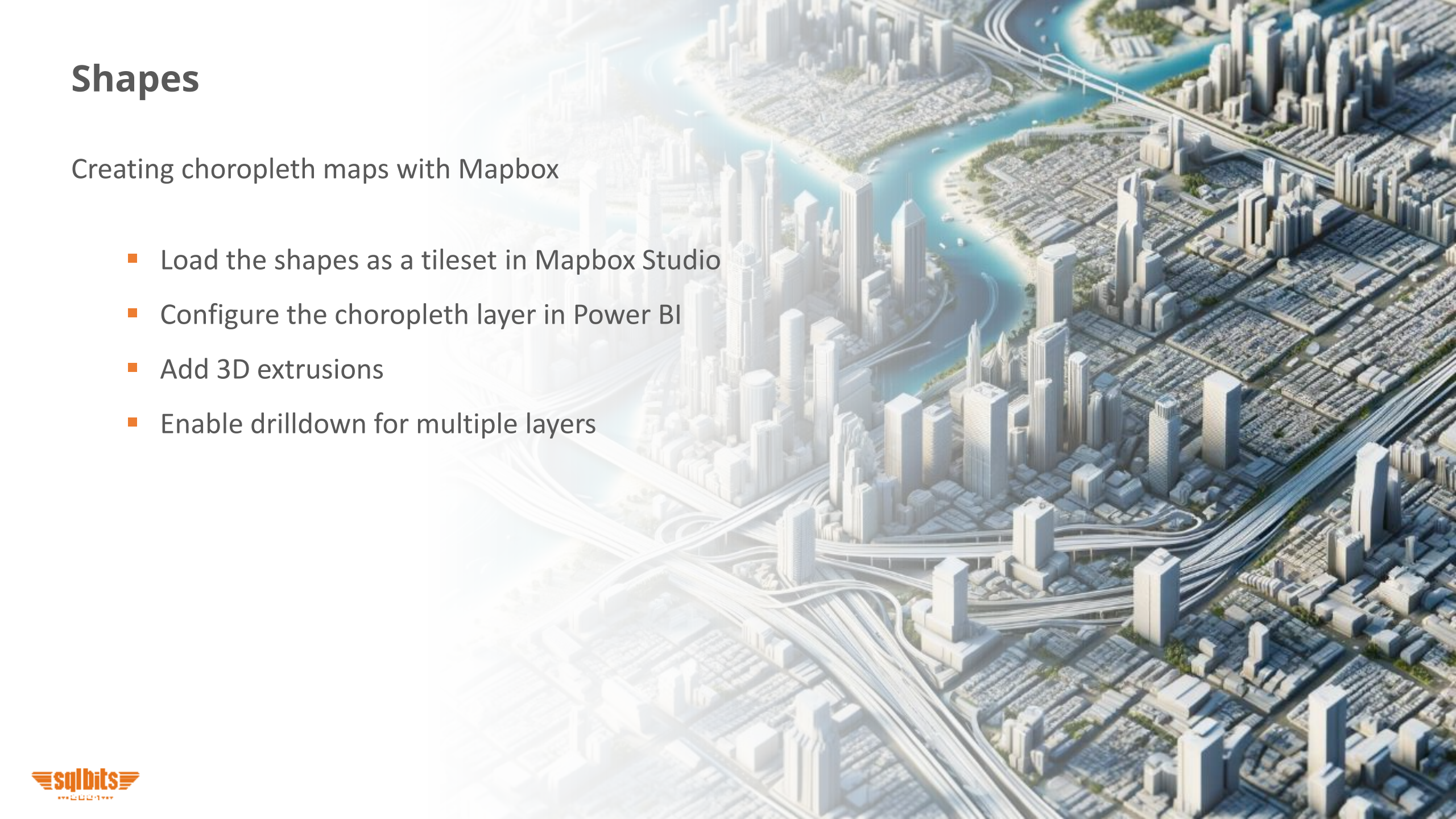
Creating choropleth maps with Icon Map

- Host the geoJSON file on the web
- Configure the Icon Map layer
- Set conditional formatting

Shapes

Creating choropleth maps with Mapbox

- Load the shapes as a tileset in Mapbox Studio
- Configure the choropleth layer in Power BI
- Add 3D extrusions
- Enable drilldown for multiple layers



Shapes

Working with WKT for Power BI datasets

- Need to convert to WGS84
- Reduce the complexity of shapes
- Reduce the decimal precision
- Split across multiple rows or fields

Shapes

Creating Vector Tilesets with Geoserver

- Load into PostGIS
- Configure PostGIS
- Create tileset
- Format in Power BI with conditional formatting

Shapes

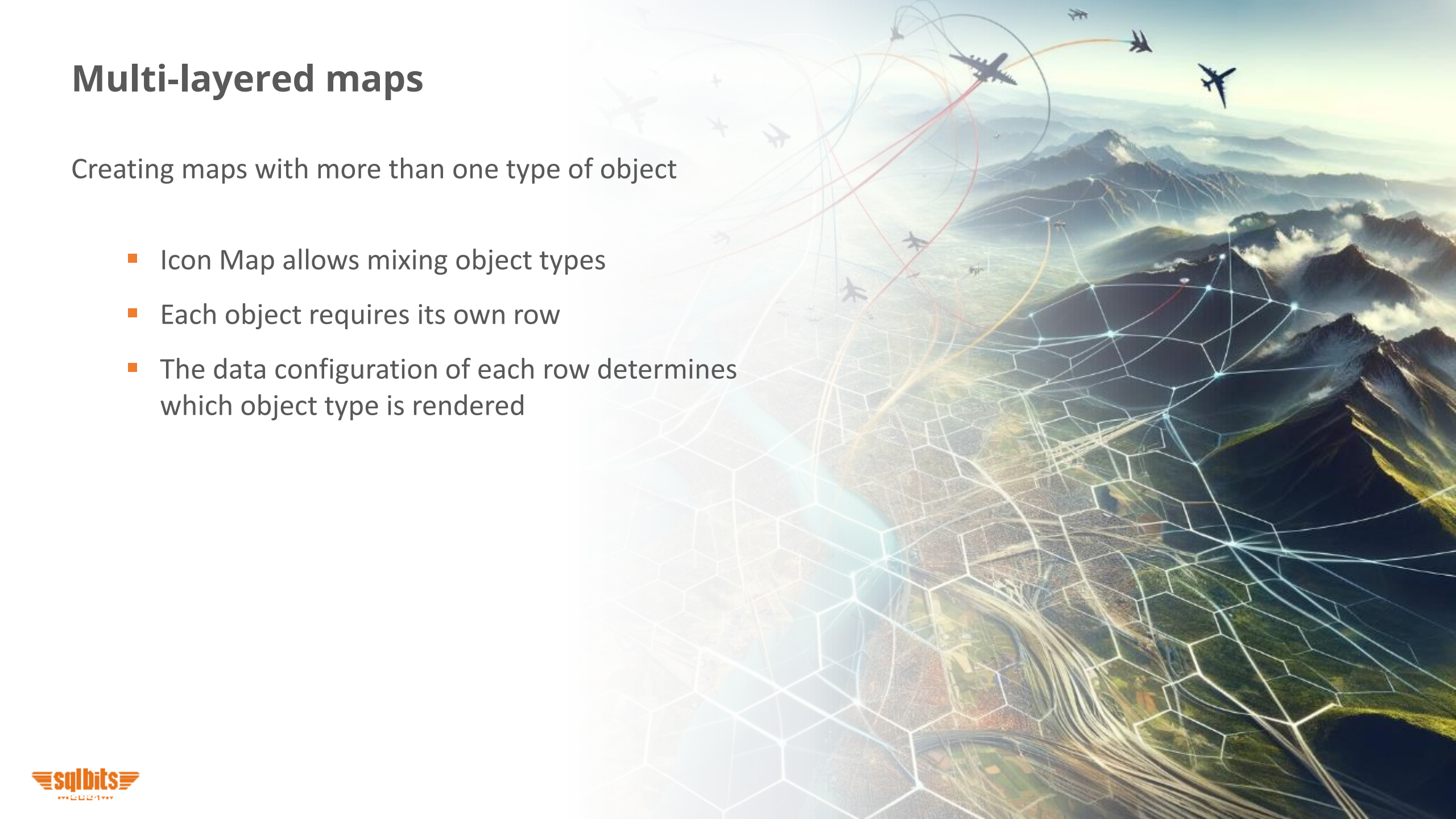
Using KQL DB in Microsoft Fabric for spatial clustering

- Load data into KQL DB
- Use the Geohash, S2 or H3 functions
- Create a direct query dataset from Power BI to analyse millions of rows of data

Multi-layered maps

Creating maps with more than one type of object

- Icon Map allows mixing object types
- Each object requires its own row
- The data configuration of each row determines which object type is rendered



What's missing and what's next?

- Multiple independent data bound layers
- Limitations on the number of points
- Continuing evolution of Azure Maps visual
- Dated Mapbox and ArcGIS visuals
- A new visual required?

Thank you and any questions?

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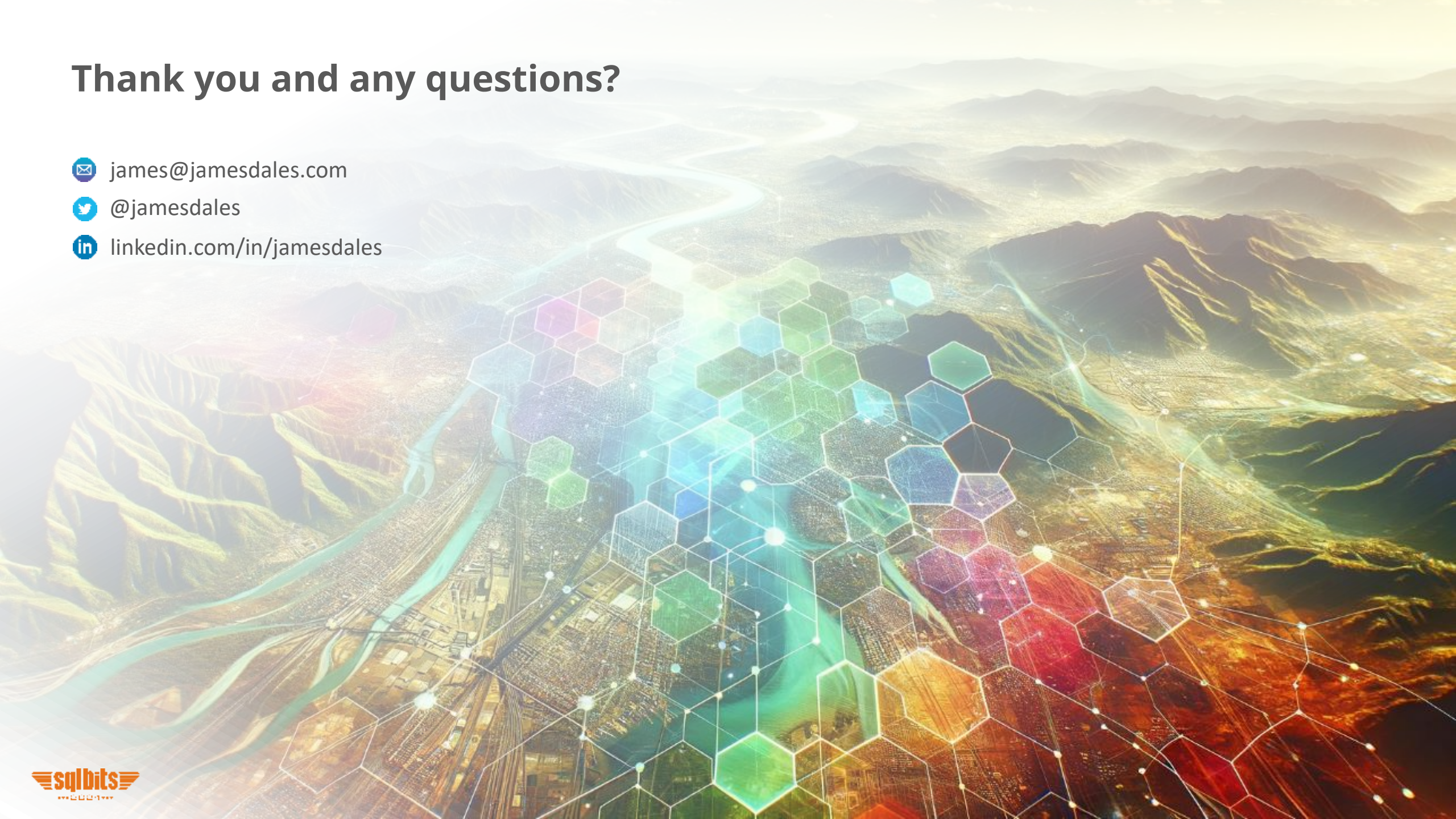

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