Integrating CAD and GIS – using ArcGIS Online

As a ***'Geographer in a CAD World'*** I am always searching for smarter ways to integrate CAD and GIS – **Software, Data** and **Processes**.

I have previously written a 4-part video blog series on integrating **Open Source GIS** with geospatial enabled CAD software, such as; Autodesk **InfraWorks**, Autodesk **Map3D** and Autodesk **Civils**. This has proved highly successful as these applications have **Database Connectivity** tools allowing you to connect to geospatial assets in databases, such as **SQL** and **PostGIS**. If you want to learn how to better integrate these Autodesk applications with your GIS data here is link to the video blog:

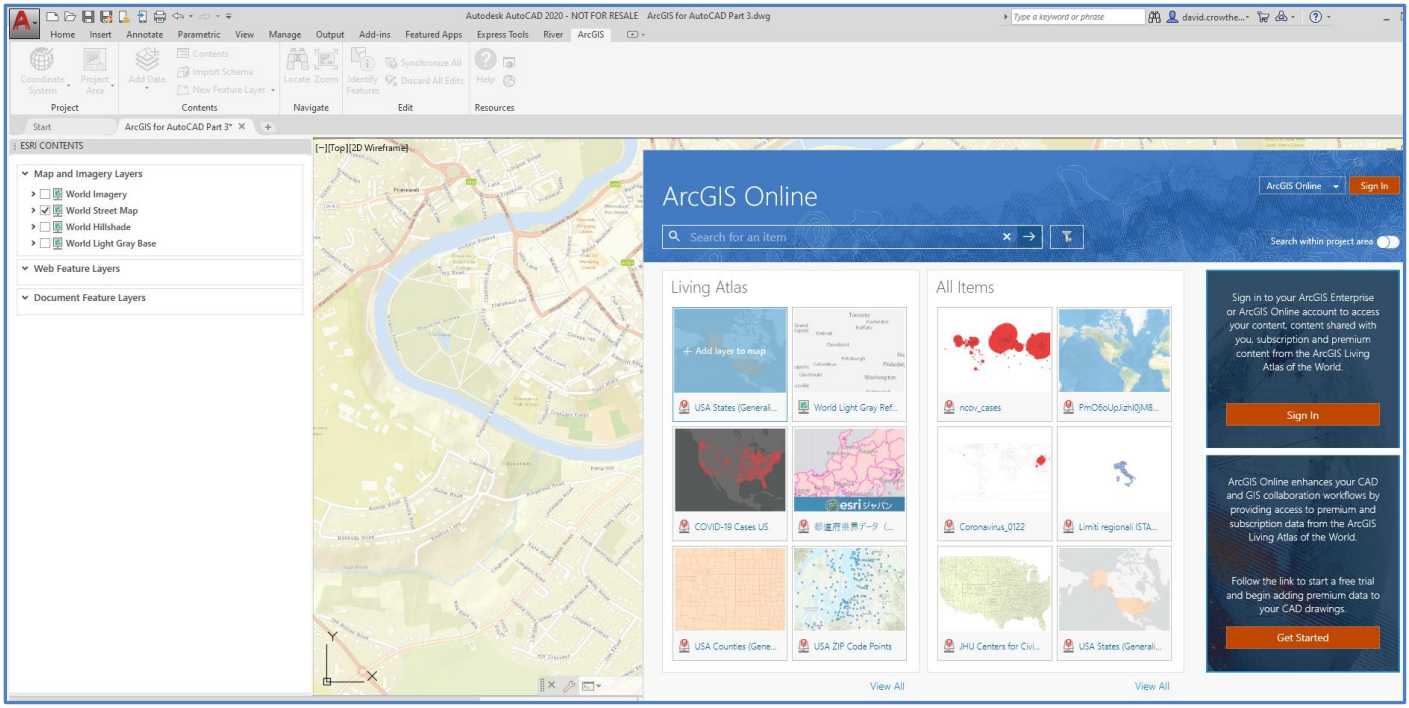
https://www.cadlinecommunity.co.uk/hc/en-us/articles/360001096598-Integrated-CAD-and-GIS

I then wrote a 3-part blog series on how to integrate your GIS datasets with CAD users that only have access to (flat) **AutoCAD** and no Database Connectivity options. This blog series started by exploring export and import options between Map3D/Civils to CAD, and then ended exploring in detail the **ESRI ArcGIS to AutoCAD plugin**, where your CAD Users can now seamlessly access your ESRI geospatial datasets directly within AutoCAD.

- Integrating CAD and GIS – Using AutoCAD Part 1 - GIS to CAD – using export and import of geospatial assets in a DWG.
- Integrating CAD and GIS – Using AutoCAD Part 2 - Using the ArcGIS for AutoCAD plugin to provide geospatial basemapping options within AutoCAD.
- Integrating CAD and GIS – Using AutoCAD - Part 3 - Explores the most recent version (beta 400) of the ESRI ArcGIS to AutoCAD Plugin to manage (view, edit, delete, update) your geospatial assets via an ArcGIS Online Account, Then synchronising those changes with the wider project team e.g. InfraWorks Users who see those changes instantly updated within their Models.

To complete this journey of discovery, this final blog will concentrate on how to manage your **ESRI ArcGIS Online** account to upload, view, manipulate and then distribute your ESRI based geospatial datasets across your wider CAD team.

In the blog - Integrating CAD and GIS – Using AutoCAD - Part 3 – we provide full details of how to access, download and **install the ArcGIS for AutoCAD plugin**, which then provides the **ArcGIS Ribbon** within your CAD software. If you haven't already done this please follow the steps in that blog to get started.



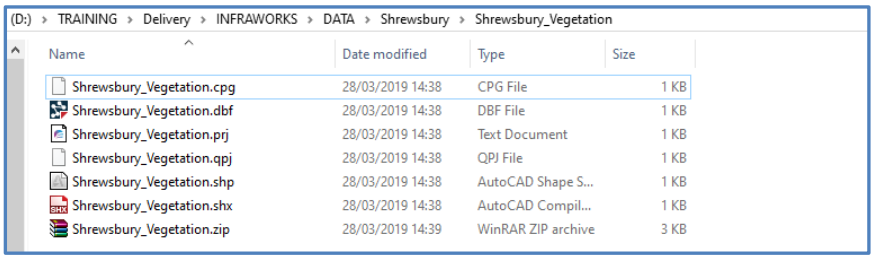
In this blog, we will detail how to upload, store and manipulate those geospatial assets within your **ESRI ArcGIS Online** account so that those assets can then be accessed from your preferred Autodesk software e.g. CAD, Civils, InfraWorks.

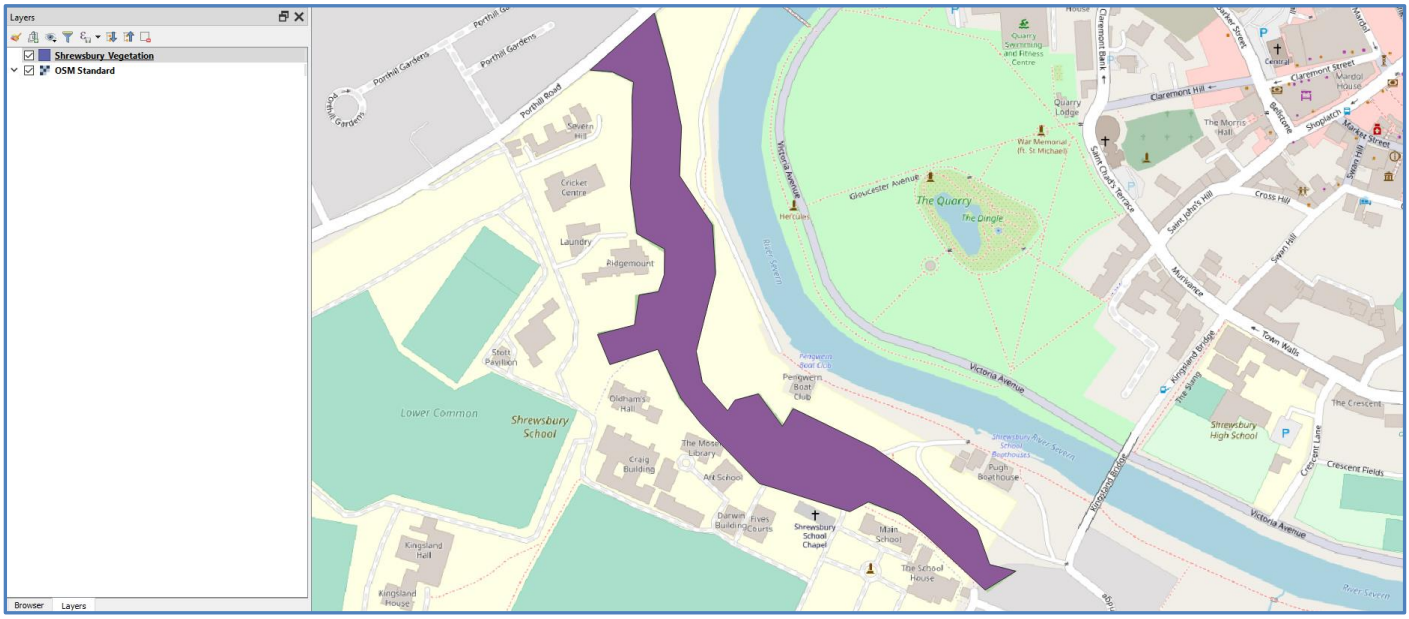
Section 1: ArcGIS Online

In Section 1 we will explore using ArcGIS Online to create a **Web Map**, **upload GIS** files and create **Hosted Feature Layers** which can then be accessed later in your Autodesk applications.

Step 1: Zip your spatial data

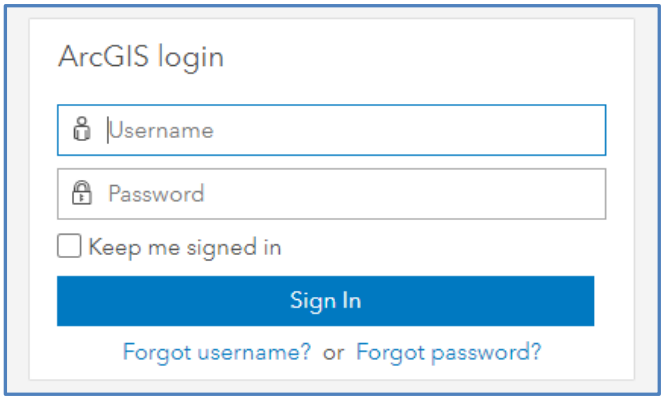
Before uploading your spatial assets to your ArcGIS Online account, you must first **zip** the files. In this example we will zip up our **Shrewsbury Vegetation** Shapefile.



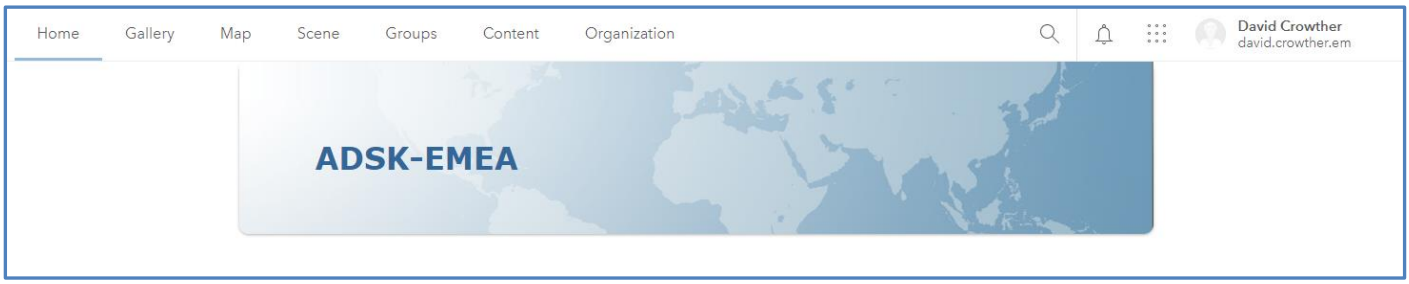


Step 2: Login to your ArcGIS Online and Create a Map

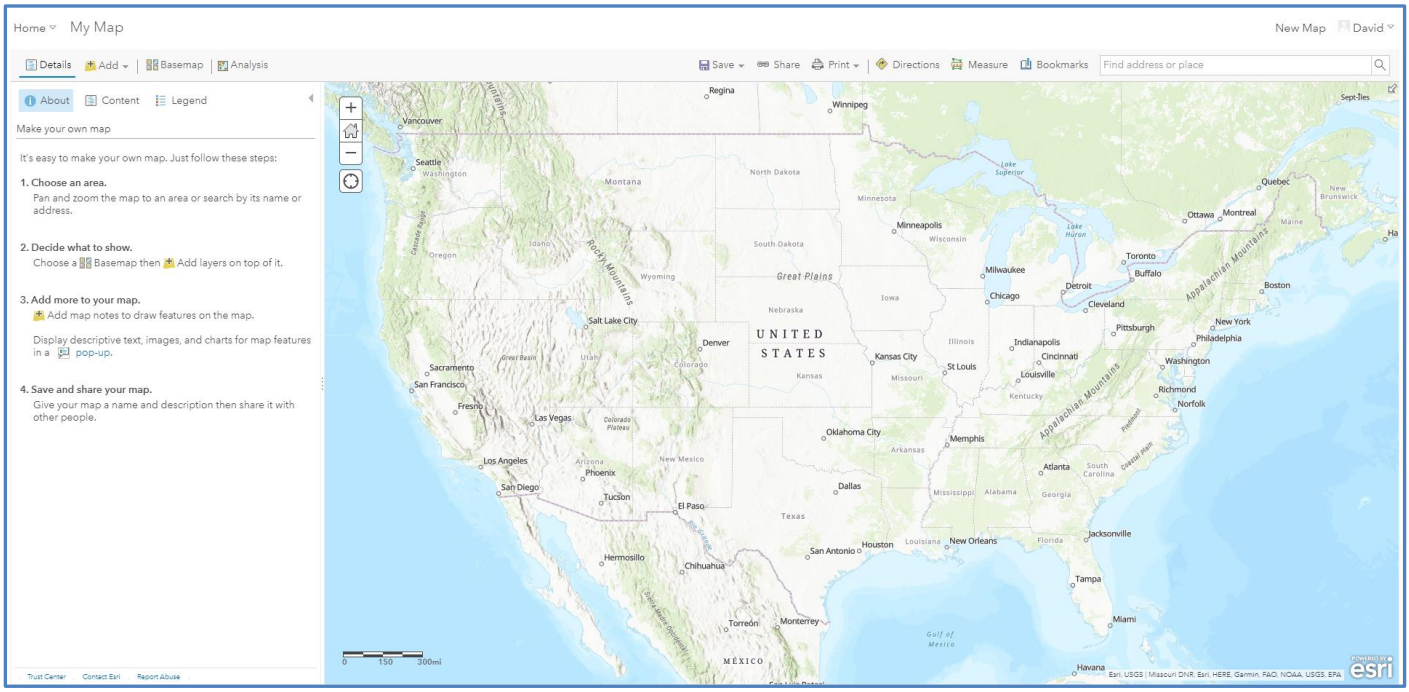
Login to your ESRI ArcGIS Online Account



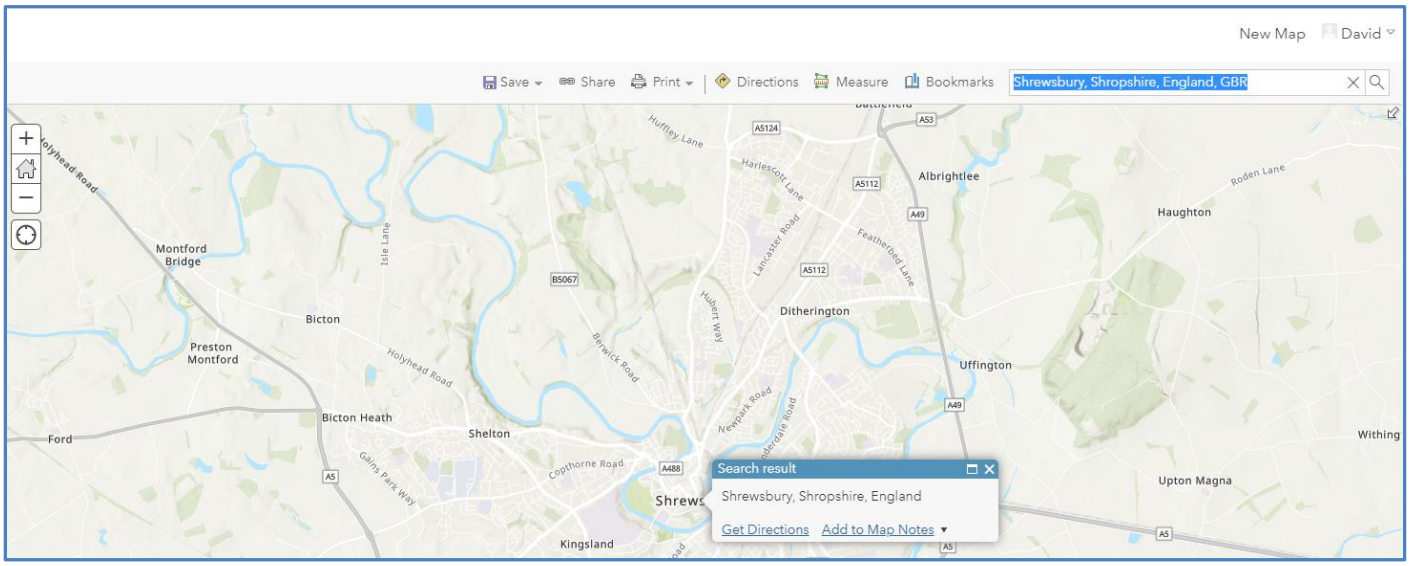
For this blog we are using the **Autodesk ArcGIS Online** organisation details.



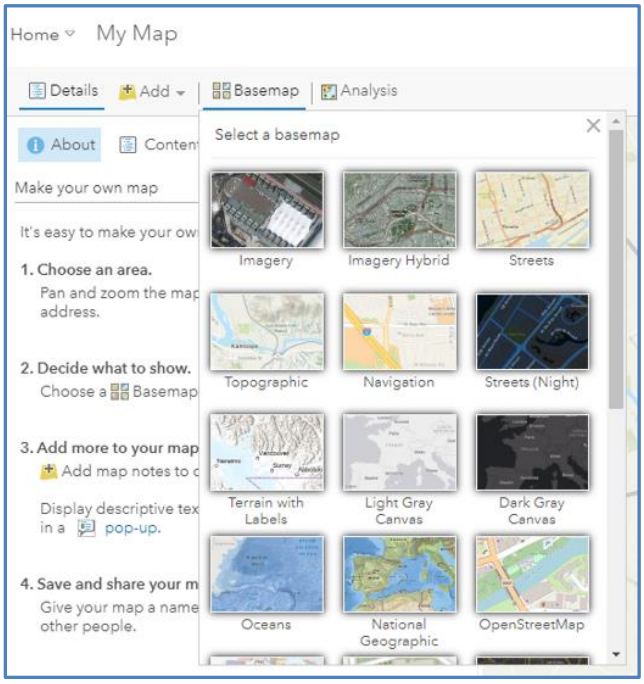
Once logged in, choose the **MAP** tab and it will open a default Map showing the United States.

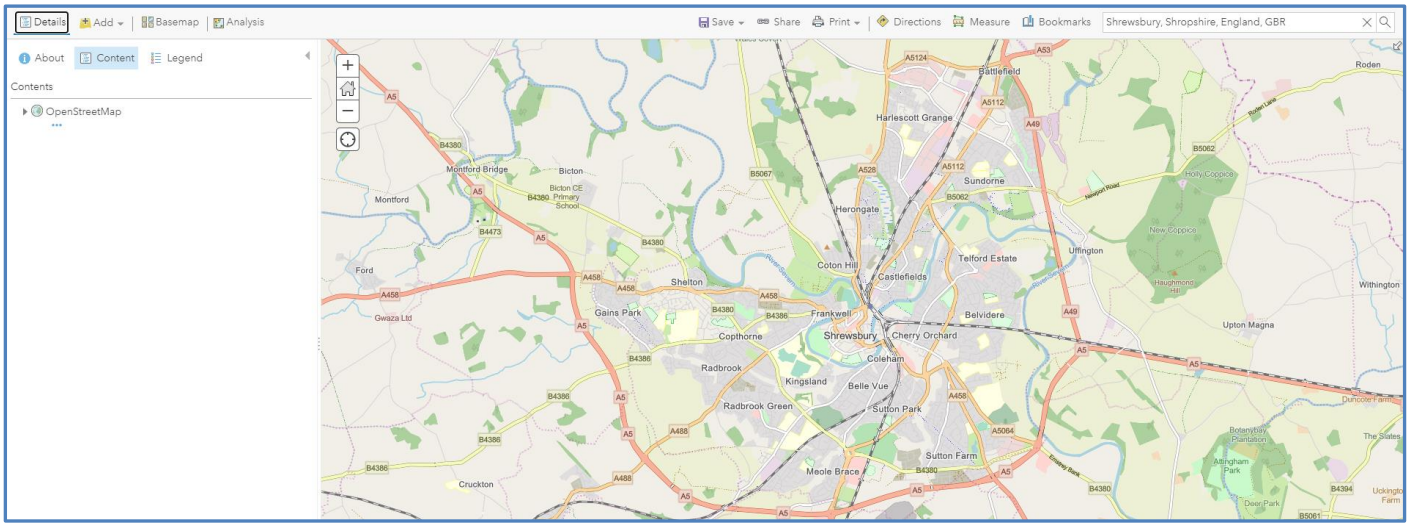


Zoom to your area of interest, in this case we will base our Map and GIS datasets on **Shrewsbury** in the UK.



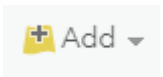
Next, choose the **Basemap** button and select a useful Basemap to show in your Map e.g. **OpenStreetMap.**



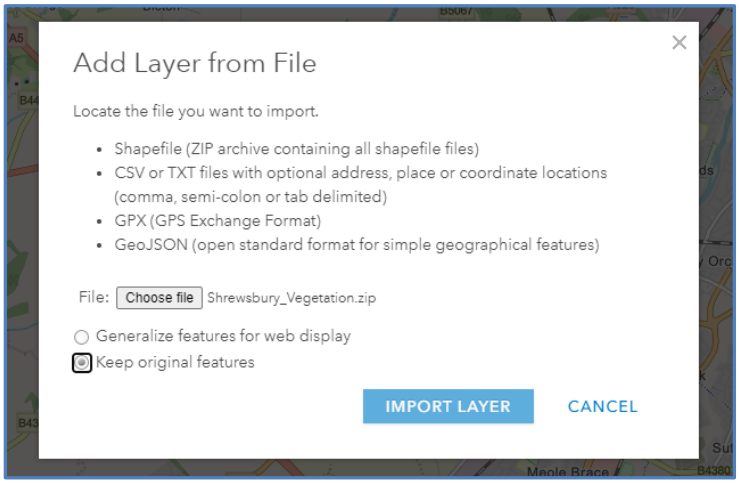


Step 3: Add Layers to Maps

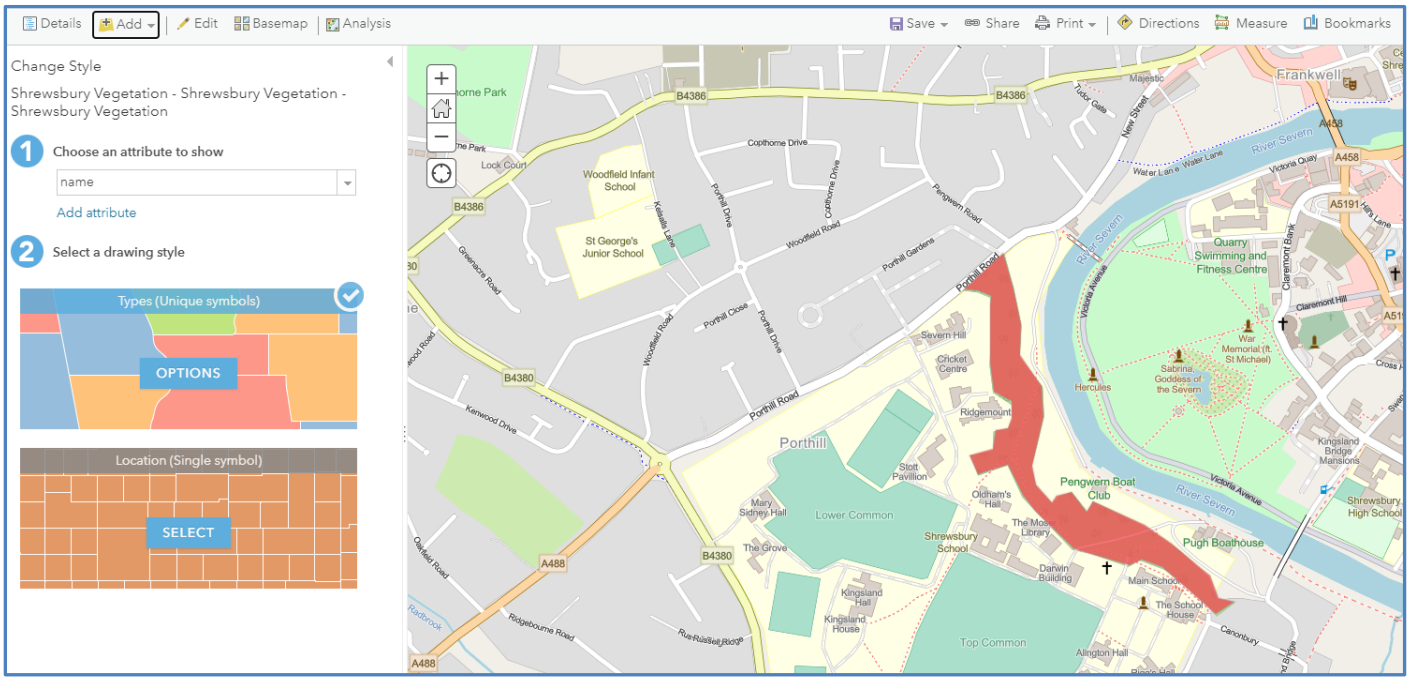
Having built your Map, you can now start adding datasets to share with others. Use the **Add** button to start adding your GIS datasets to include in your Map.



Under the Add menu, choose **Layer from File** and Browse to find the ZIP file that contains your GIS data. In this example we will locate the Shrewsbury Vegetation Shapefile that we zipped in Step 1.



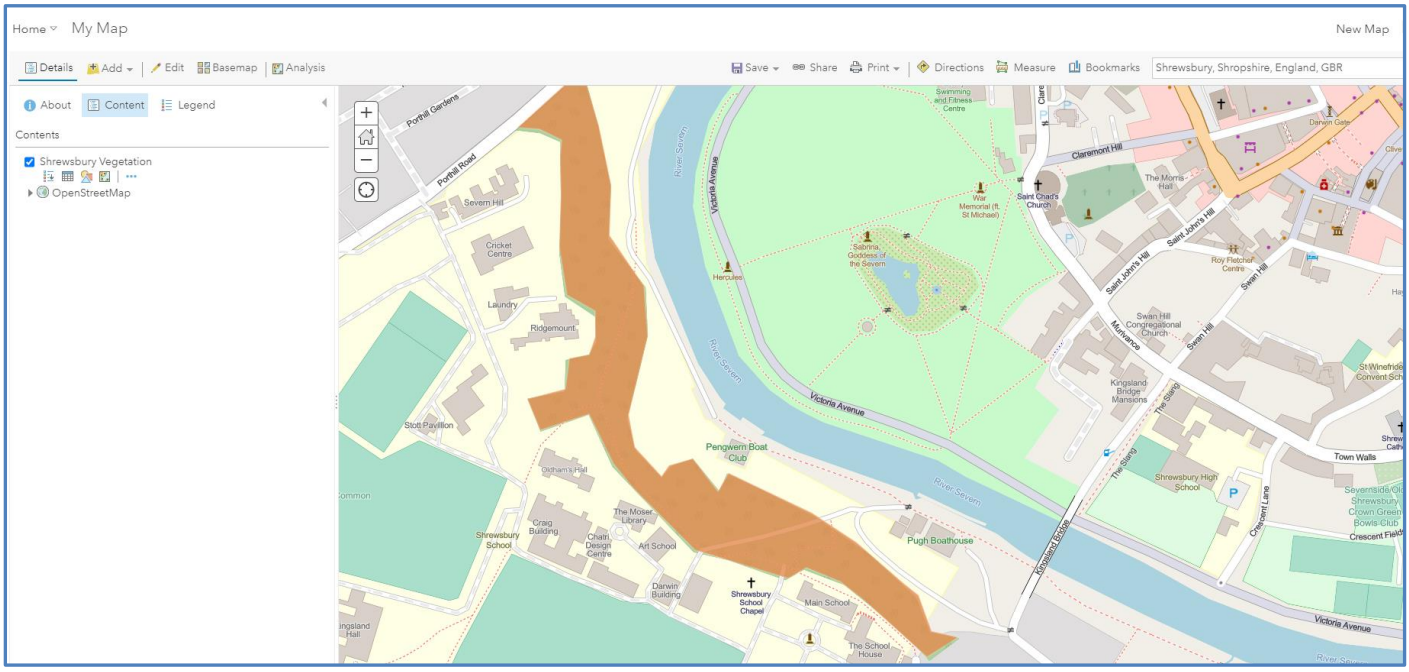
You have an option to import the dataset with the **original geometry,** or to **generalise** the features for better web map rendering speeds. Once uploaded the GIS file (Shrewsbury Vegetation.shp) is added to your Map.



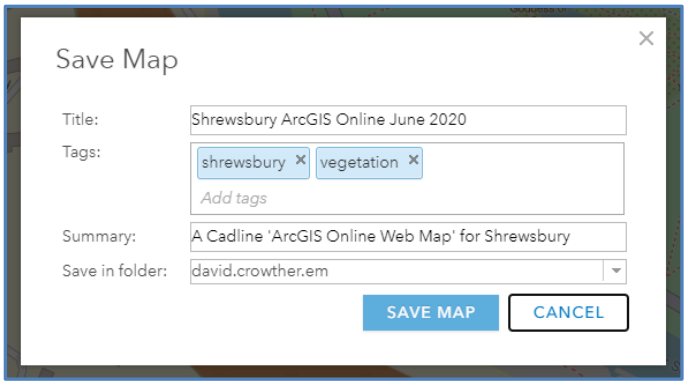
1 – Choose an Attribute Value to show – this allows you to define the Column/Field from the Layer to show.

2 – Choose to display the Layer as either Single Symbol where all features are styled the same or use a Thematic option.

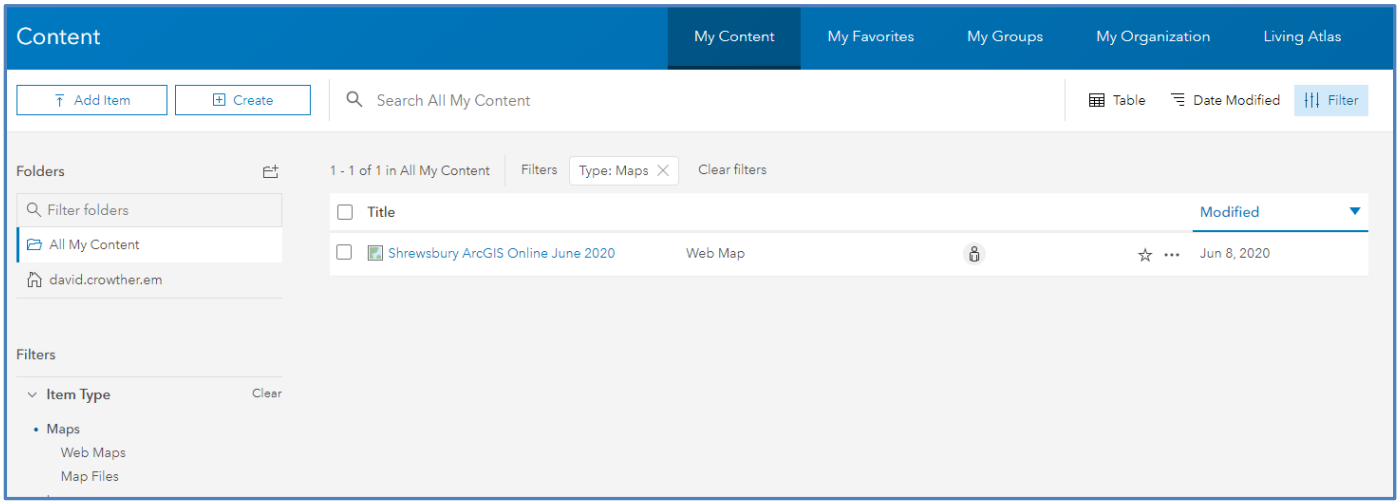
Your Map now has a Basemap and One GIS Data Layer.



To Save and Share this Map with others choose the **Save** > **Save As** option and we can return to this Web Map.



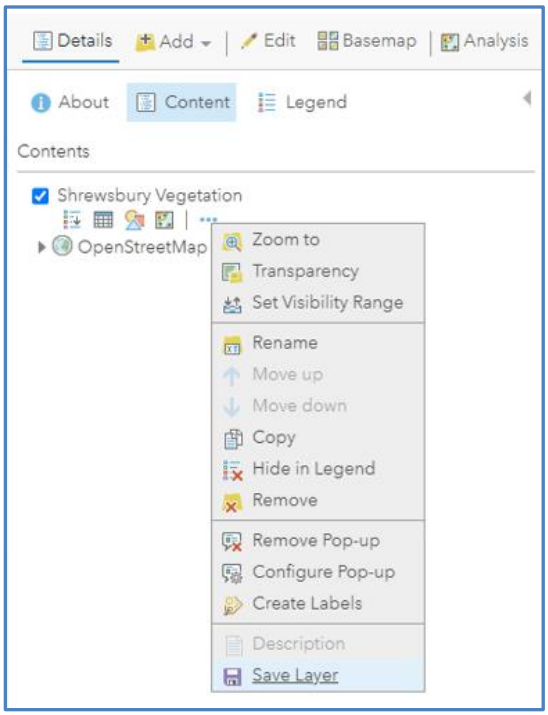
If you now choose the **CONTENT** page, you can see that your **Web Map** has been created and stored in your Content.



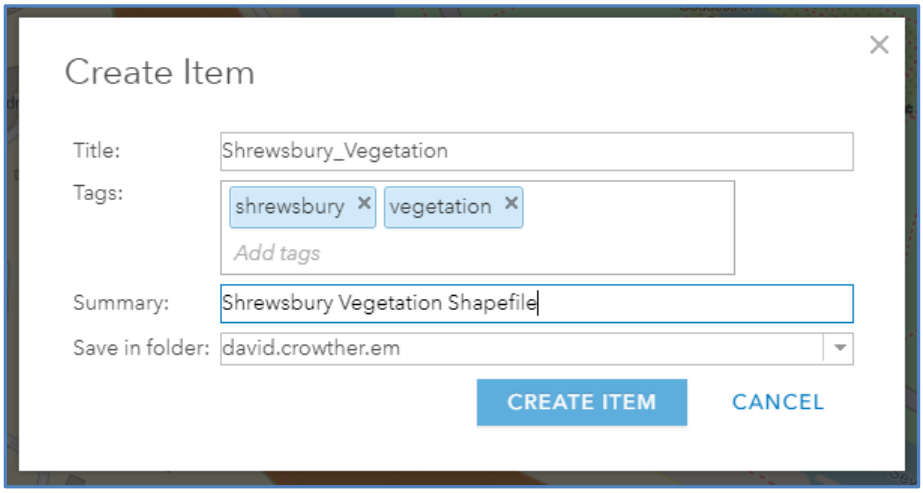
However, the GIS Layer (Shrewsbury Vegetation) that we added to our Map is not present in our Content, so hasn't been uploaded as a Layer into our ArcGIS Online Account.

Step 4: Save as Feature Layers

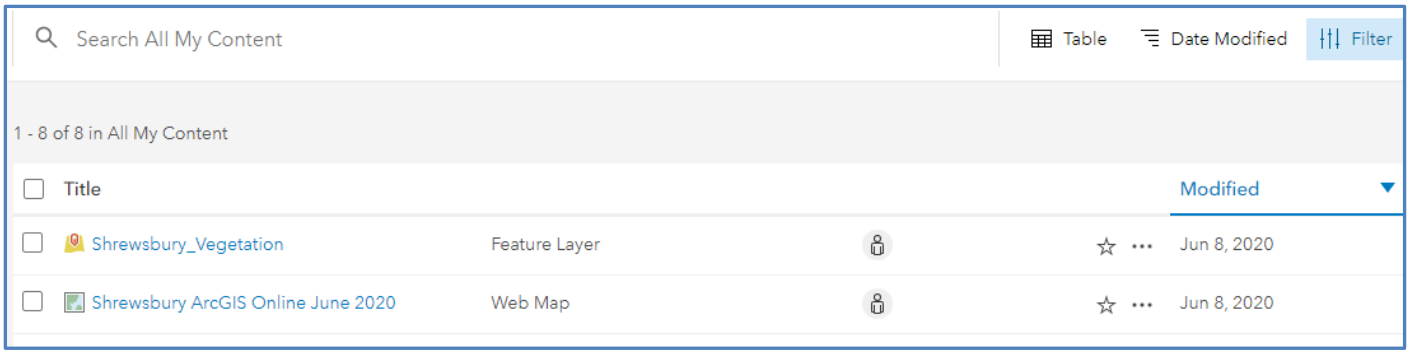
To now Save the Layer as an Item that can be reused in other Map Projects (as a Feature Layer) and to be accessible to other Users, select the Layer in the **Map Pane** and choose **Save Layer**.



Now choose a **Title** for the Layer that you added, add some **Tags** for searching and provide a **Summary** or descriptive text for this Layer.



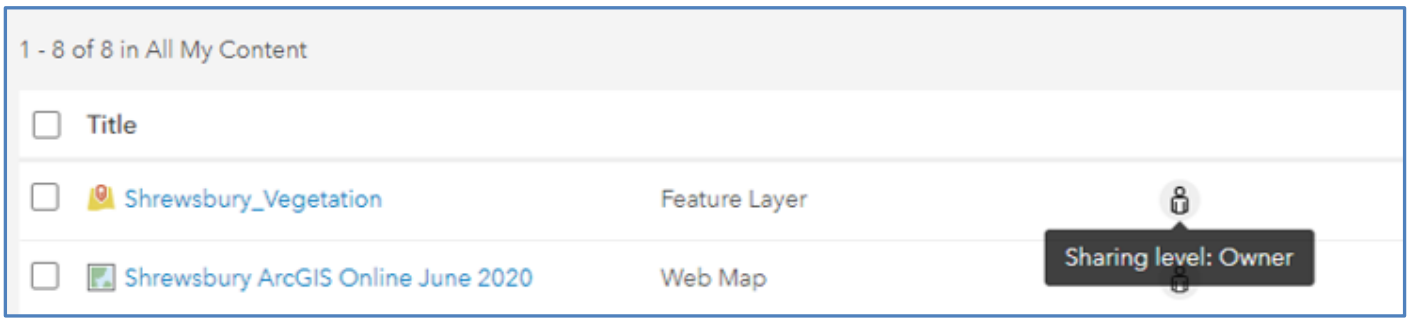
Once you choose **Create Item** the GIS Layer is now fully uploaded into your ArcGIS Online portal. If you now return to your **Content** Page you will see the **Feature Layer** has been added.



Step 5: Create a Shared Hosted Feature Layer

Although the new Feature Layer that you have created is available for you to add to your ArcGIS Online Map Projects, others won't be able to see it and the Layer will also not be available to add into any Autodesk application yet. We therefore need to update the **Sharing** options and then create a **Hosted Feature Layer**.

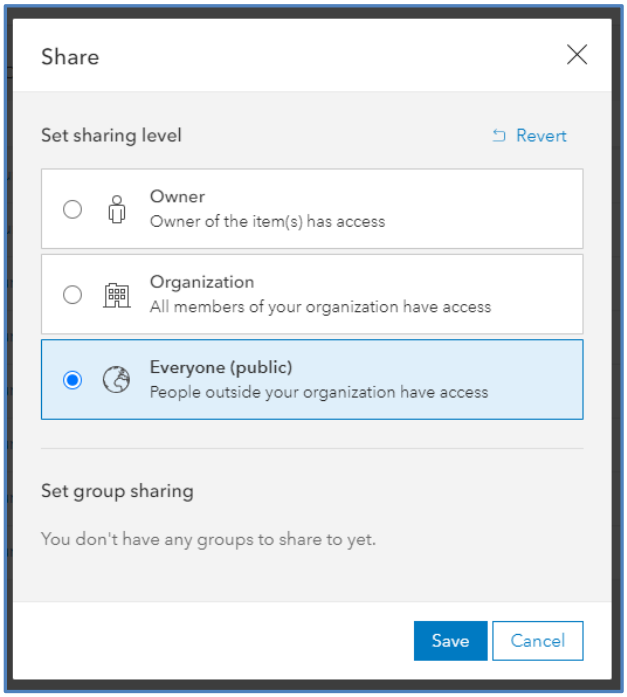
To update the **Sharing** options for the Shrewsbury Vegetation Feature Layer, click on the **person** icon.



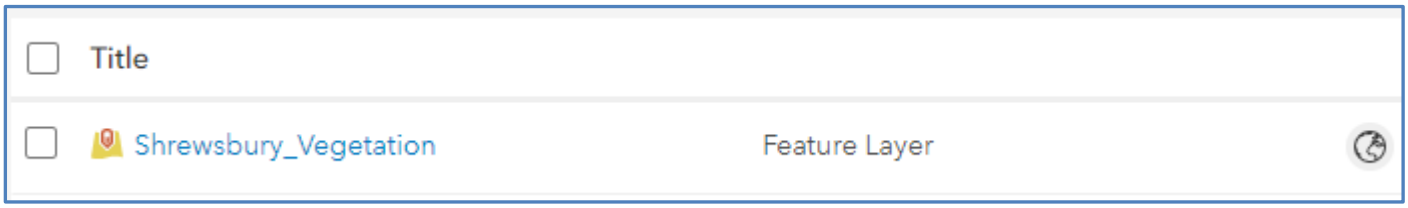
This opens a new Sharing window, where you can choose to set the Sharing status for the Feature Layer as 3 options;

- Owner
- Organisation
- Everyone (Public)

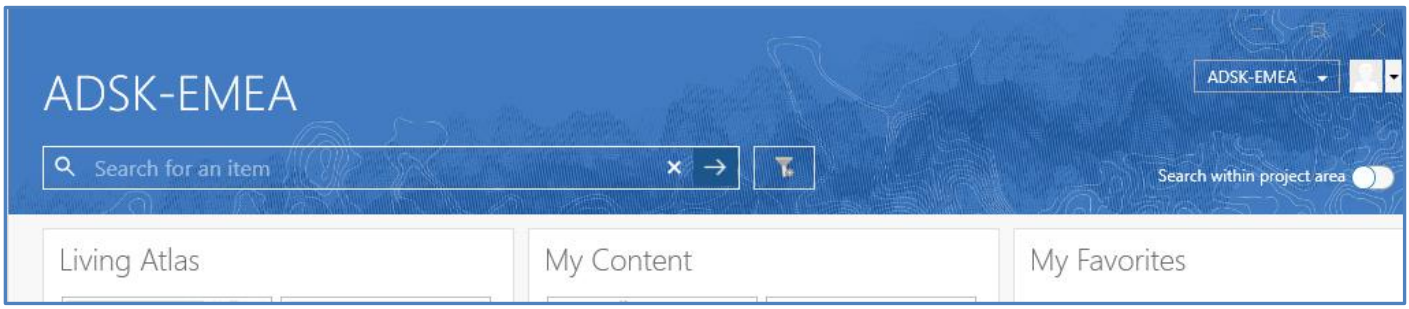
So that other Users and Applications can access our Layer we will set the Sharing option to **Everyone.**



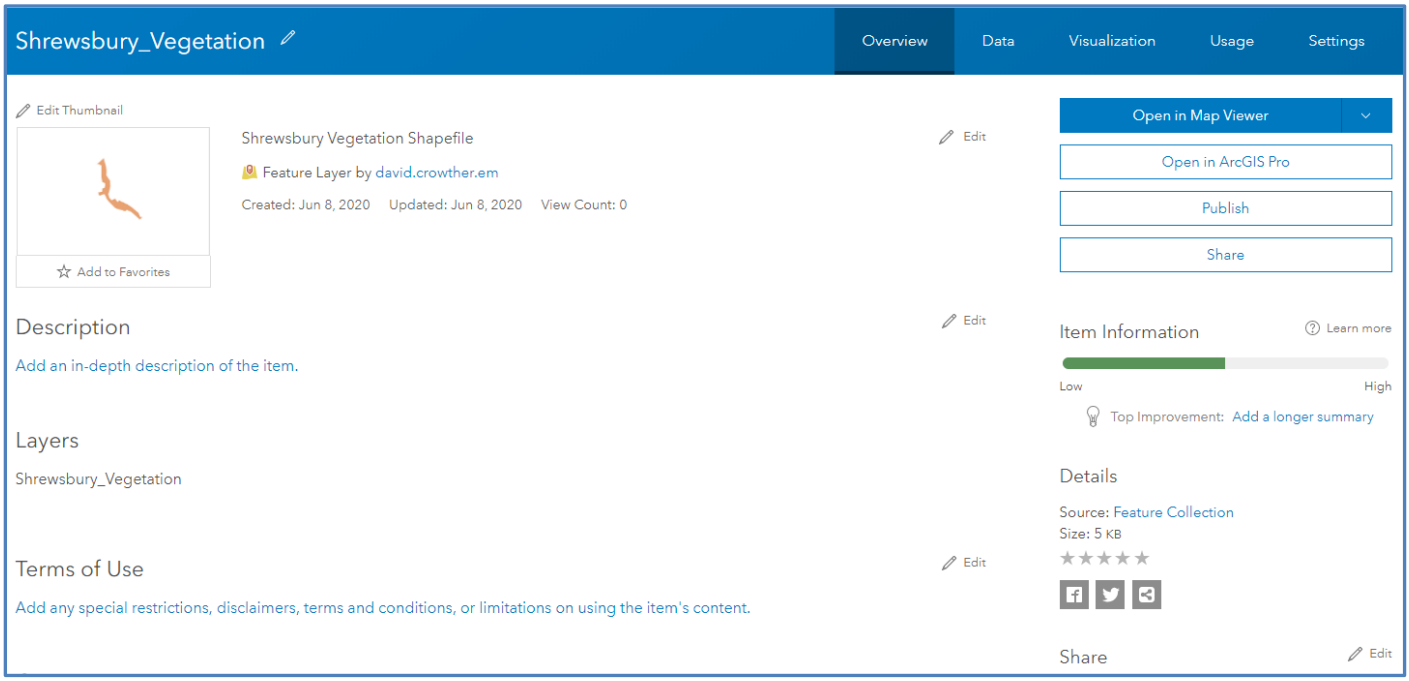
Once Saved the layer will now show as a **World Icon** in the Sharing column, which denotes it is shared publicy.



Although we have managed to upload our GIS Layer and also Shared it with Public Users, we won't be able to access this Layer through the **Autodesk to ArcGIS Connector** until the Layer is saved as a **HOSTED Feature Layer**.

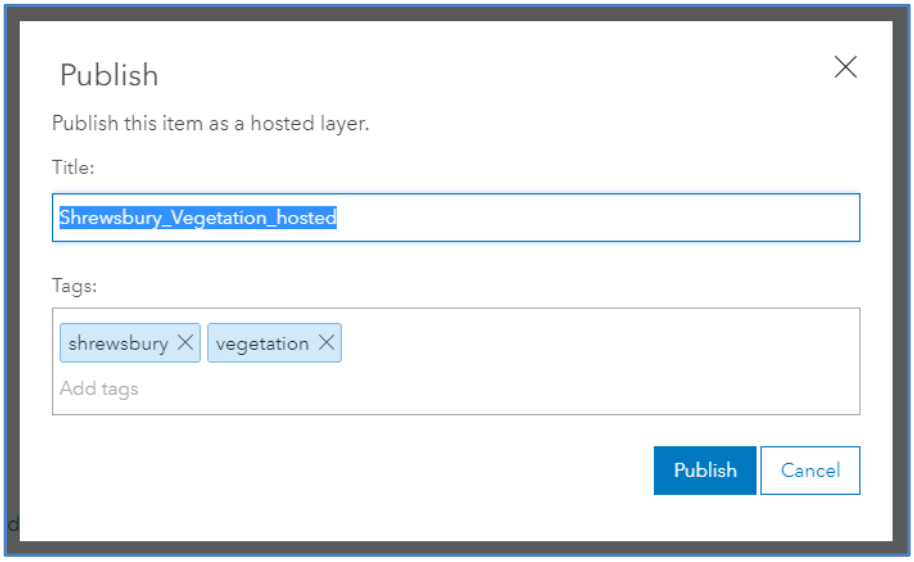


To create a **Hosted Feature Layer** simply choose to View the **Item Details** page for the Shrewsbury Vegetation Layer.

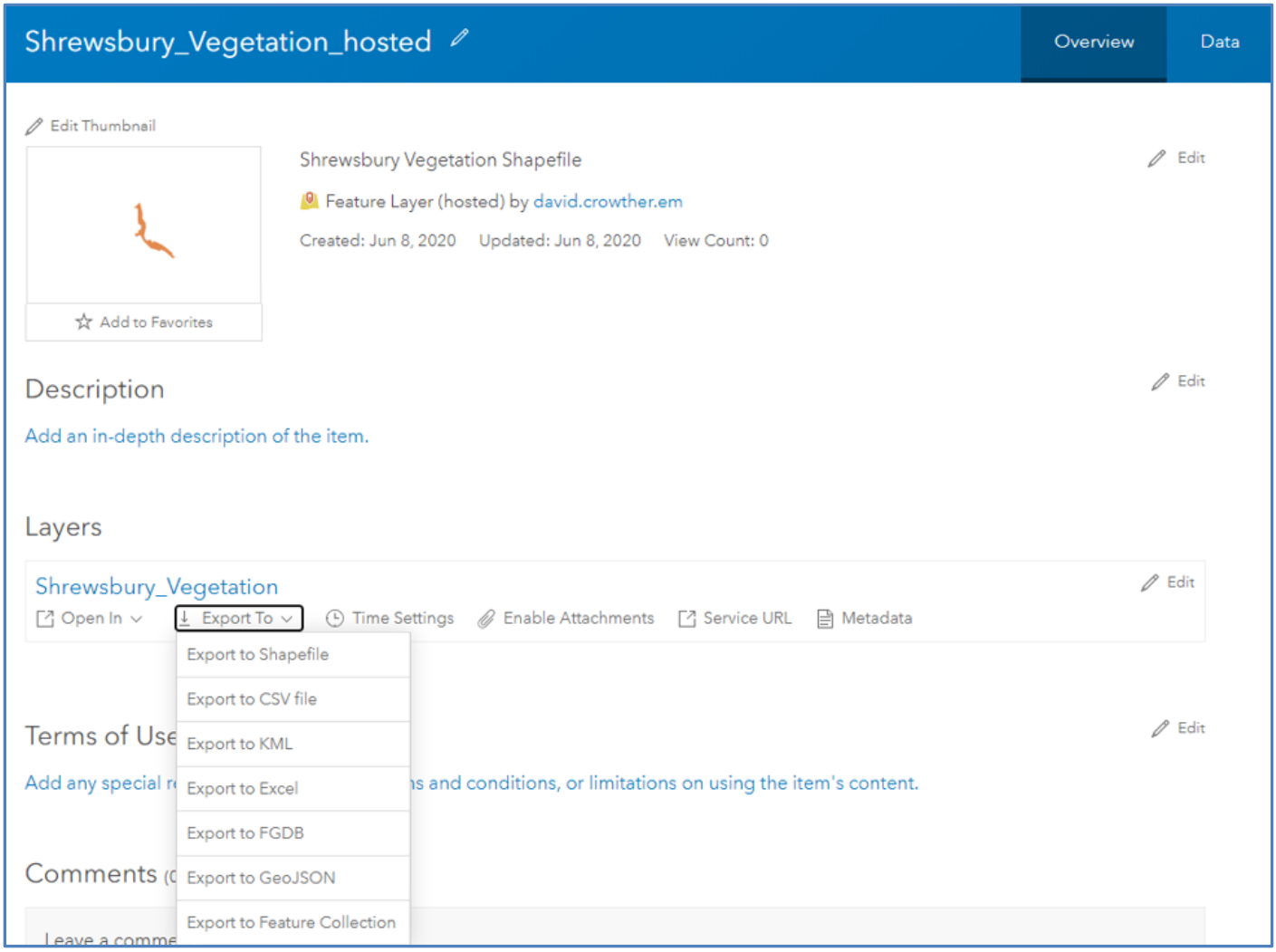


In the Item Details page choose the **Publish** button from the right-hand side.

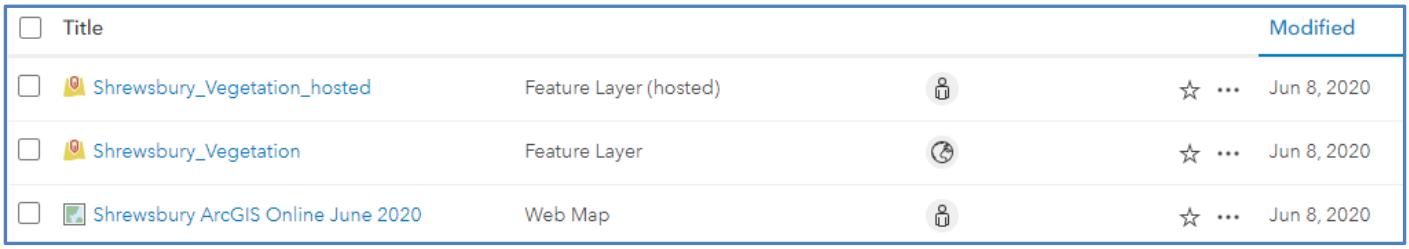
Give the Hosted Feature Layer a **Title** (Name) for example add the words – hosted – on the end so that you know that this layer is a Hosted version of the Feature Layer.



Add some useful **Tags** (for searching) and choose **Publish**. Once saved the new Hosted version of the Feature Layer is created and you have options to edit the Thumbnail, add a Description as well as options to export the Layer to other GIS formats.

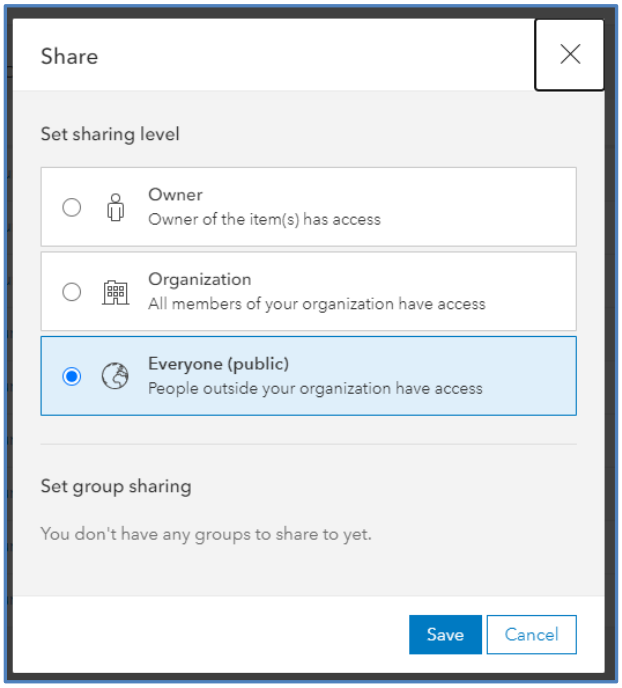


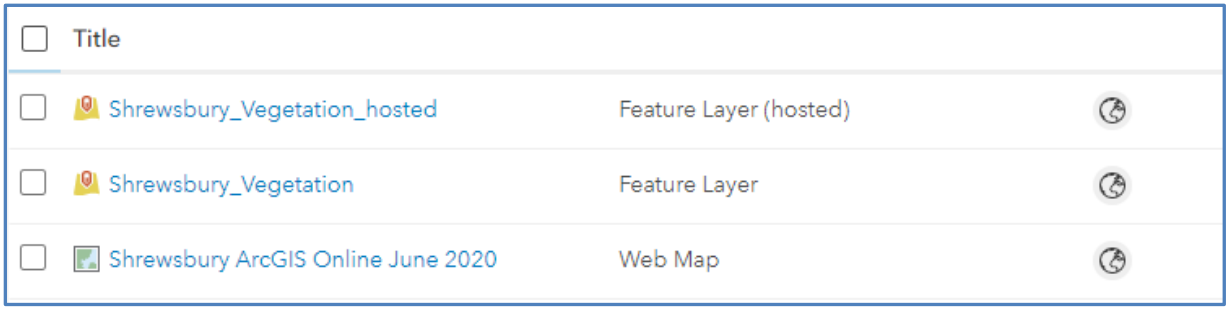
If you now view your **Contents** page you will see the new **Hosted** version of the Layer is listed.



Having created a Hosted version of the Feature Layer it appears that the Sharing options are not copied across and the Hosted Layer is only accessible by the **Owner.**

So, ensure you edit the **Sharing** options and set the Hosted Feature Layer to be available for **Everyone (public).**



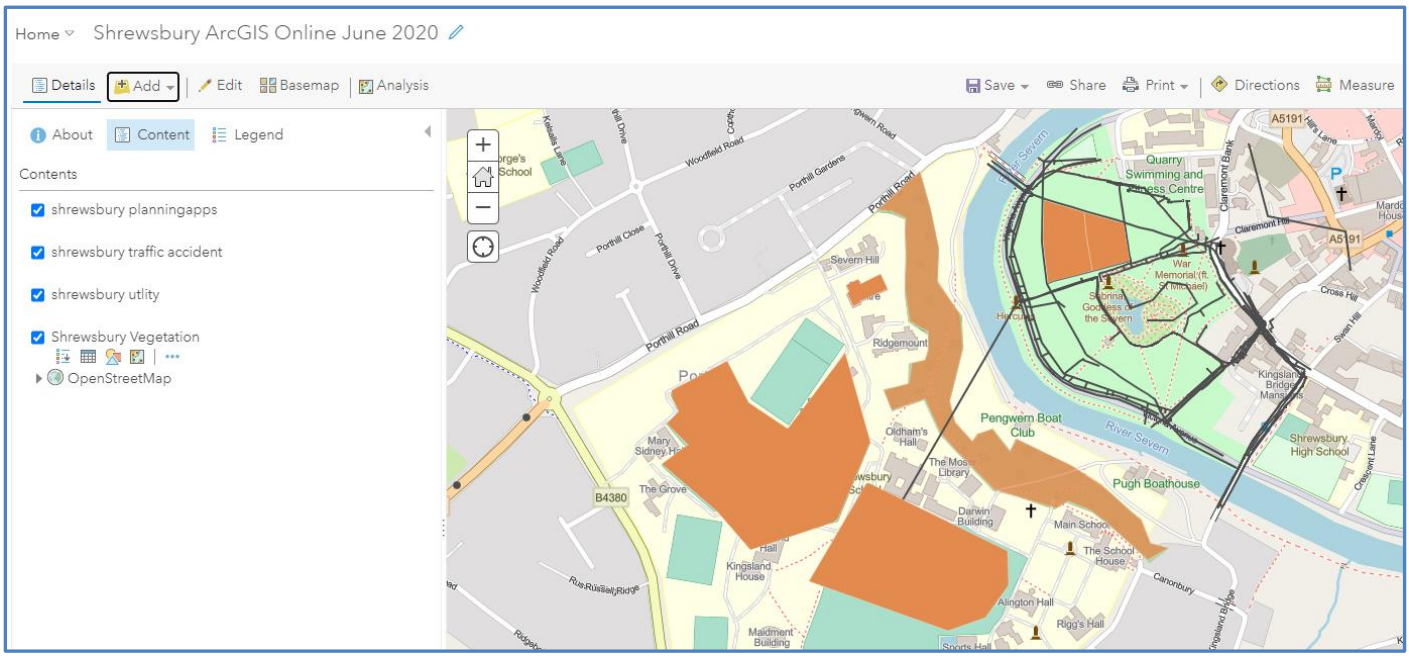


Step 6: Upload and Create More Hosted Feature Layers

Using steps 3,4 and 5, now **upload** other GIS files to your ArcGIS Online Map, save those as **Feature Layers** and then **Publish** those for Everyone and create a **Hosted Feature Layer.**

For my Shrewsbury Map I have uploaded ZIP files and created Feature Layers for the following layers;

- Planning Apps
- Utility Lines
- Traffic Accidents



In our Content, ensure we change the Sharing options for these Layers and also create a **Hosted version** of each Feature Layer, so that we can then access them later using the Autodesk to ArcGIS Connector.

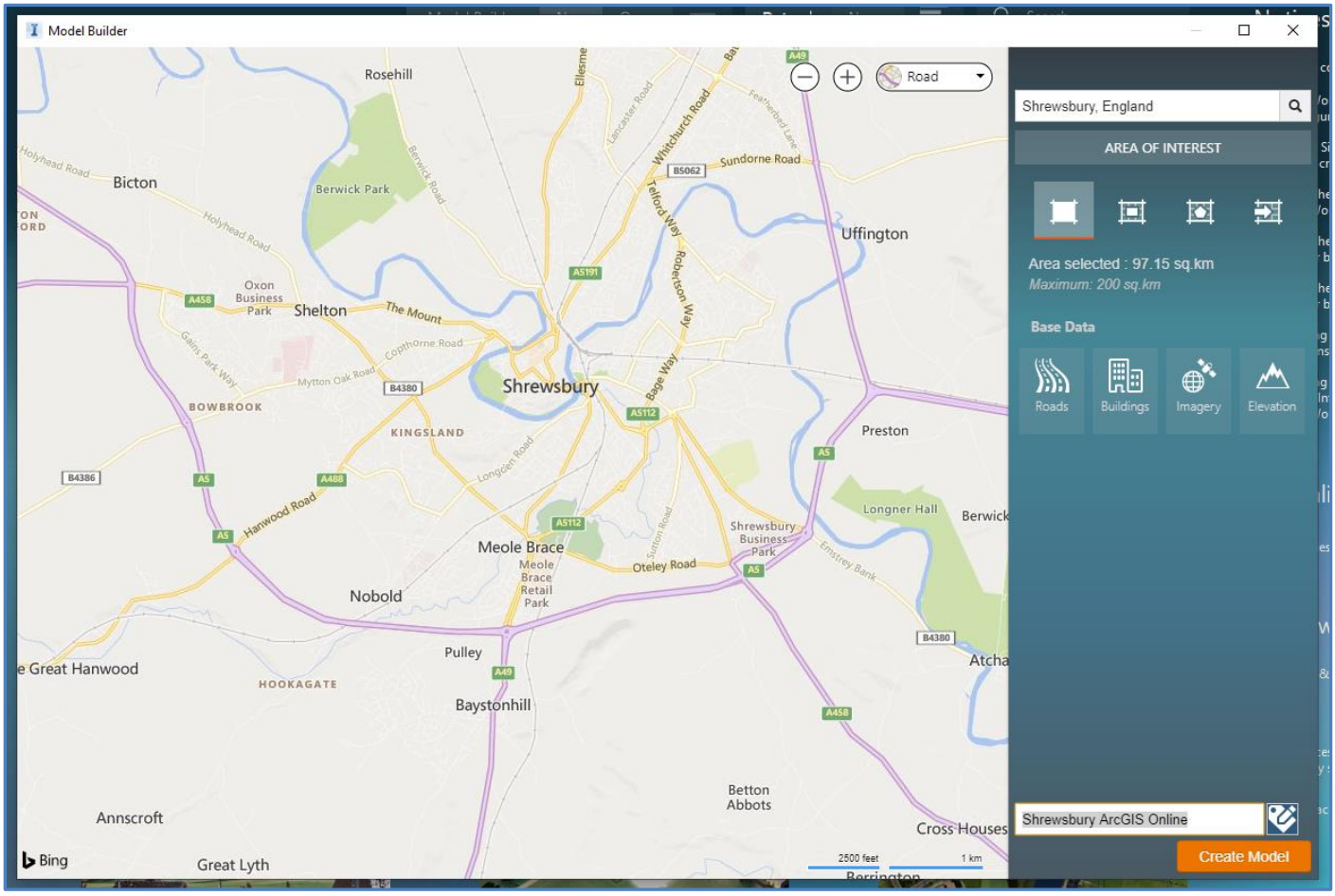
shrewsbury_planningapps_hosted	Feature Layer (hosted)	
shrewsbury_traffic_accident_hosted	Feature Layer (hosted)	
shrewsbury_utlity_hosted	Feature Layer (hosted)	
shrewsbury_utlity	Feature Layer	
shrewsbury_traffic_accident	Feature Layer	
shrewsbury_planningapps	Feature Layer	

Section 2: Using the Autodesk to ArcGIS Online Connector

In Section 2, now that we have uploaded our GIS data to our ArcGIS Online Portal and created Hosted Feature Layers, we can now access these GIS assets in our **Autodesk Applications** e.g. **InfraWorks** and Auto**CAD.**

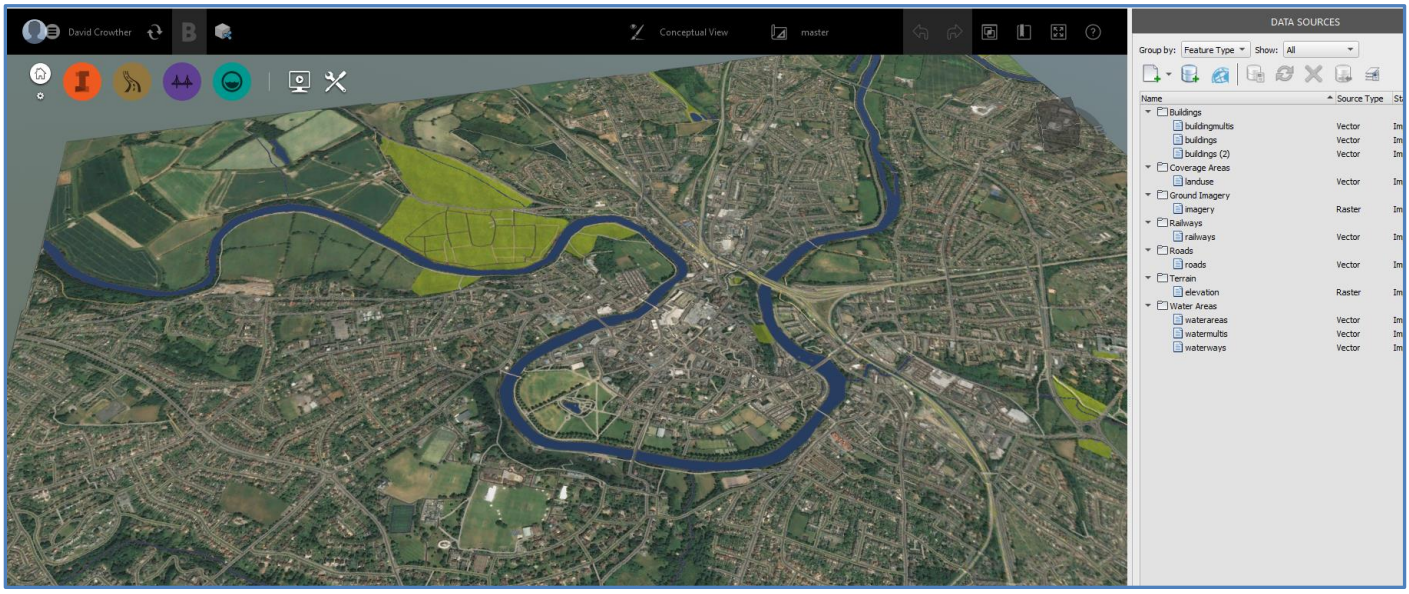
InfraWorks

Before we access our ArcGIS Online GIS Layers, firstly we will create an **InfraWorks Model** for Shrewsbury.

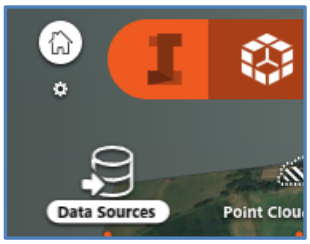


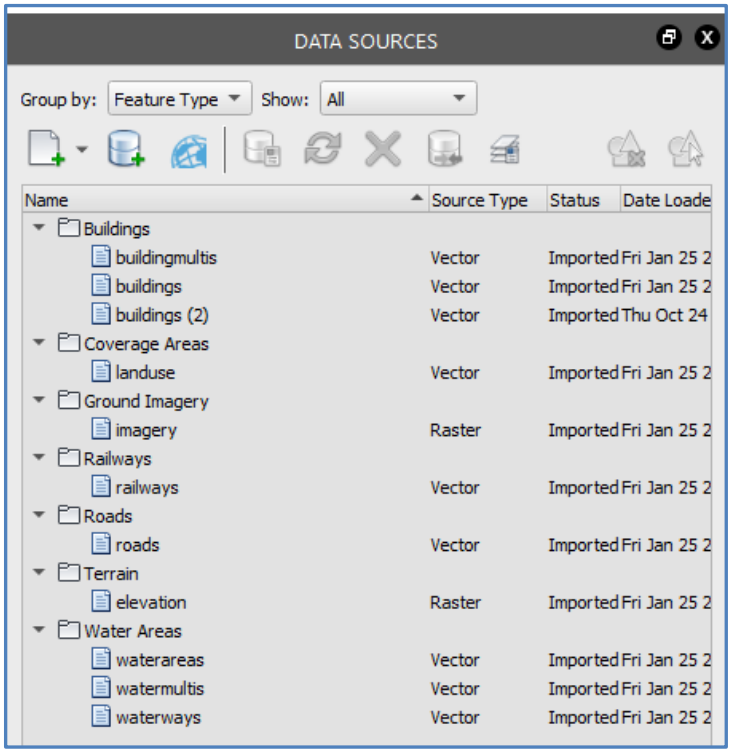
The new InfraWorks Model will open with the core Open Source data layers;

- **OpenStreetMap** – Buildings and Roads
- **Bing** – Imagery and Terrain



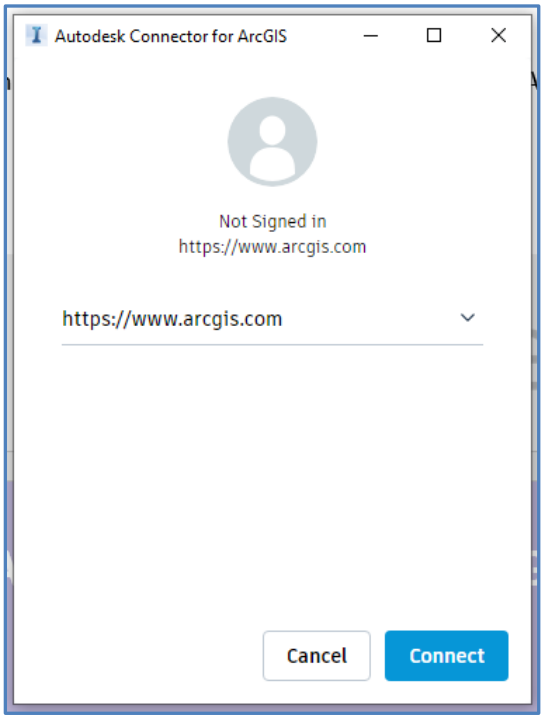
From the **Build, Manage & Analyse** Tab choose the **Data Source** option to open the **Data Sources** Pane.



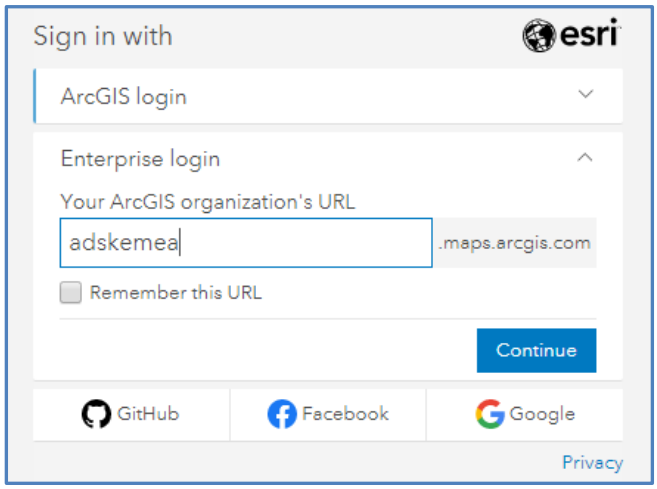


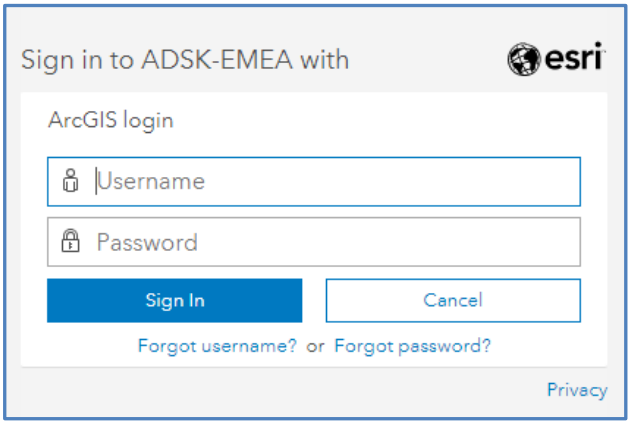
Here we can now use the **Add ArcGIS Data Source** icon to make a connection to our **ArcGIS Online Account.**

You will then be presented with a login option to your ArcGIS Online Account.

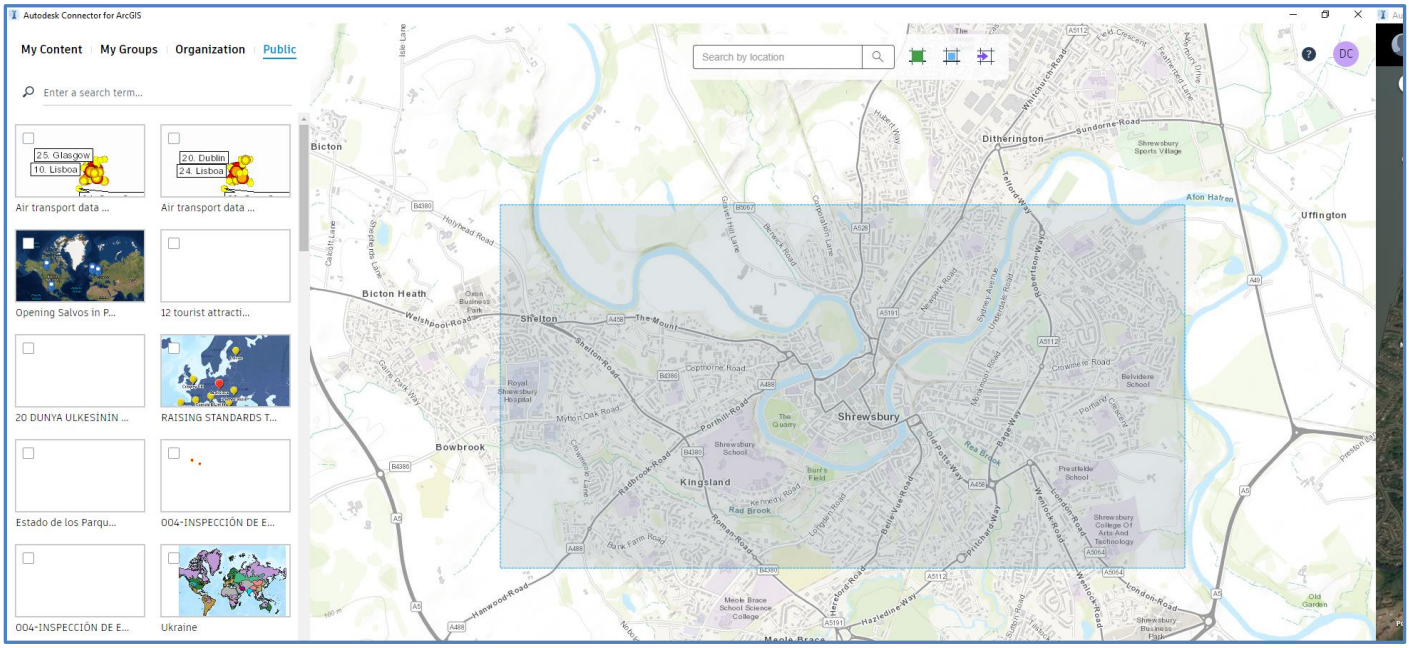


In this case Cadline are using the **Autodesk Enterprise** login so we need to change the sign in page to use an **Organisation** instead of a personal ArcGIS Account.

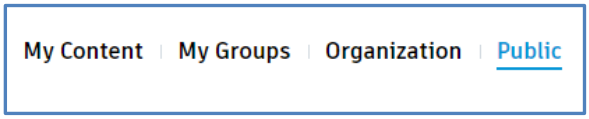




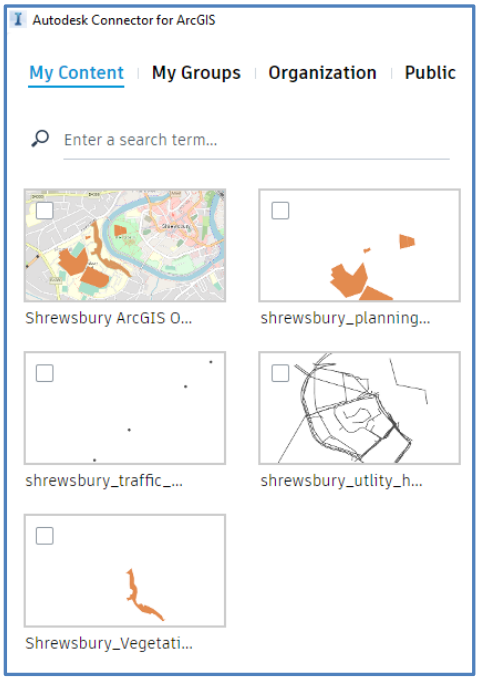
Once successfully logged in the **Autodesk Connector for ArcGIS** will fully open and centre over your Model area, in this case Shrewsbury in the UK.



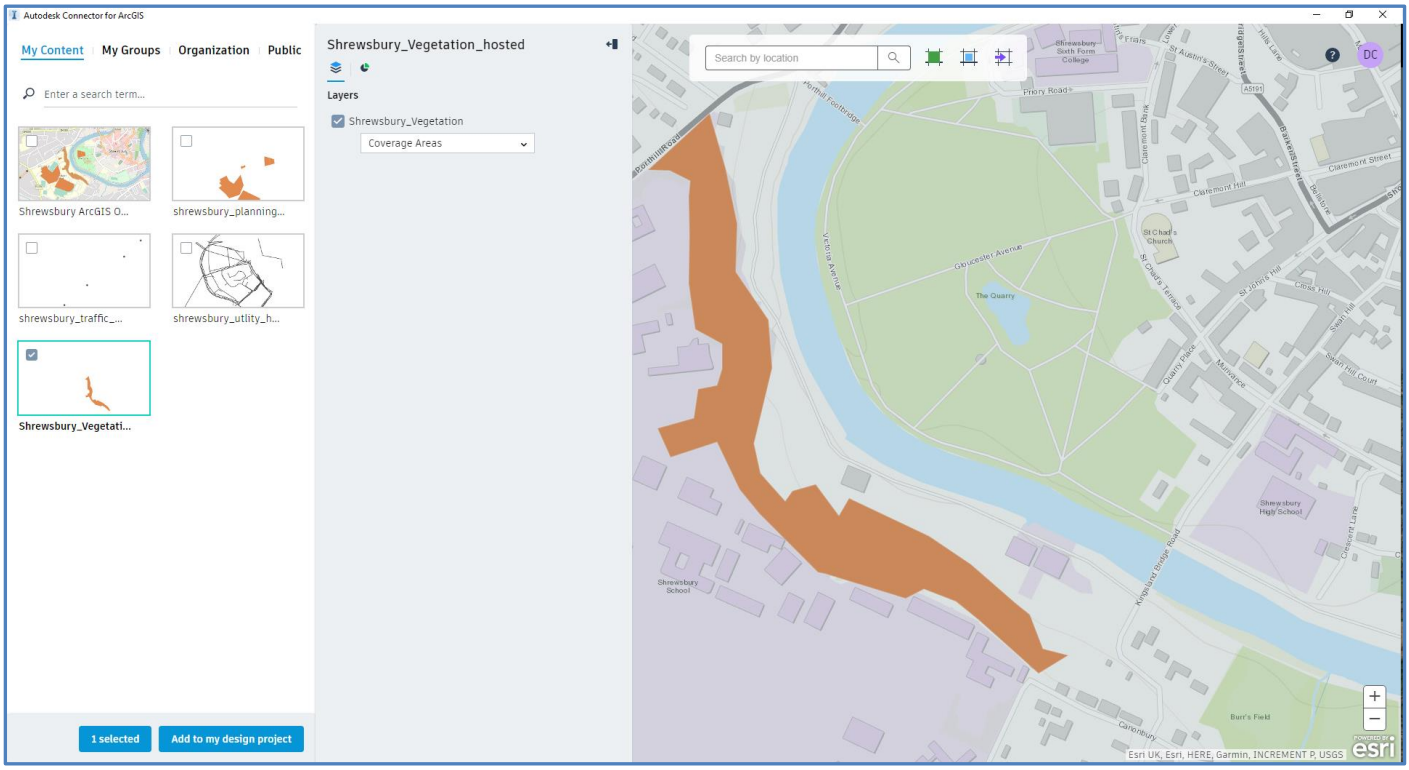
You now have the ability to add GIS datasets from a number of resources, including **Public Datasets**, Layers shared by your **Organisation** and your own **Content.**



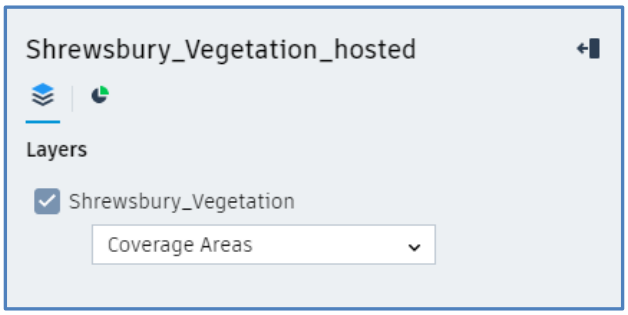
Change the option to be **My Content** and we will then see the **Hosted Feature Layers** that we uploaded into our ArcGIS Account earlier in this Blog.



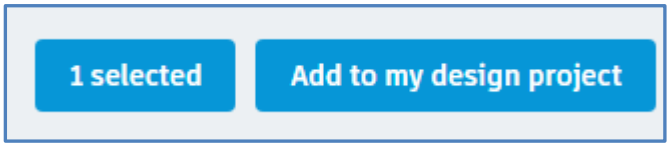
Here we will add one Feature Layer at a time, choosing to **add** the **Shrewsbury Vegetation** first. Simply **tick** the box next to the Feature Layer, and the map on the right updates to show a preview of the Layer.



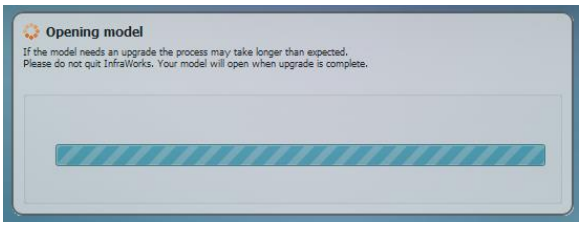
In the centre pane you can now choose how the GIS Layer will be configured when it opens into InfraWorks – this saves a lot of time manually configuring Layers yourself. For this Layer we will set the Shrewsbury Vegetation as a **Coverage Area.**

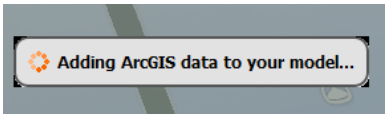


Now choose to **Add** the GIS Layer to your design project.



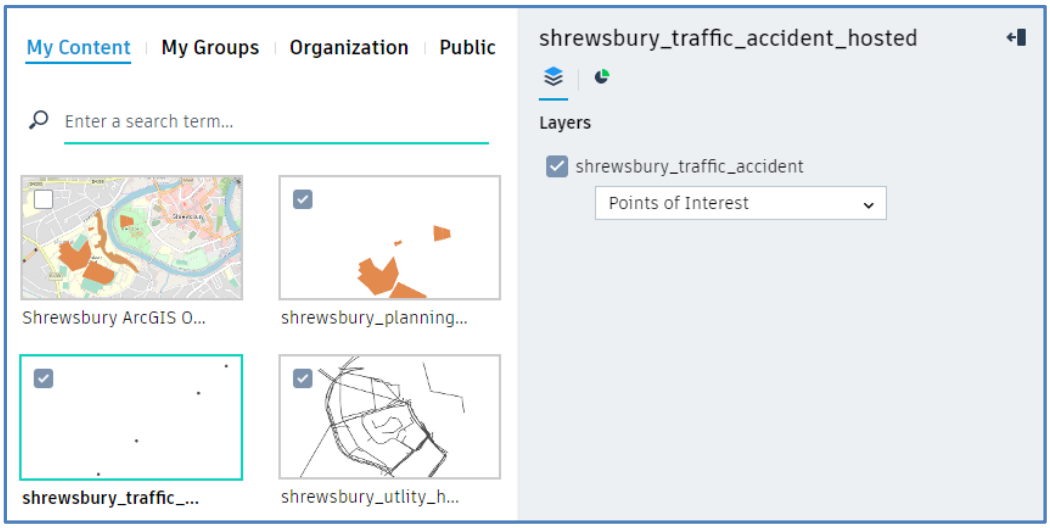
The Layer is then added to the InfraWorks Model.



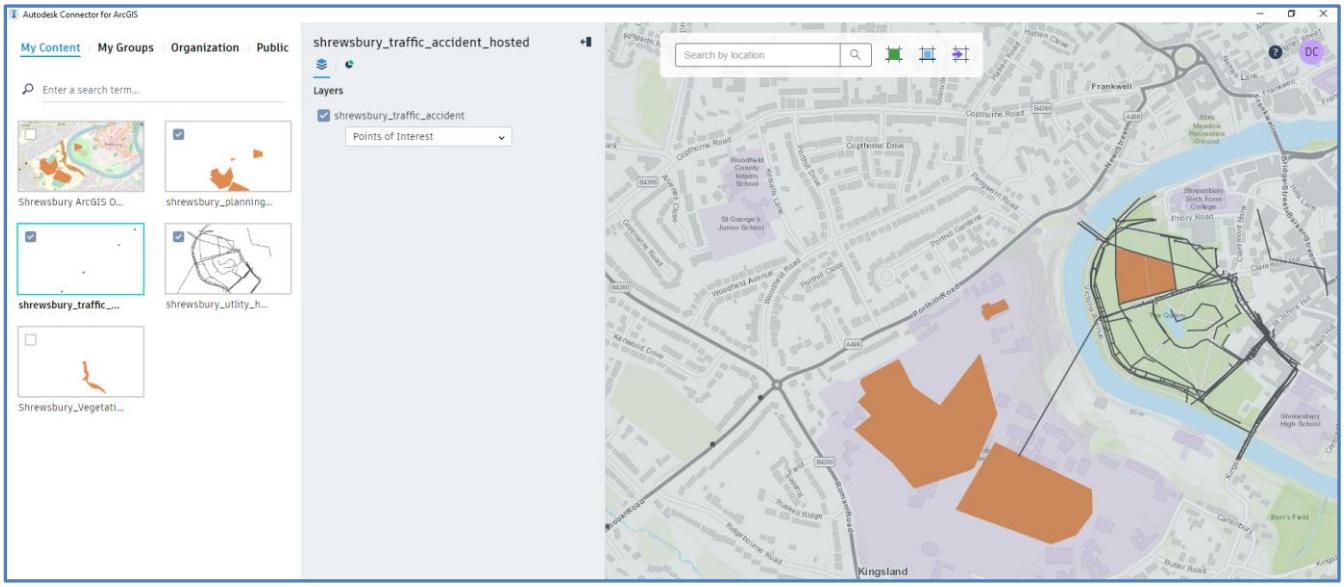


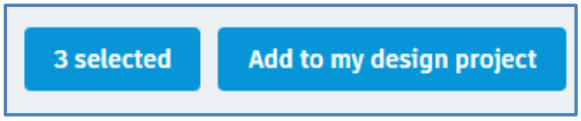
Once added the GIS Layer – Shrewsbury Vegetation – is now shown in the Model and listed in the **Data Source Pane**.

We can now add all the other Shrewsbury ArcGIS Online Feature Layers.



Clicking on each Feature Layer to in turn choose the type of feature within InfraWorks.





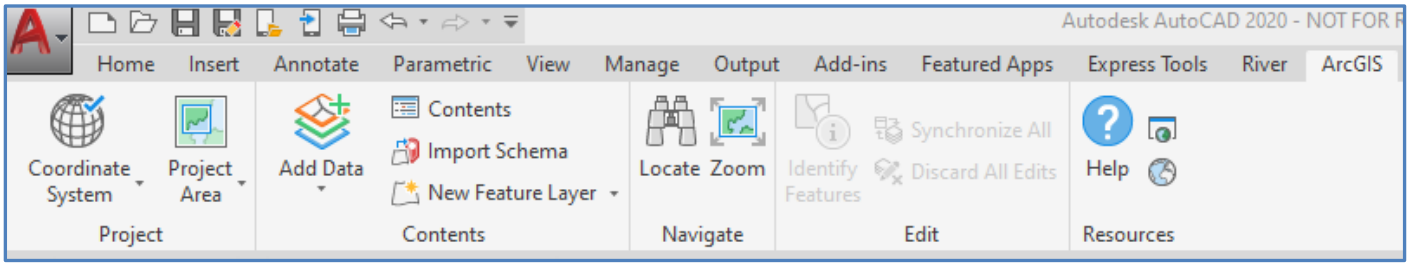
Once all Feature Layers are added, your InfraWorks Model now contains all the GIS files within your ArcGIS Online Account.

AutoCAD (or Civils/Map3D)

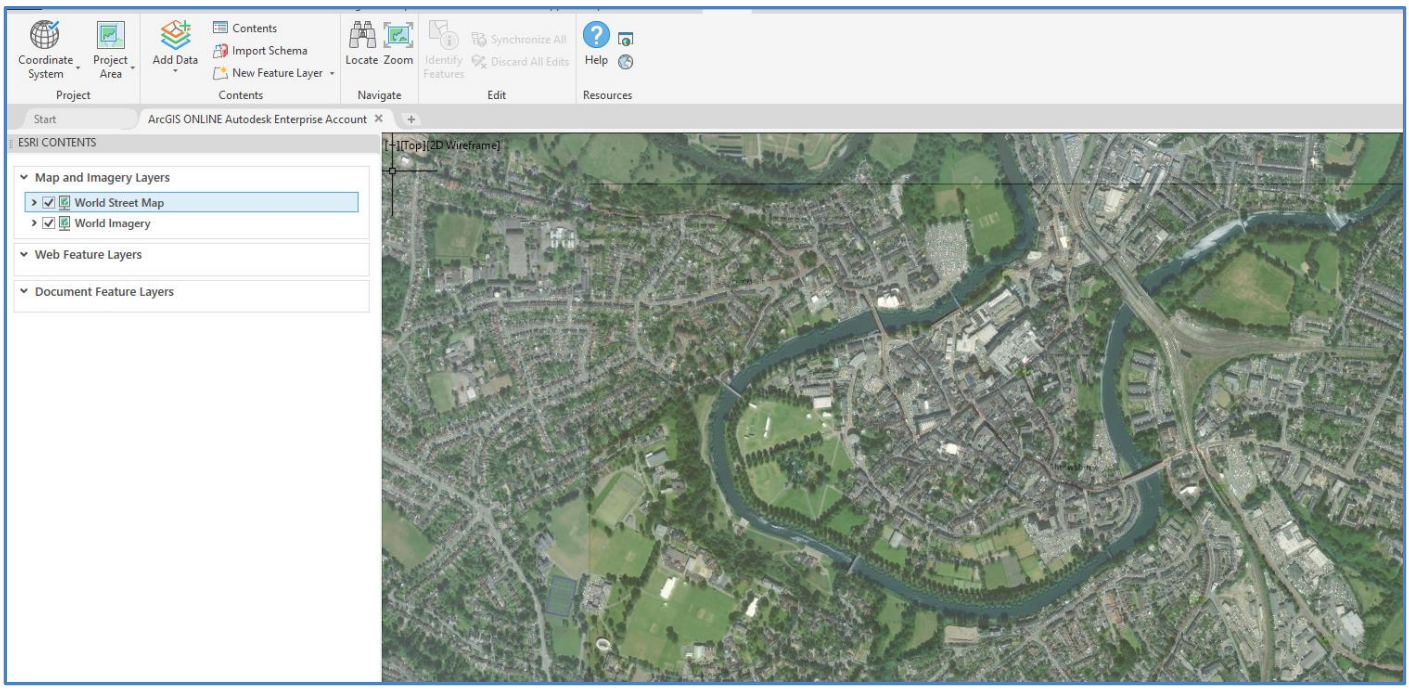
In the next part of the blog we will explore how to access the same ArcGIS Online Feature Layers using **AutoCAD** (or Civils/Map 3D). Furthermore, we will see if we can also manipulate these GIS assets through CAD, to then share those changes to be viewed in ArcGIS Online and InfraWorks – fully integrating Autodesk and our ArcGIS Online datasets.

In my previous blog **Integrating CAD and GIS – Using AutoCAD Part 3** we have already explored how to download and install the **ArcGIS for Autodesk Plugin**.

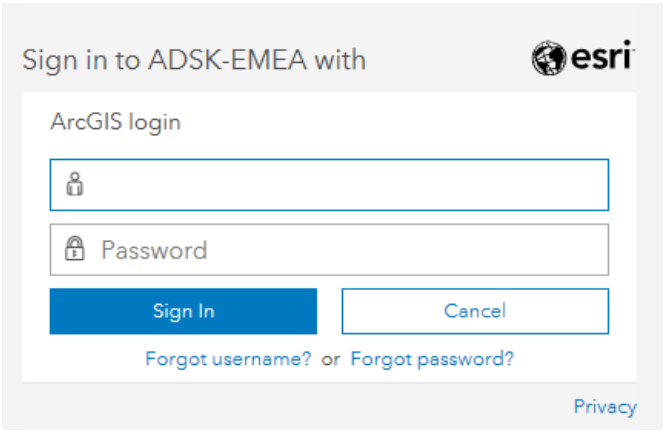
So, loading CAD on my machine, now gives me the **ArcGIS Ribbon** and Menu items.



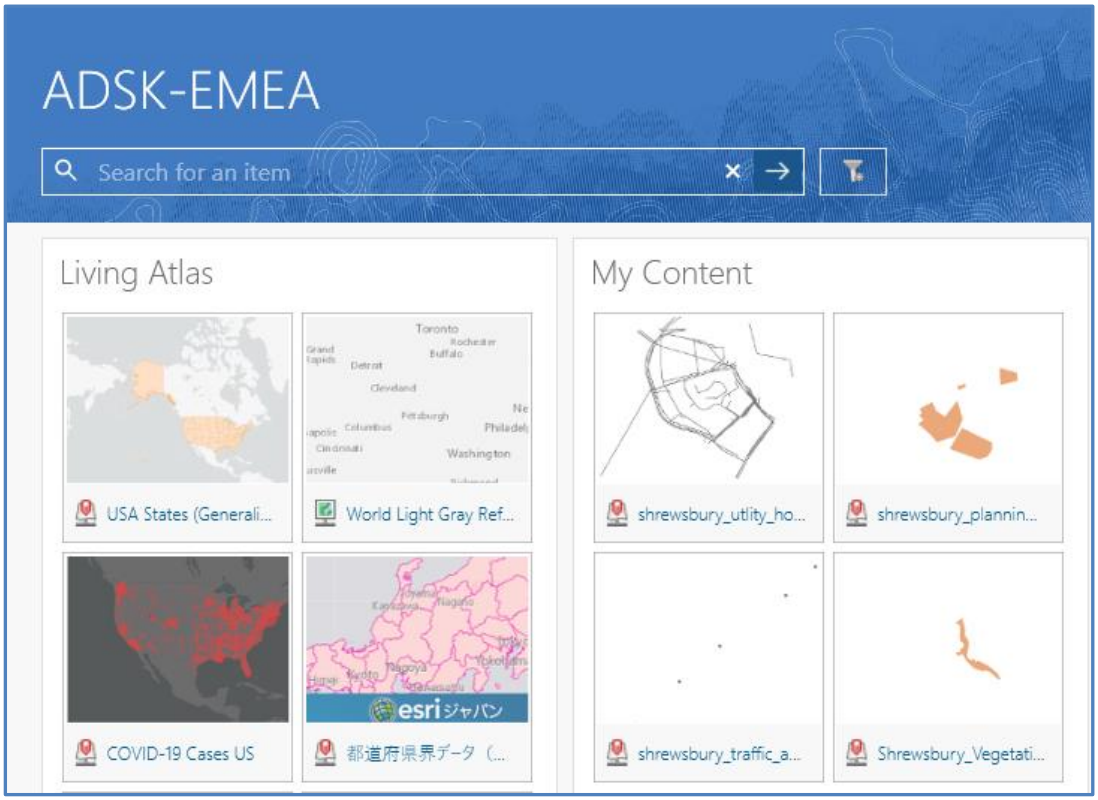
Using the **Add Data** button we will load in some **basemapping** and zoom to Shrewsbury.



When using the **Add Data** button, we can now login to our **Autodesk Enterprise Account** to then access the **Feature Layers** that we uploaded earlier.



Once logged into our ArcGIS Online Account, again we have access to the Publicly available Living Atlas as well as Our **own Content.**

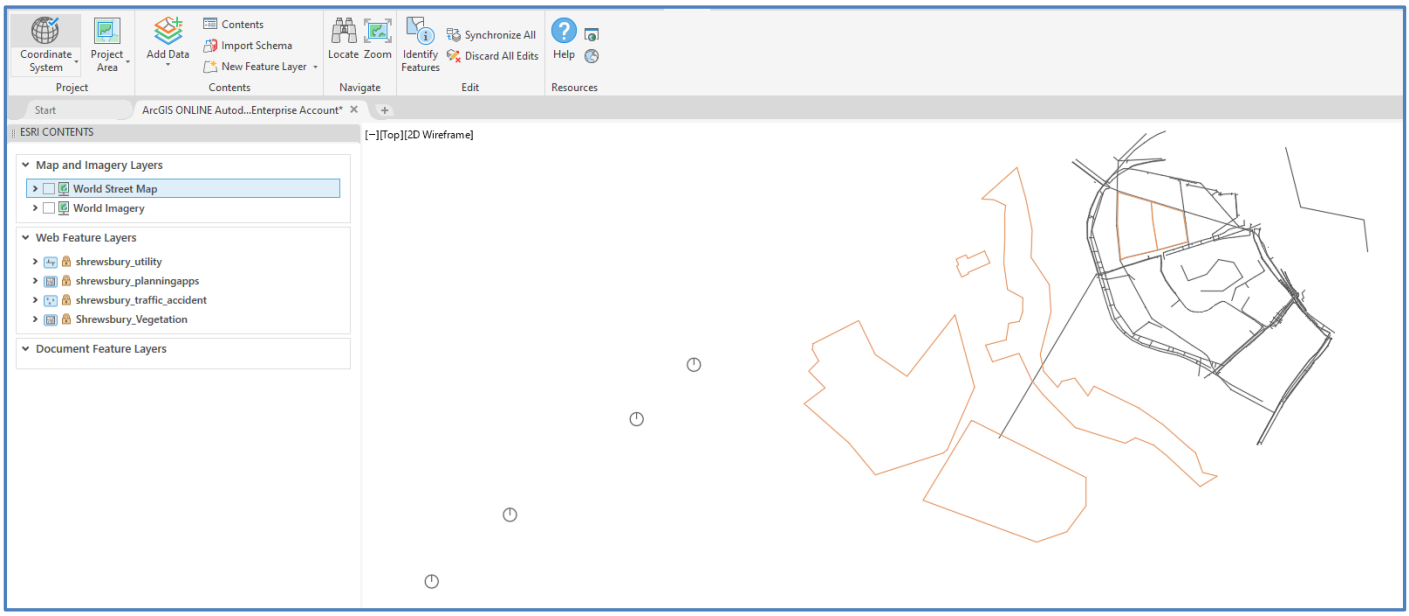


Choose the ArcGIS Feature Layer that you wish to open in AutoCAD by clicking over the **thumbnail icon.**

The ArcGIS Online Feature Layer is then loaded into the AutoCAD Drawing.

And once loaded is then available from the ArcGIS Layers Pane in CAD.

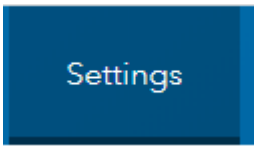
Repeat this for all our ArcGIS Online Feature Layers, so that we now have all 4 Feature Layers loaded.



The blog - [Integrating CAD and GIS – Using AutoCAD Part 3] – provides full details of how to **edit ArcGIS Online** data and synchronise those changes made in AutoCAD back to your ArcGIS Online Portal.

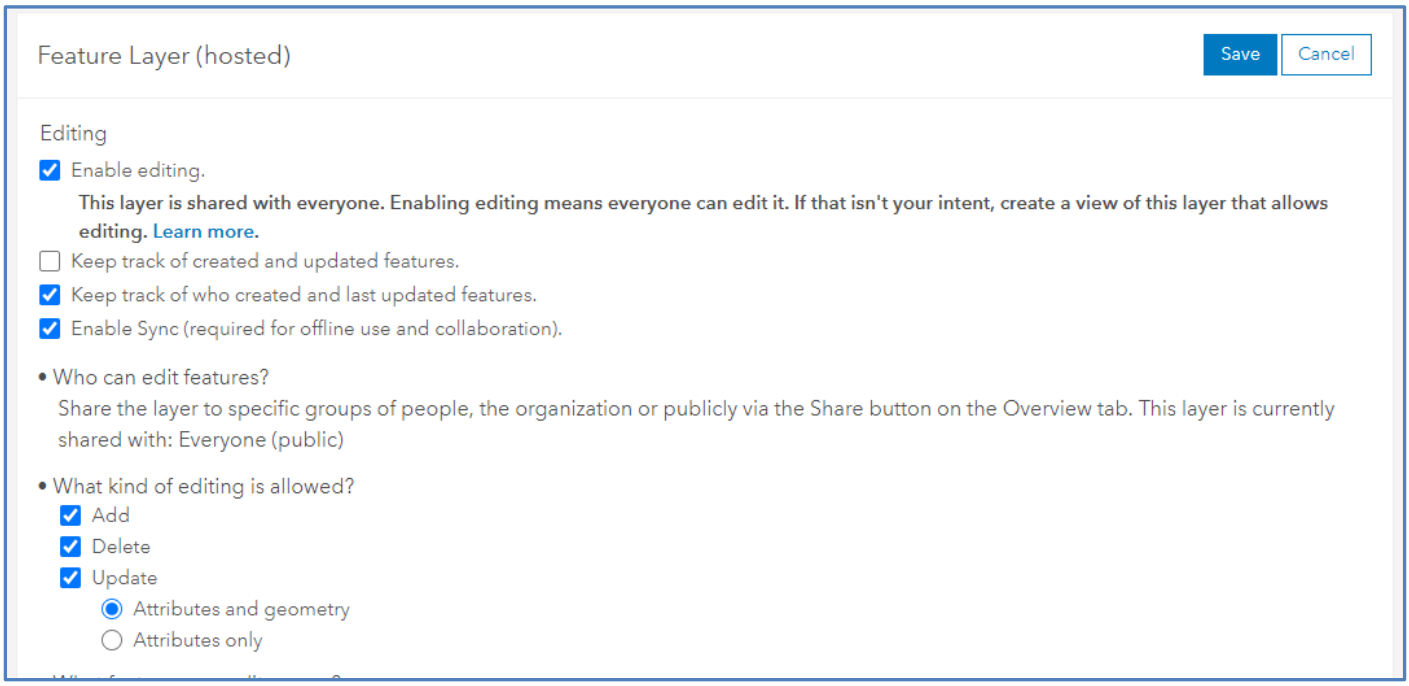
However, here we will make a simple **edit** to the **Shrewsbury Vegetation** Layer and see how that is easily saved and then **synchronised** back to view in our ArcGIS Web Map and also within our InfraWorks Model.

Note – by default the Feature Layers that are created in ArcGIS Online will be **ReadOnly**, so if you try to edit the GIS Layers in AutoCAD it will say that the Layer is **Locked for Editing**. To make a Feature Layer editable in ArcGIS Online, view the **Details** Page and choose the **Settings** Tab.

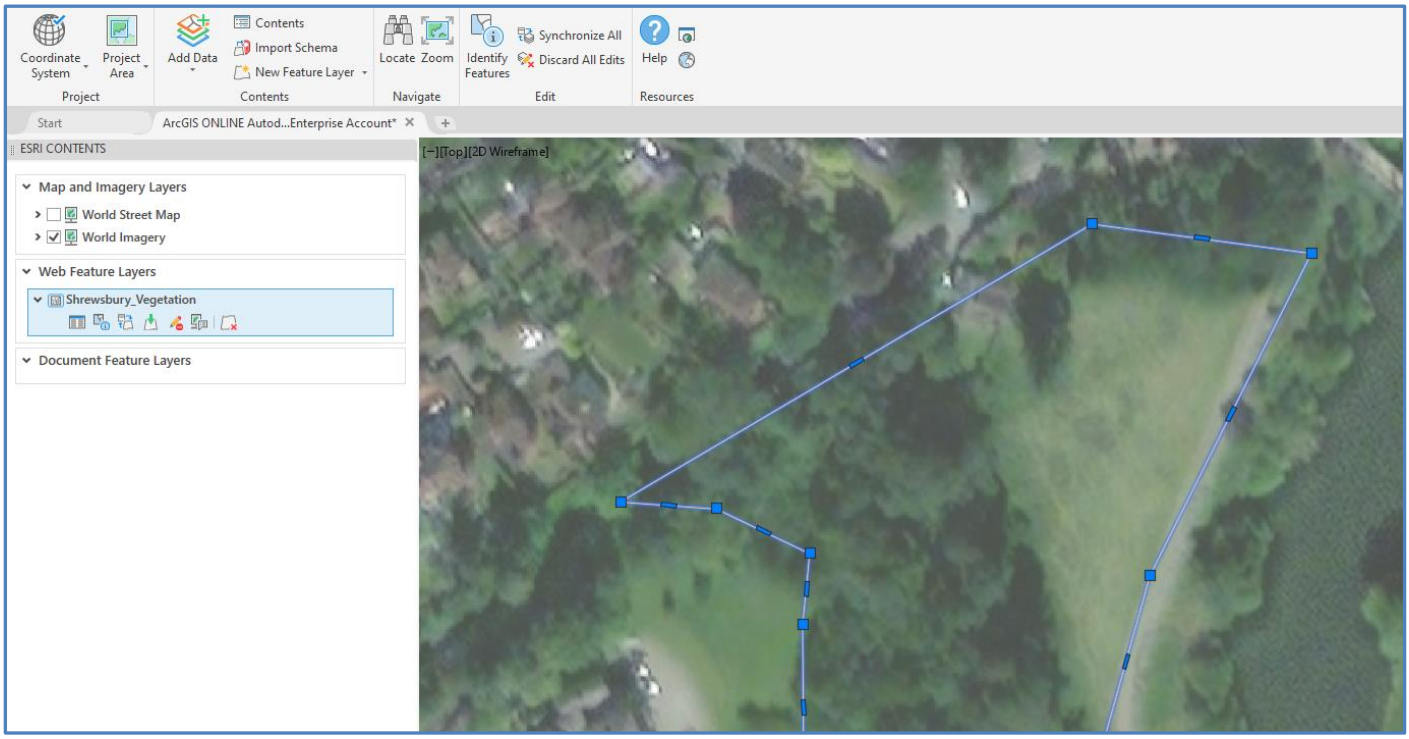


In the **Settings** Page notice that the Editing is not currently enabled.

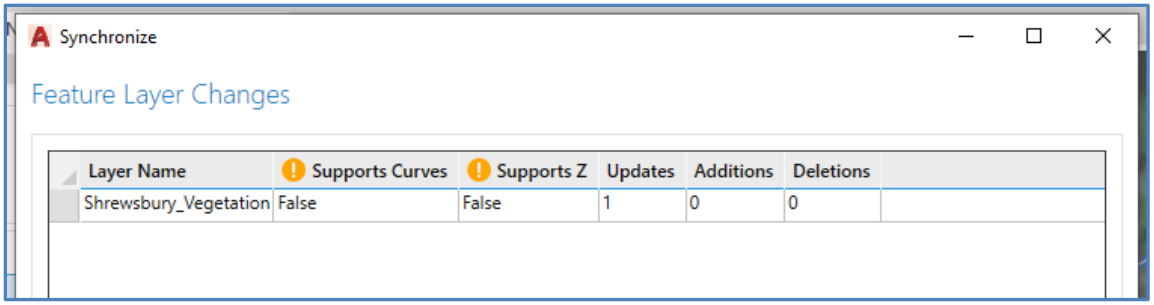
To **enable Editing** tick the options that you require and Save the changes to the Feature Layer.



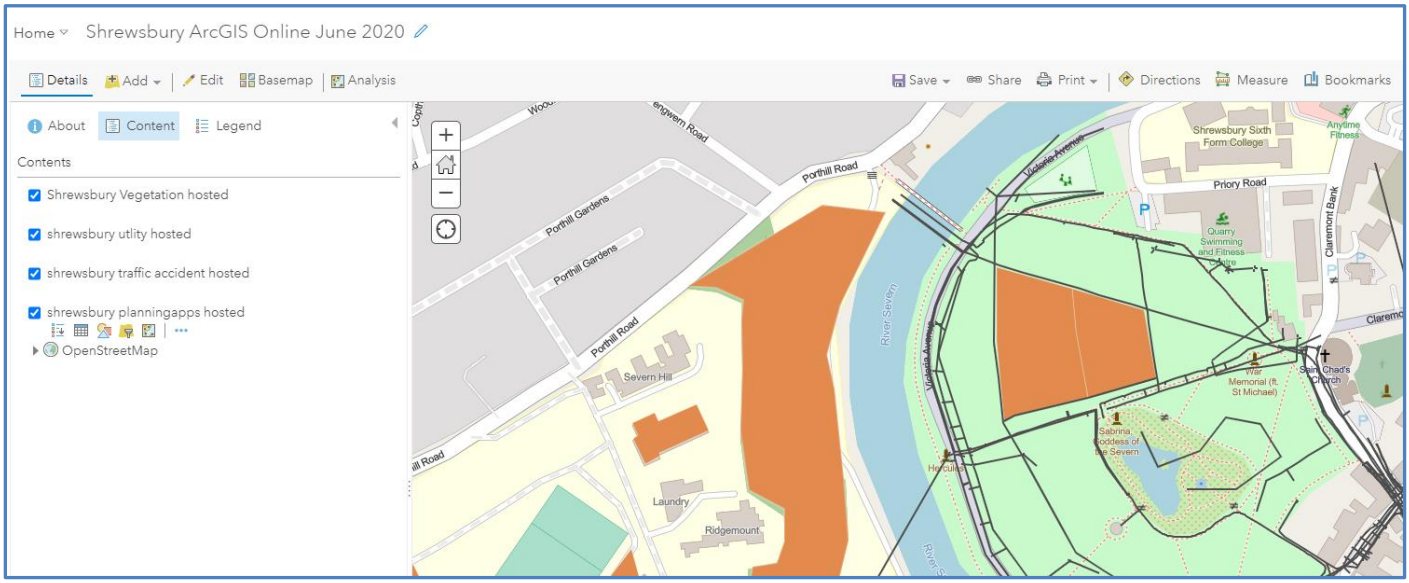
If we now re-connect to the ArcGIS Online Feature Layers in AutoCAD, we can now successfully **reshape** the geometry of the Shrewsbury Vegetation Feature Layer.



Choosing **Edit** > **Synchronise All** will allow you to choose the Feature Layers that you wish to Save changes for, in this case we edited the Shrewsbury Vegetation Feature Layer.



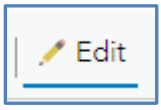
If we now return and view our ArcGIS Online Map, we can see that the Shrewsbury Vegetation Layer has successfully be edited in CAD and now updated into ArcGIS Online.



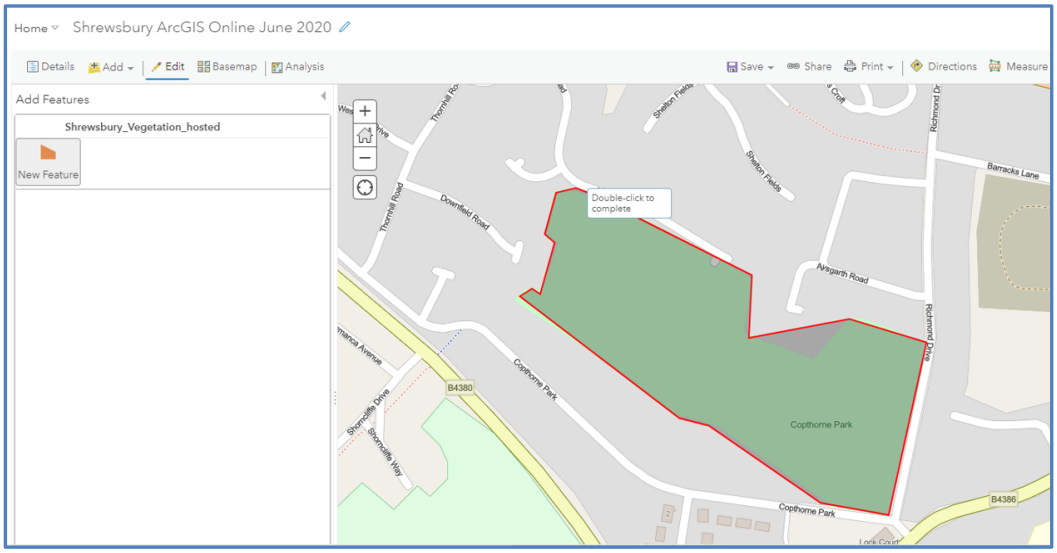
Similarly, if we choose the **REFRESH** Data Source icon in our **InfraWorks Model**, the same 'Shared' Layer is updated from its previous shape (shown on left) to the newly updated shape (shown on right).

A final example of making a change, would be to manage your spatial data in **ArcGIS** and see how those changes are then pushed out to all CAD Users. For example, we will **add another Polygon** to the Shrewsbury Vegetation Feature Layer.

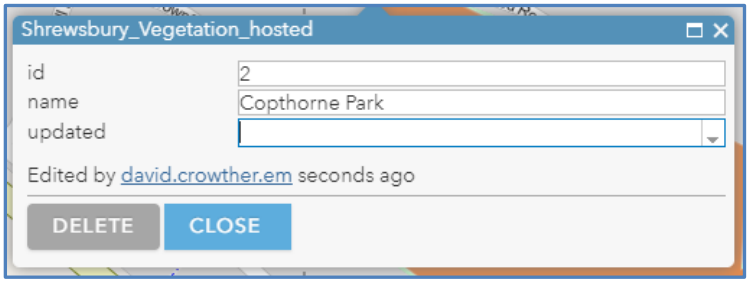
In ArcGIS Online open the **Shrewsbury Map**, select the **Shrewsbury Vegetation Hosted Layer** and choose **Edit.**



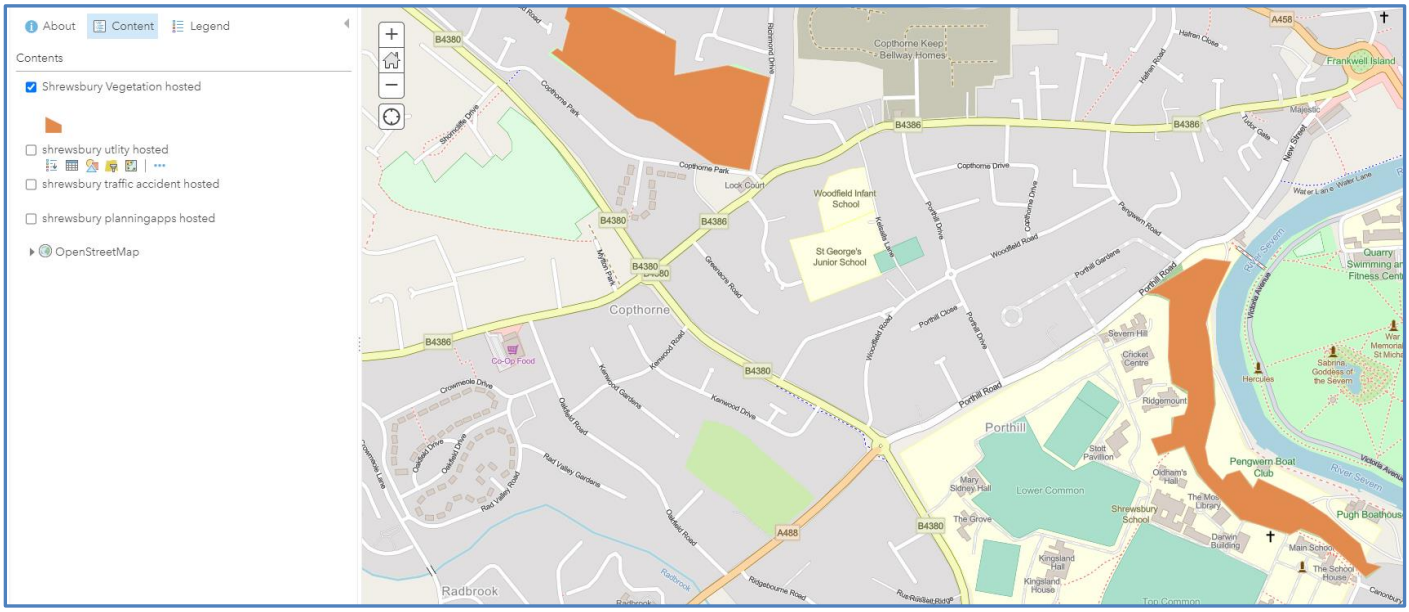
Draw the new Polygon into the Shrewsbury Vegetation Layer by **left clicking** in the map.



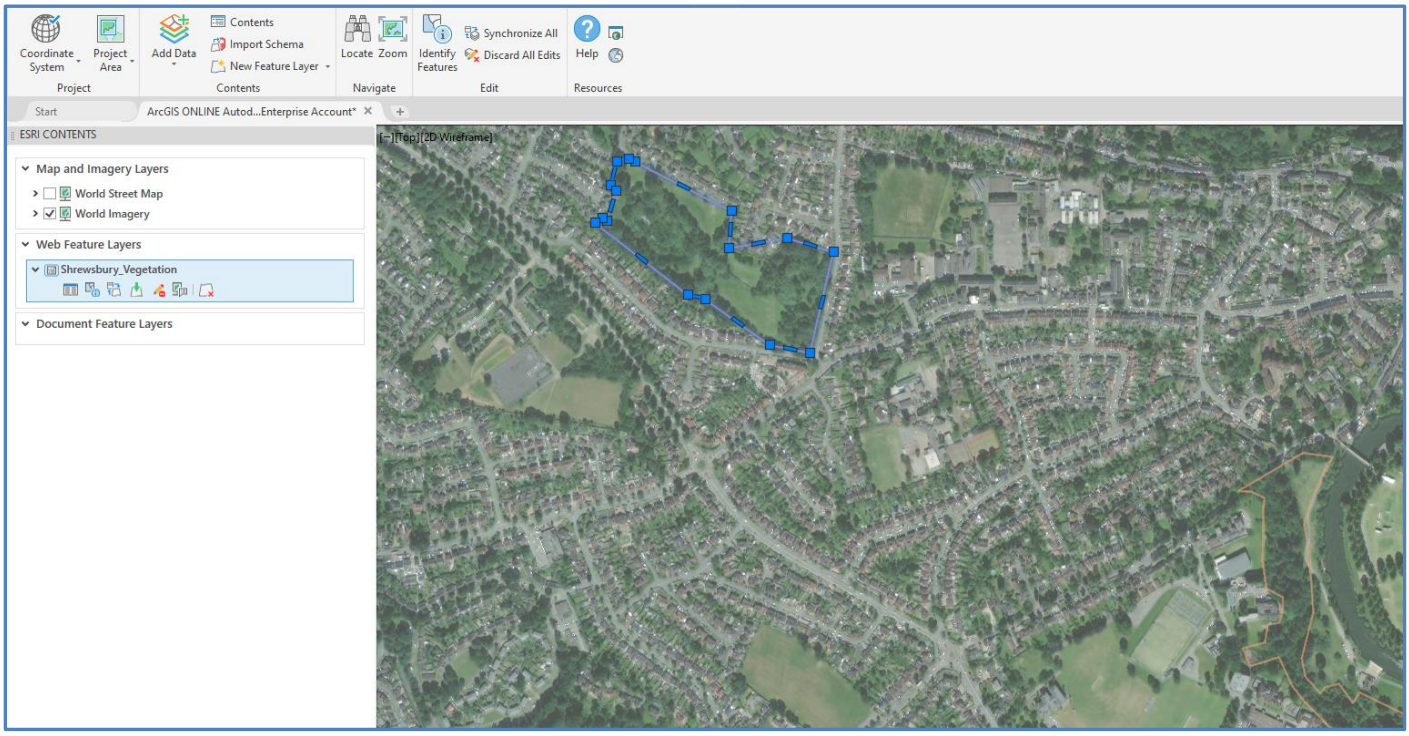
Then add the **attributes** and choose **Close** to create and save the new Feature.



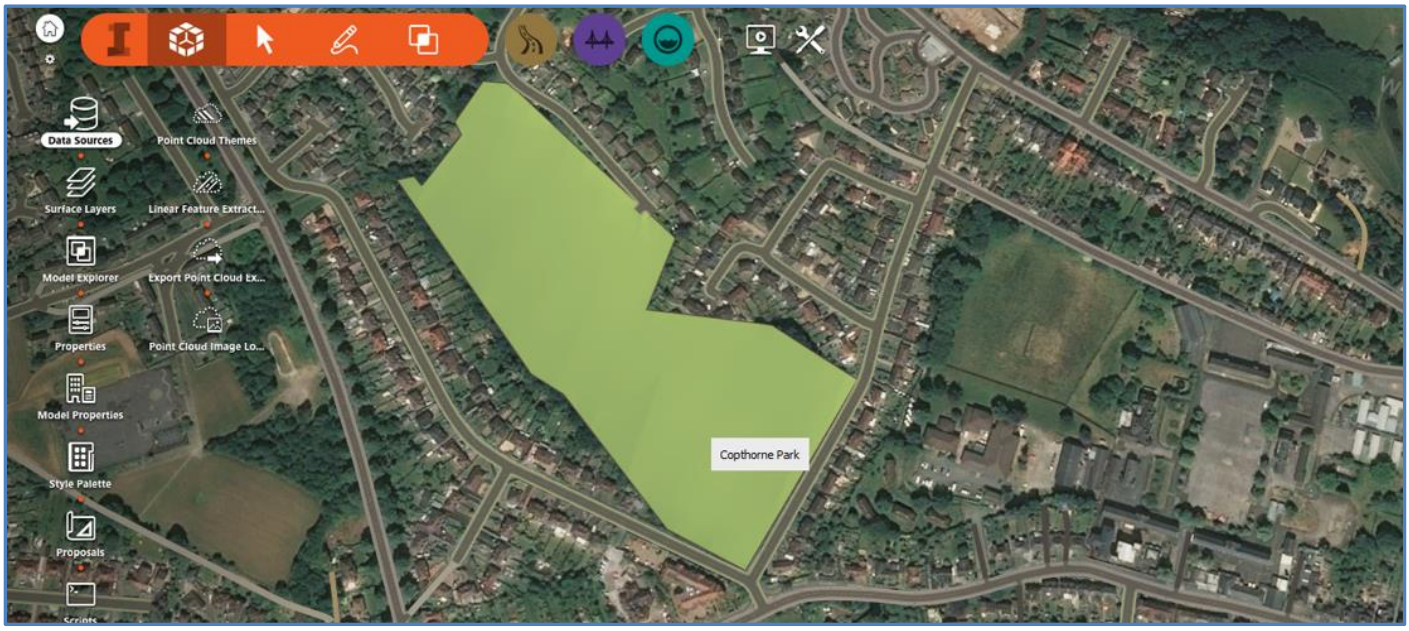
Viewing the Shrewsbury Vegetation Feature Layer in ArcGIS Online we can see there are now **2 Vegetation features.**



Re-synchronising the Layer in **AutoCAD** will then show the new feature added by the GIS Team into the ArcGIS Online Feature Layer.



And **refreshing** the Data Layer in **InfraWorks**, again ensures that the Project Team are sharing the same map features as maintained by your GIS Team.



Our journey exploring the integration between CAD and GIS is now complete!

We started by exploring using **Open Source GIS** tools, such as **QGIS**, **GeoServer** and **PostGIS** to allow you to maintain shared assets with your spatially enabled CAD Users in Map3D and Civils. We then tried to demystify the 'Matrix' and get this ***'Geographer in a CAD World'*** to then share spatial data using import and export options between CAD and GIS. And finally, we have touched on the new relationship between **ESRI** and **Autodesk** and how we can now leverage these new tools to help you better integrate your CAD and GIS datasets and workflows!

One thing that is for certain is that your GIS datasets shouldn't be locked away in your individual DWG's, and we shouldn't be wasting time and money exporting and importing between file formats to try and share datasets between CAD and GIS Users. So, whether you choose to use **Open Source Geospatial** solutions, or an **ESRI ArcGIS** Solution, the key is to centralise your geospatial assets in a format that is interoperable with as many applications as possible and to move away from historic **Data Silos.**