Getting started with Hydra Modeller

Stephen Knox, University of Manchester, December 2015

Download

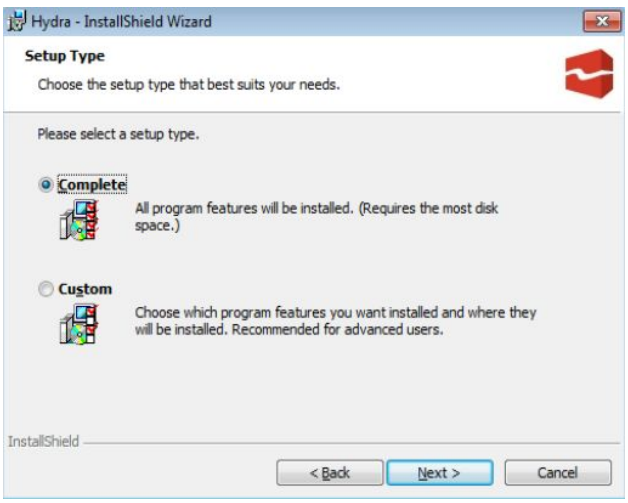
Hydra Modeller will soon be available on http://www.hydramodeller.com but while it is still undergoing development, it can be accessed at this url: https://ch2m-my.sharepoint.com/personal/rob_honeywill_ch2m_com/_layouts/15/guestaccess.aspx?guestaccesstoken=shYDJSCV5lDAbRDuKjfdXNICl%2fuzdMM9oX7jjzov0dQ%3d&docid=088fbe7262e83411a817ee49edc6b0e83&expiration=1%2f2%2f2016+11%3a11%3a29+AM

Installation

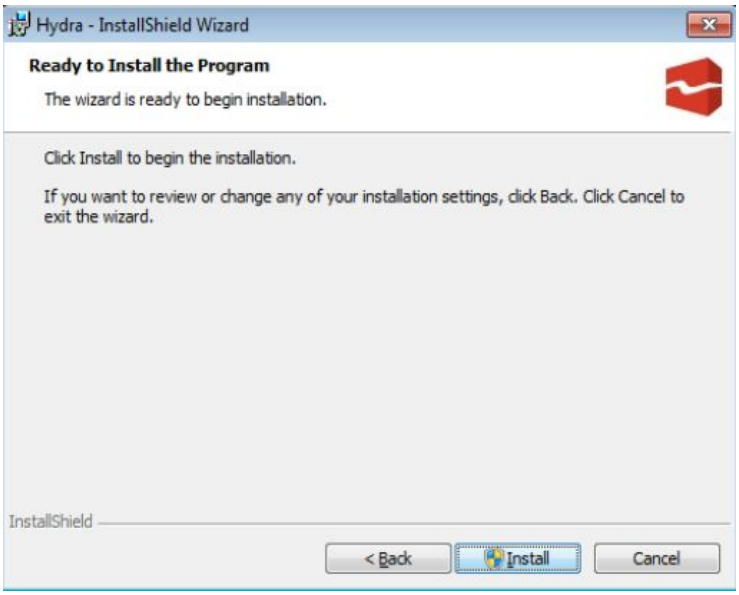
Double-click on ‘hydra.exe’ to open the ‘InstallShield Wizard for Hydra’

Click the ‘I accept the terms of the license agreement’ and hit ‘Next’

Choose ‘Complete’ and hit ‘Next’



Click ‘Install’. This will bring up a progress bar, which will show hydra installing on your computer.



And you're done!
Click on 'Launch Hydra' and hit 'Finish'

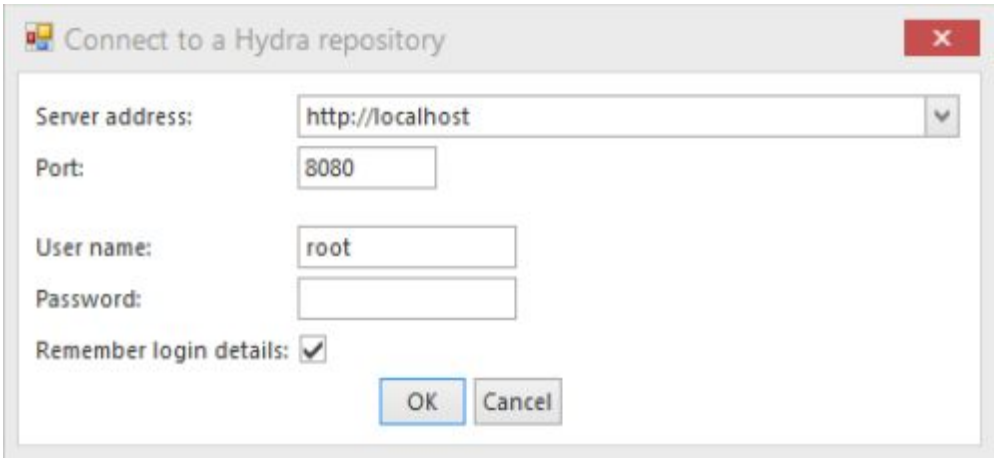
Hydra Modeller Basics

Hydra Modeller is the user interface for the Hydra Platform data management system. Hydra Platform is an open source web server which can be hosted on a user's local machine or on a remote server. Hydra Modeller can connect to multiple different Hydra Platforms and for each platform the user must have a username and password.
By default, the Hydra Modeller setup package installs Hydra Platform a user's local machine. When Hydra Modeller starts up, it will start the Hydra Platform server automatically and when the user closes the software, the server will be shut down routinely also.

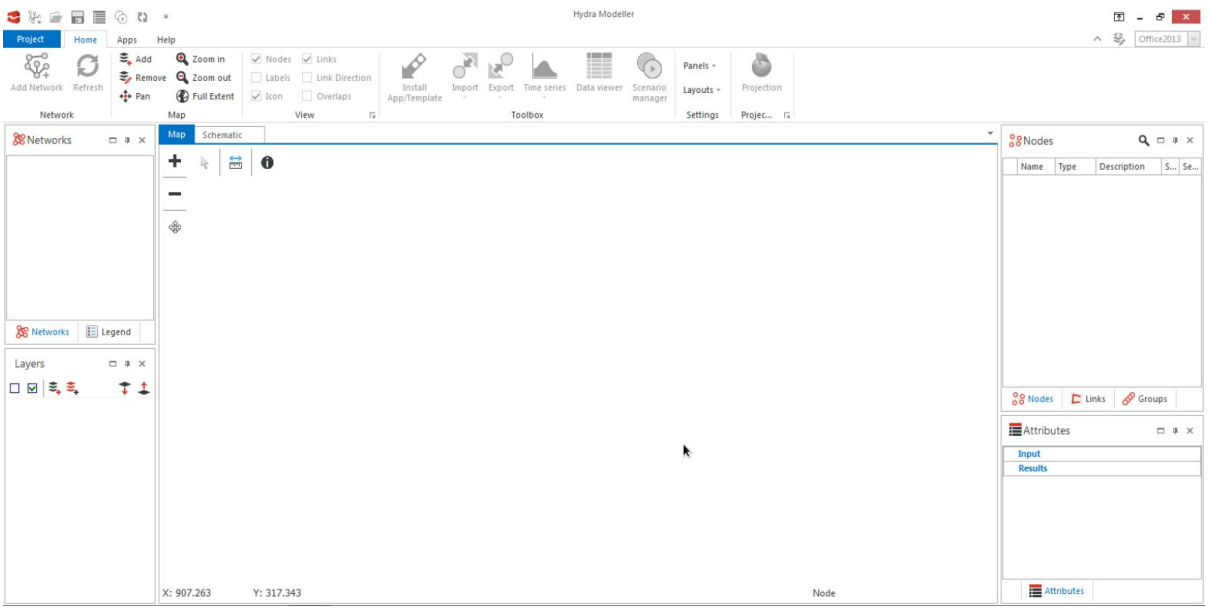
Logging in

When opening Hydra Modeller, you will be presented with a ‘login screen’. By default the server are set to the user’s local machine (not accessible by anyone else) but by simply changing the address and port, a user can connect to one of many Hydra Platform systems running in the cloud.
If you don’t know which server or port to connect to, simply leave them untouched and type ‘root’ to the username slot and leave ‘password’ empty.

Then click ‘OK.

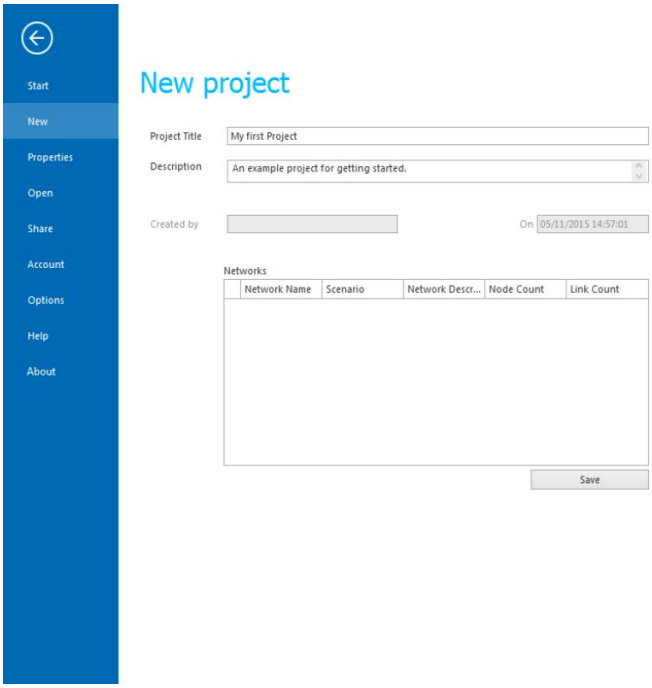


Once logged in, you will see this screen:
Notice that the icons across the top are not active. To activate them and start building networks, you can now start a new project.

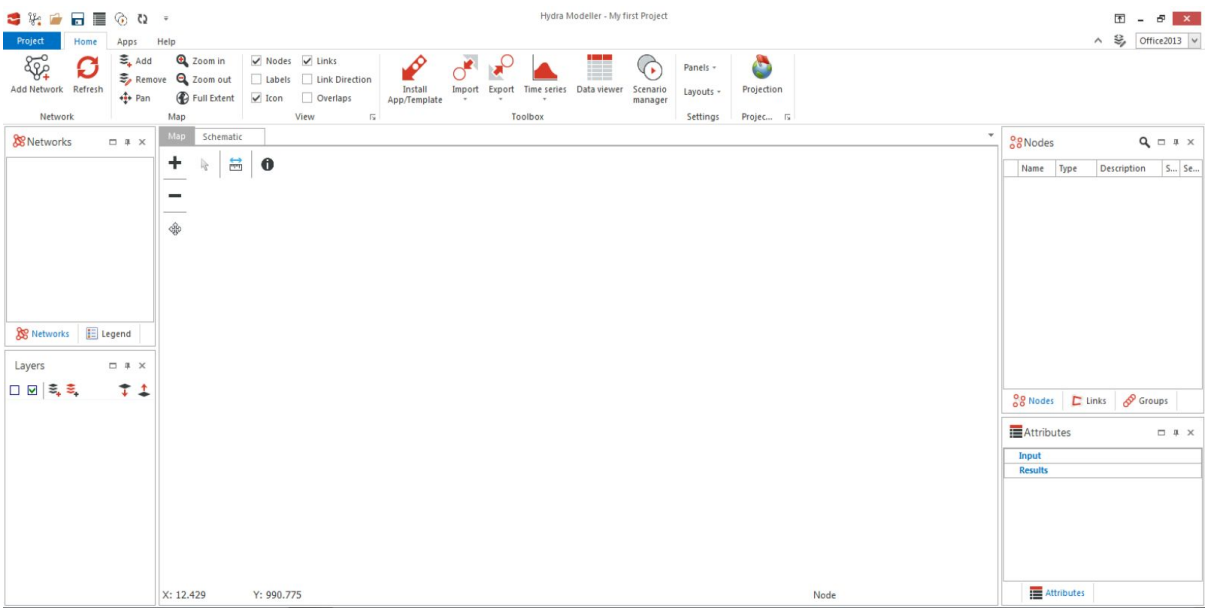


Making a network

Before working with a network, you must first create a project in which to put it. To create a new project, click on the ‘Project’ tab on the top-left. This will bring you to the ‘New’ project page. Enter the name of your project and an optional description, as below. Then click ‘Save’.



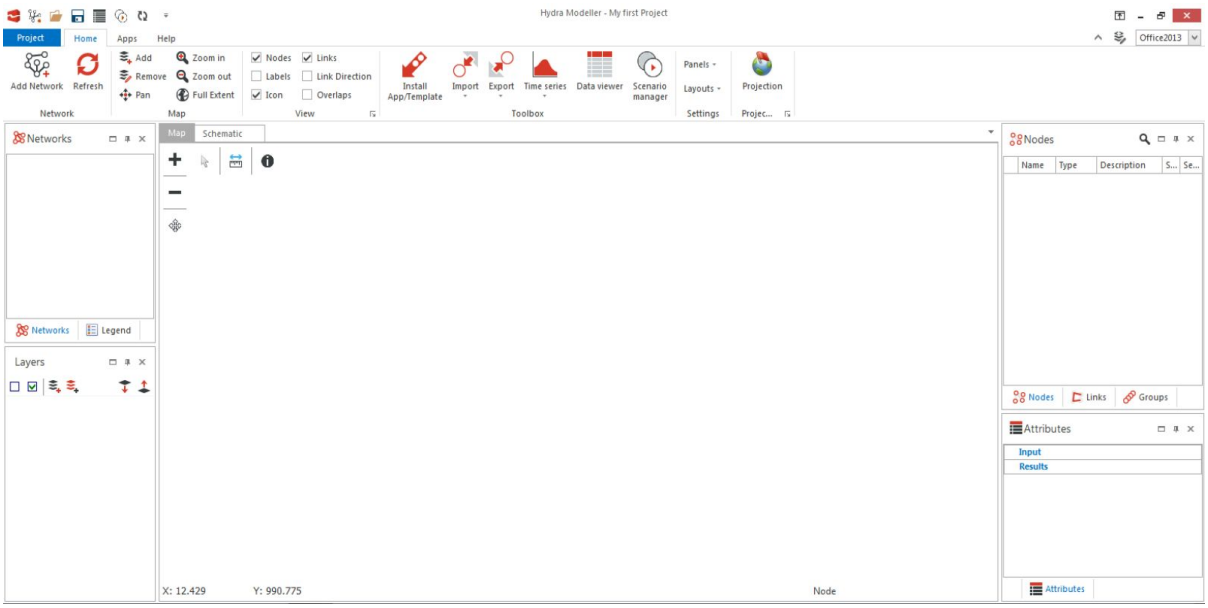
This will bring you back to the main page, but this time you will notice that the icons across the top are now active.



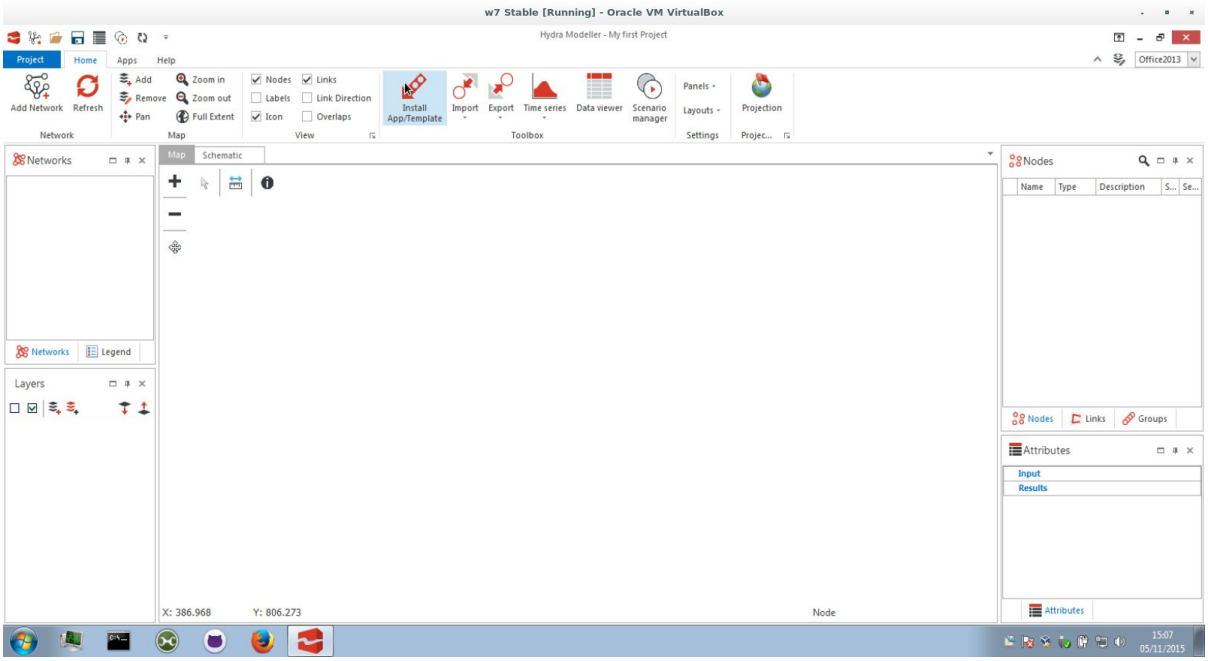
Installing a template

The next step before building a network is to install a template. A template defines the types of nodes and links you will be using, and is normally associated with a model. Each node and link definition contains information about the attributes defines the dimensions, units, restrictions and much more for each attribute. The template also defines visual features of the nodes and links such as the images or shapes used to represent them in Hydra Modeller.

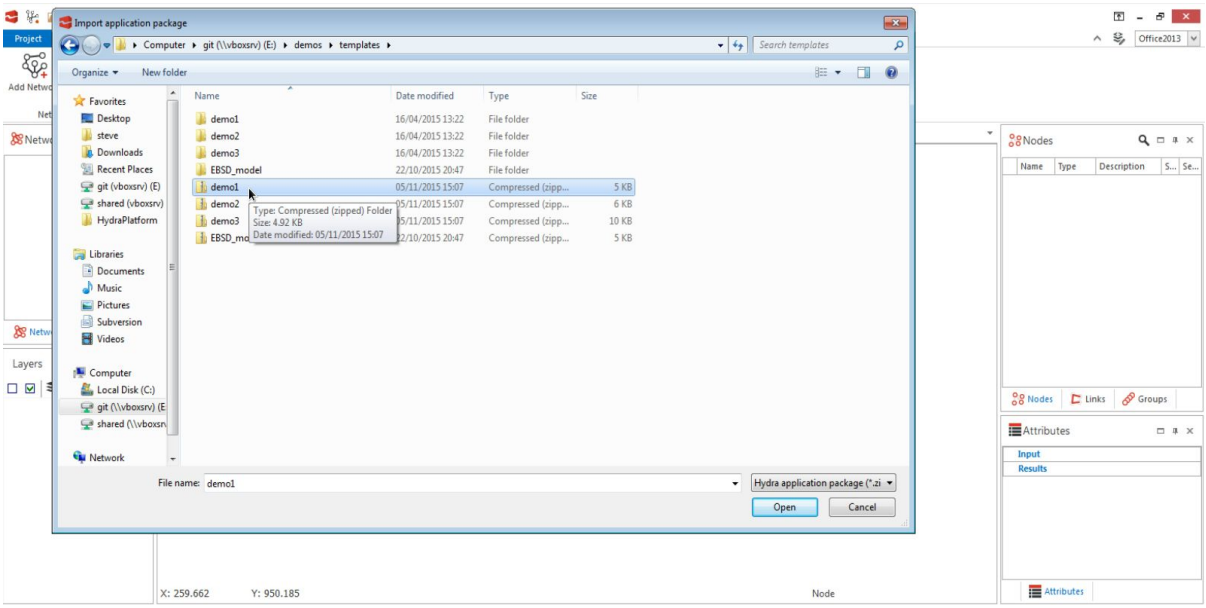
In this example, we will be using the ‘Simple Water Allocation Demo’ template, which comes with the ‘Simple Water Allocation Demo’ gams model (for more information on the demo models, see The demo model starter pack document).



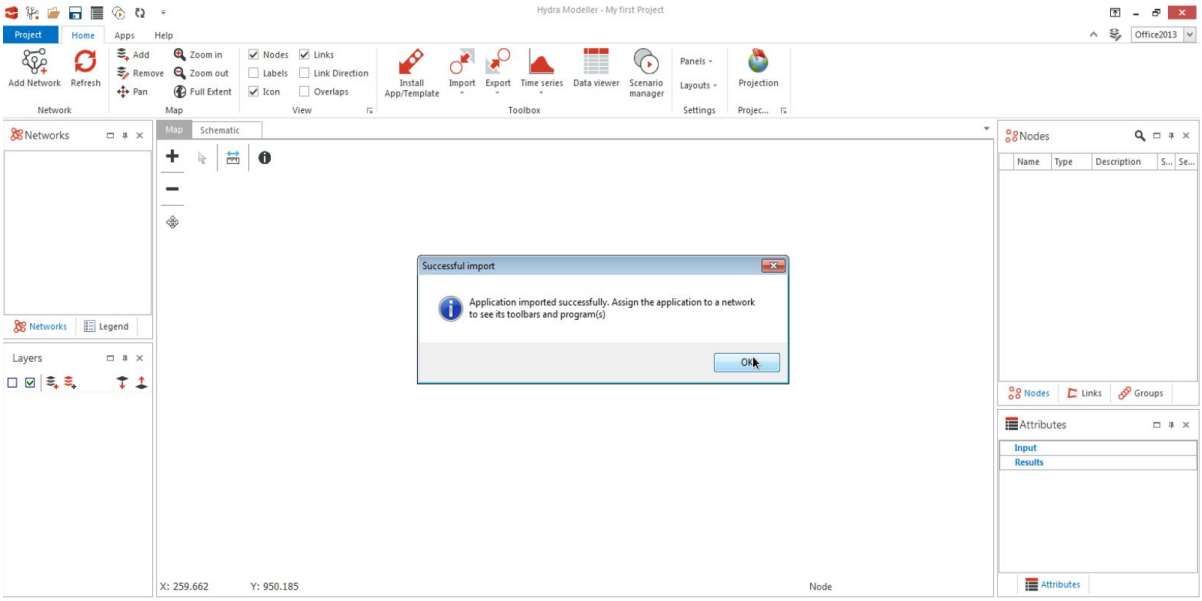
To install a template click the ‘Install App/Template’ button...



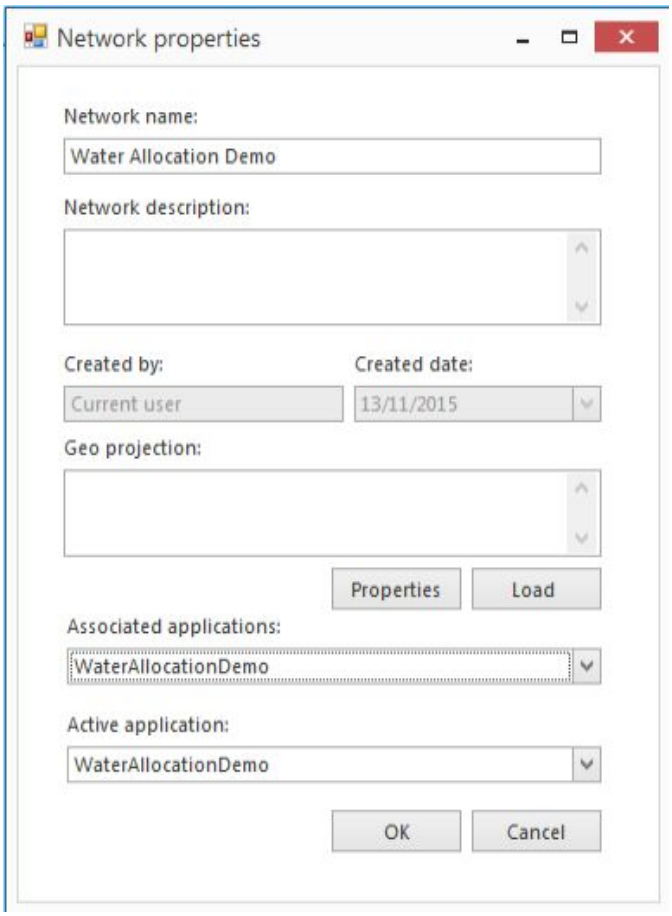
...and navigate to the template (a zip file) and click ‘Open’...



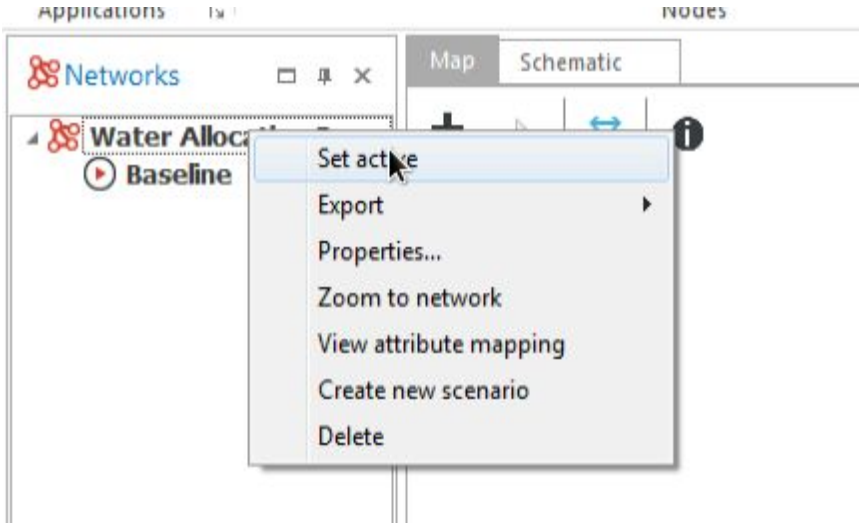
If successful, you will see the message ‘Successful Import’. Click OK.



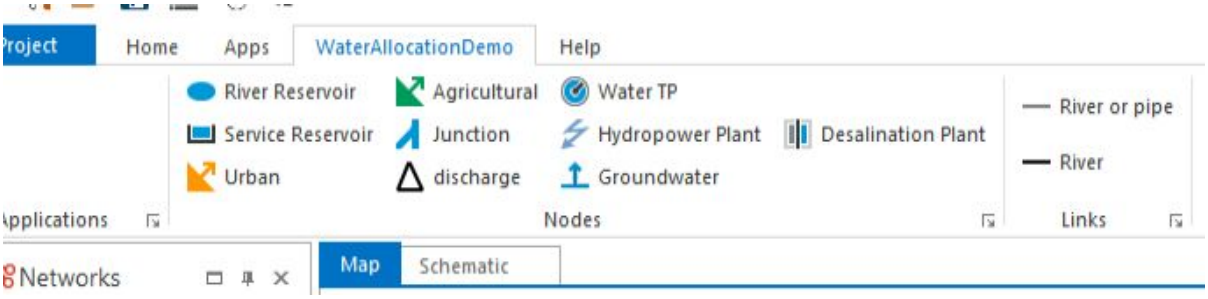
Now that a template is installed, you can start building a network. Click on ‘Add Network’ and fill in the details as below. Choose Simple Water Allocation Demo from the ‘Associated Applications’ drop down menu:



Now right click on the network name and click on ‘set active’.

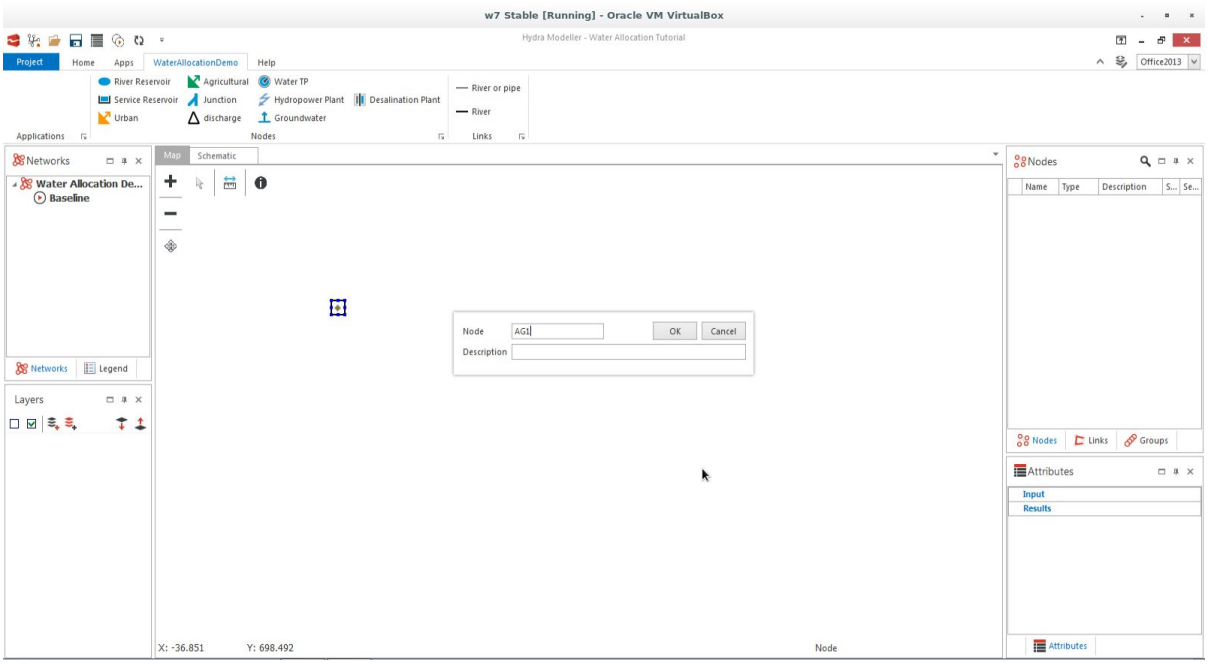


Now notice that a new network appears in the left-hand menu and a new tab appeared in the top, called ‘WaterAllocationDemo’. In that tab are the nodes and links which you can add to the network:

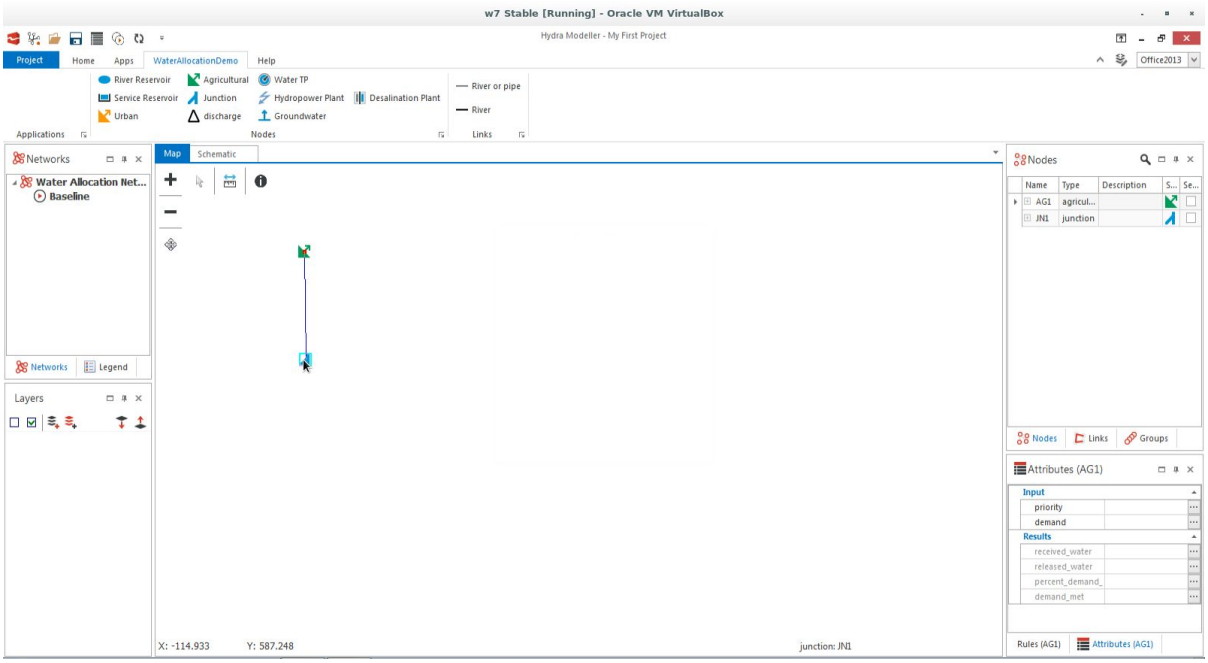


Building a network manually

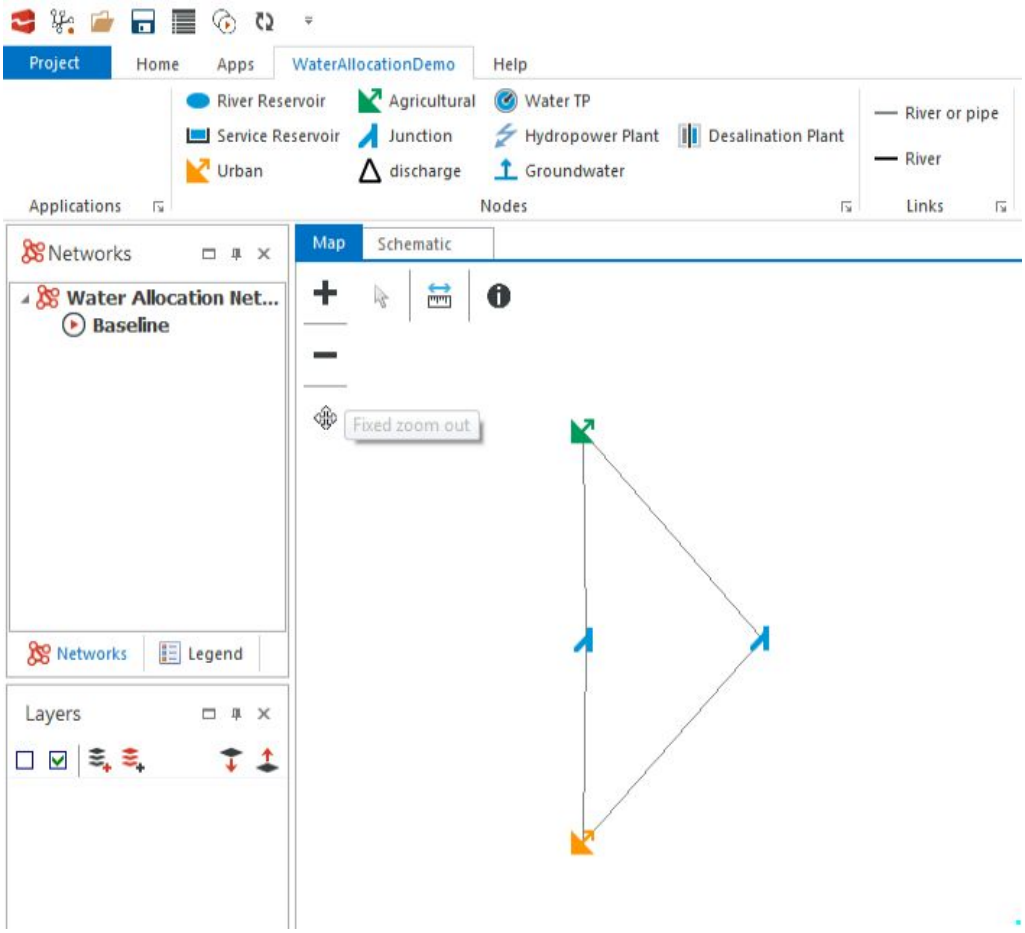
To build a network from scratch, click on the node type you want to add. The cursor will then change to the node’s symbol. Next click where on the map you want to add the node and when prompted, give a name and optional description to the node. (**Note: Node name must be unique within a network.)**, like shown:



After adding a few nodes, notice that they appear in the ‘Nodes’ box on the right-hand menu:



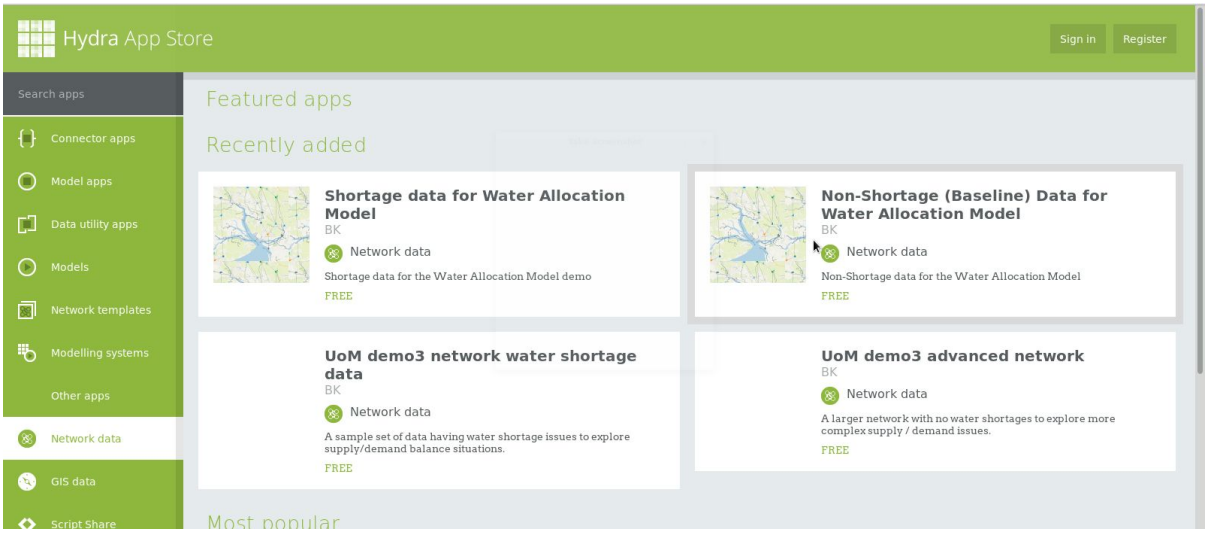
Next, add some links. To do this, choose ‘river section’. Then click on the starting node and double-click on the end node to save the link. This link will now appear in the right-hand menu, under the ‘Links’ tab. Your resulting network should look something like this:



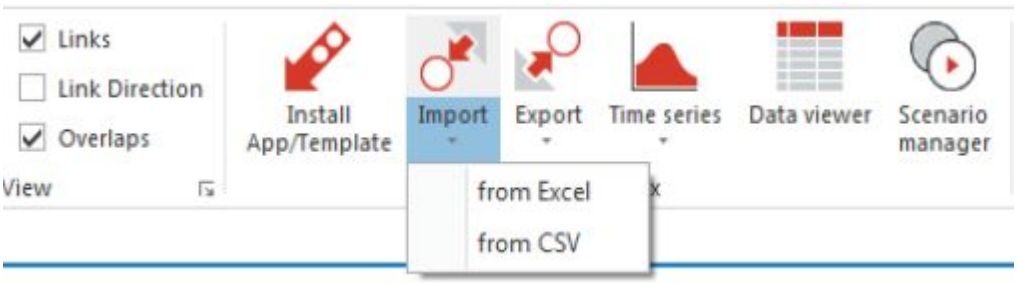
Importing a pre-defined network

Building a network from scratch can be time consuming, so Hydra Modeller provides a way to import a network from an external source. In this case, a set of CSV files, made especially for the water allocation tutorial.

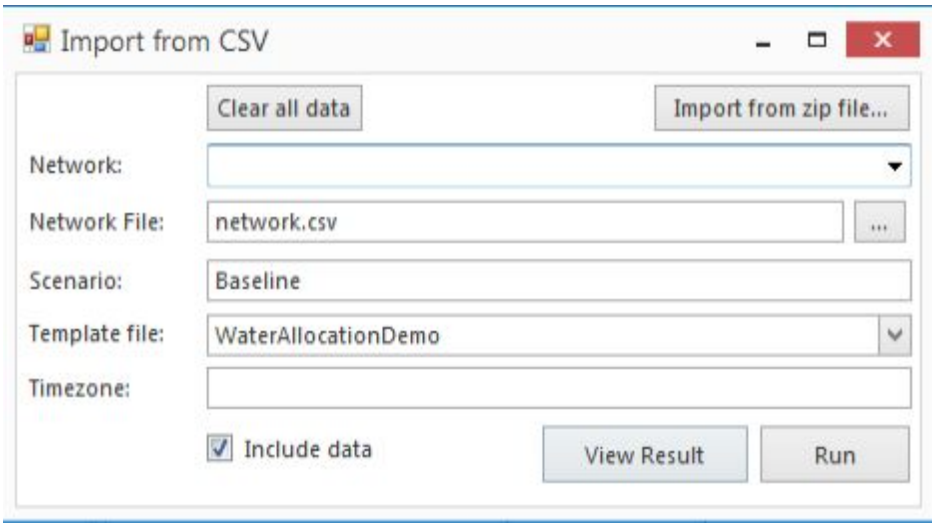
First, get the water allocation demo data from the hydra app store:
To do this, visit http://www.hydraappstore.com, and register with a new account. When logged in, search for 'Water Allocation' and select 'Non-Shortage (Baseline) Data for Water Allocation Model'. Download the file as a zip, but there's no need to unzip it.



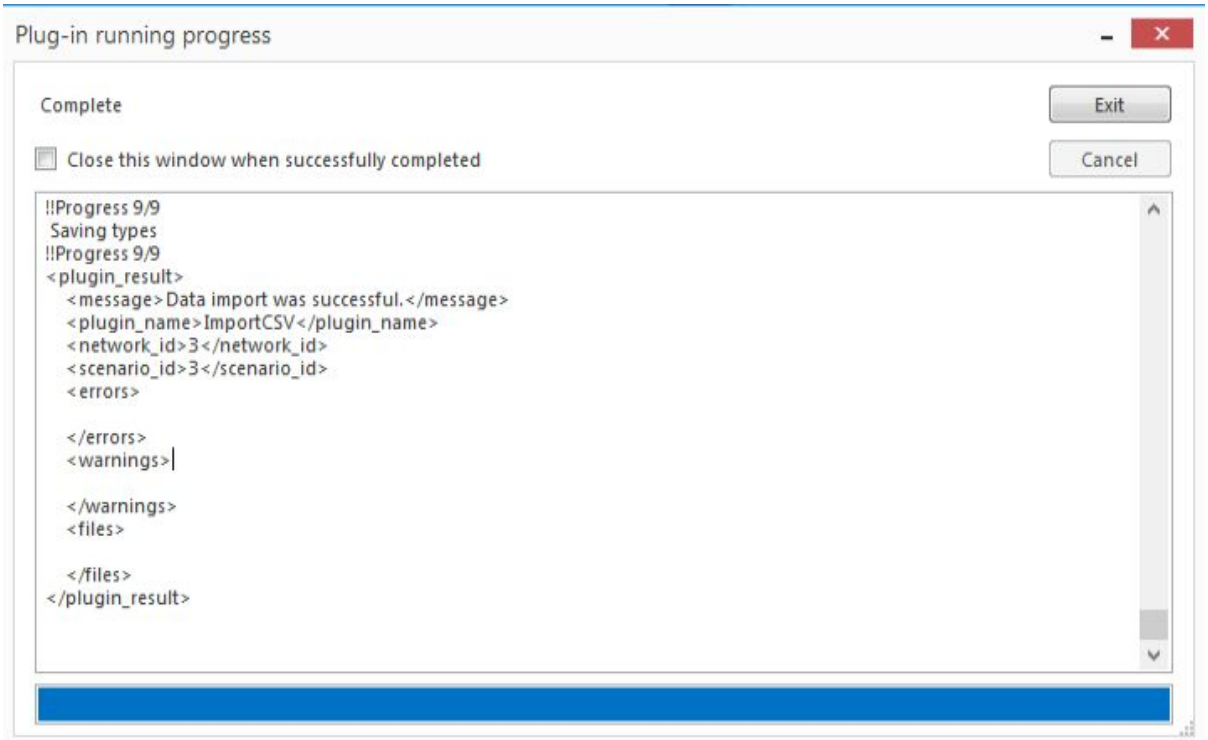
Now, back in Hydra Modeller, click on ‘Import -> from CSV’ as shown



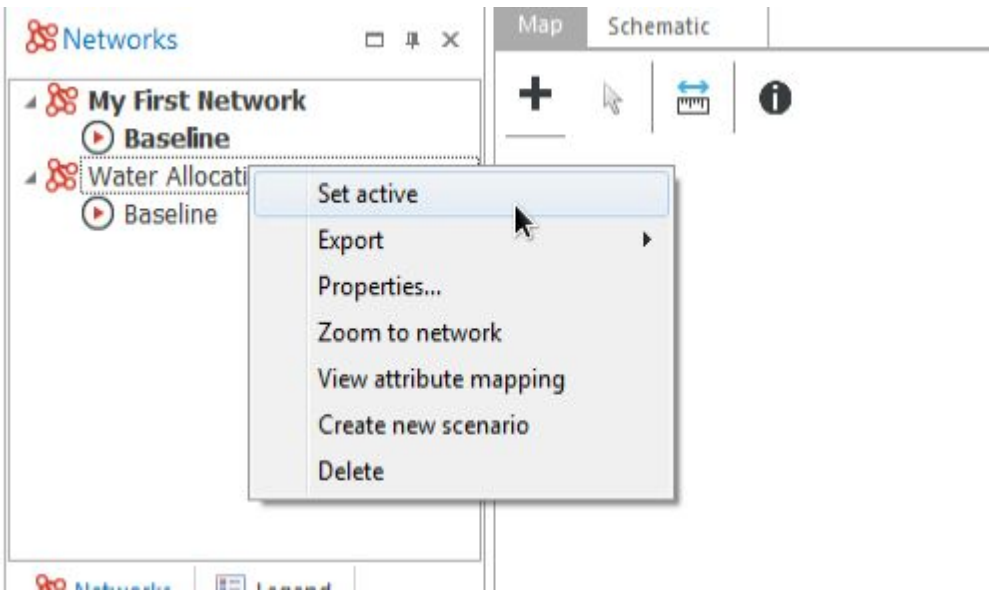
An input box will pop up. Click on ‘Import from zip file’ and navigate to the file you just downloaded. This will automatically fill in the network name and the ‘Network File’ entry. Next, select WaterAllocationDemo from the Template file input box and hit ‘Run’.



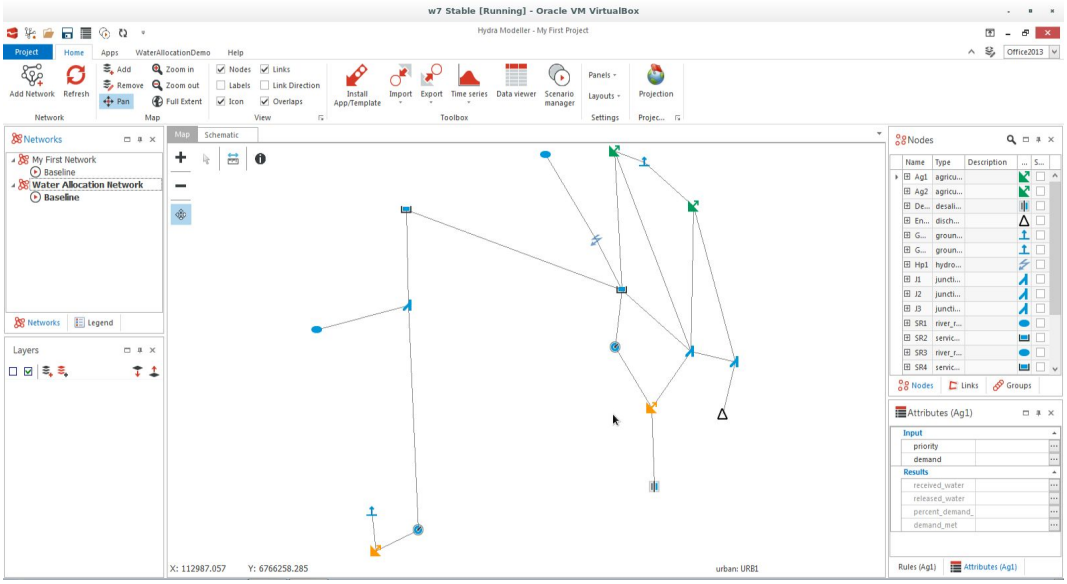
At this point a new window will open, telling you the status of the import. A the end, it should look like this. Press ‘Exit’. Now the imported network will be available on the left hand pane.



This network is not yet active (you can't edit it). To activate it, right-click on the network and click 'Set Active':



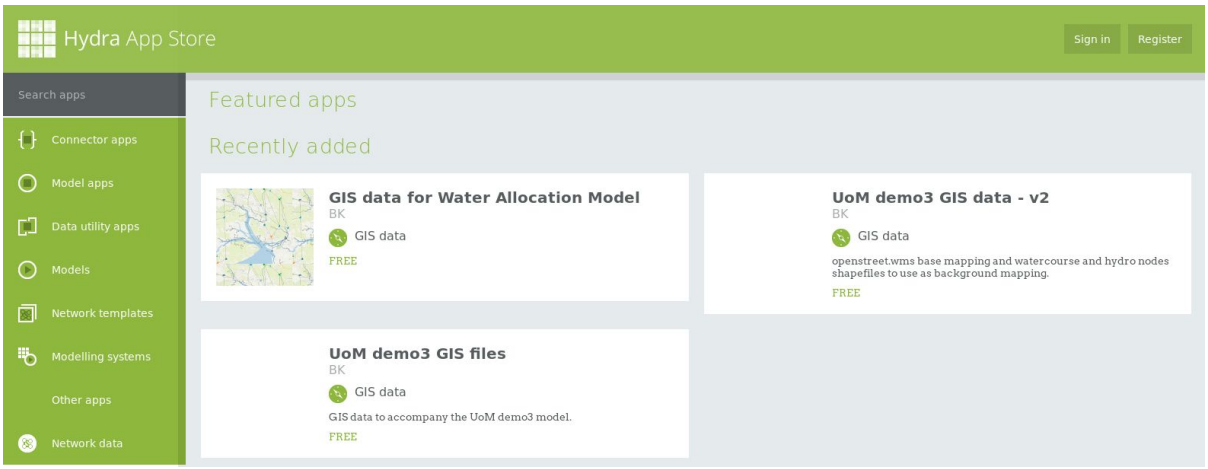
The imported "Water Allocation Network" is now active.



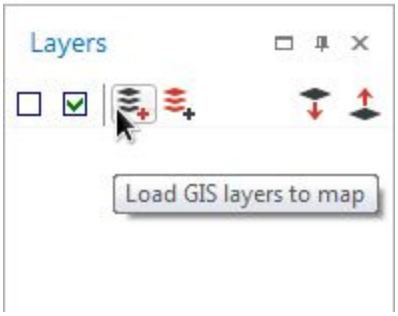
Setting GIS Layers

Often the points in a network represent real entities, so GIS layers can be used to add some context to the network. A GIS layer in Hydra is effectively a background image, with the network sitting on top.

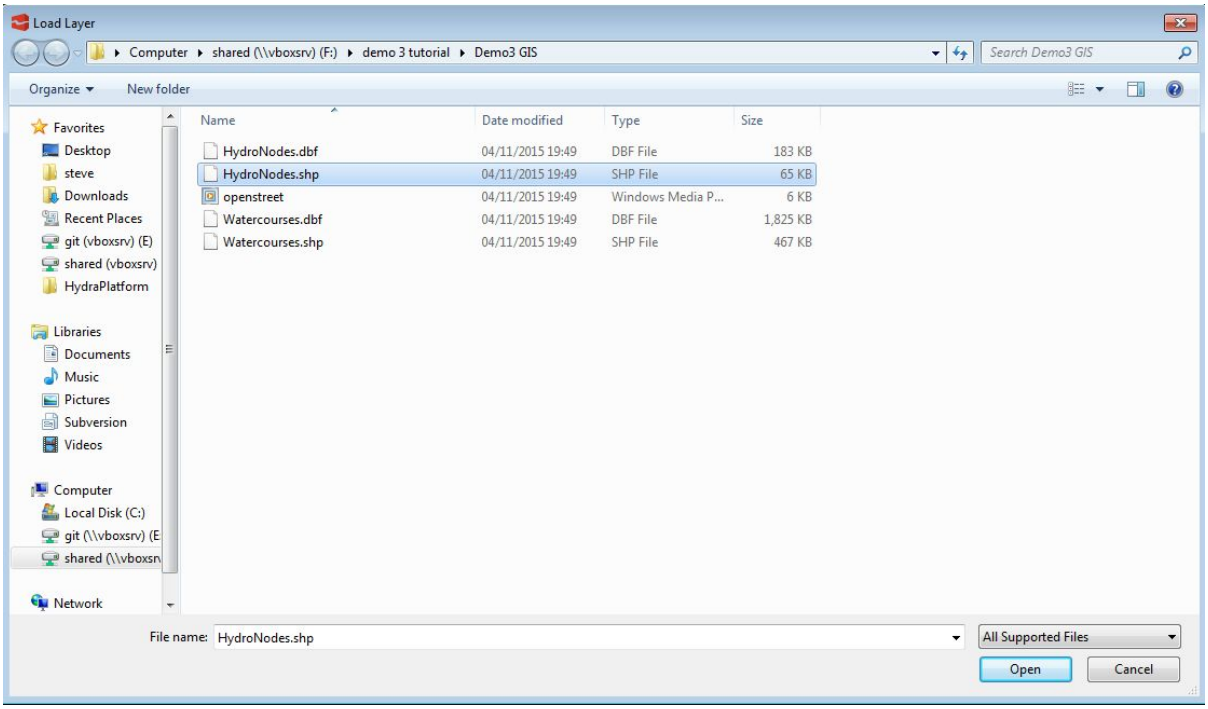
To import GIS data, click the Add layer button and navigate to the openstreet.wms layer, watercourses and Hydronodes layers that you downloaded from the Hydra App Store. This GIS data can be found by searching for ‘Water Allocation’ in the app store and locating the GIS data. Download and unzip the GIS data.



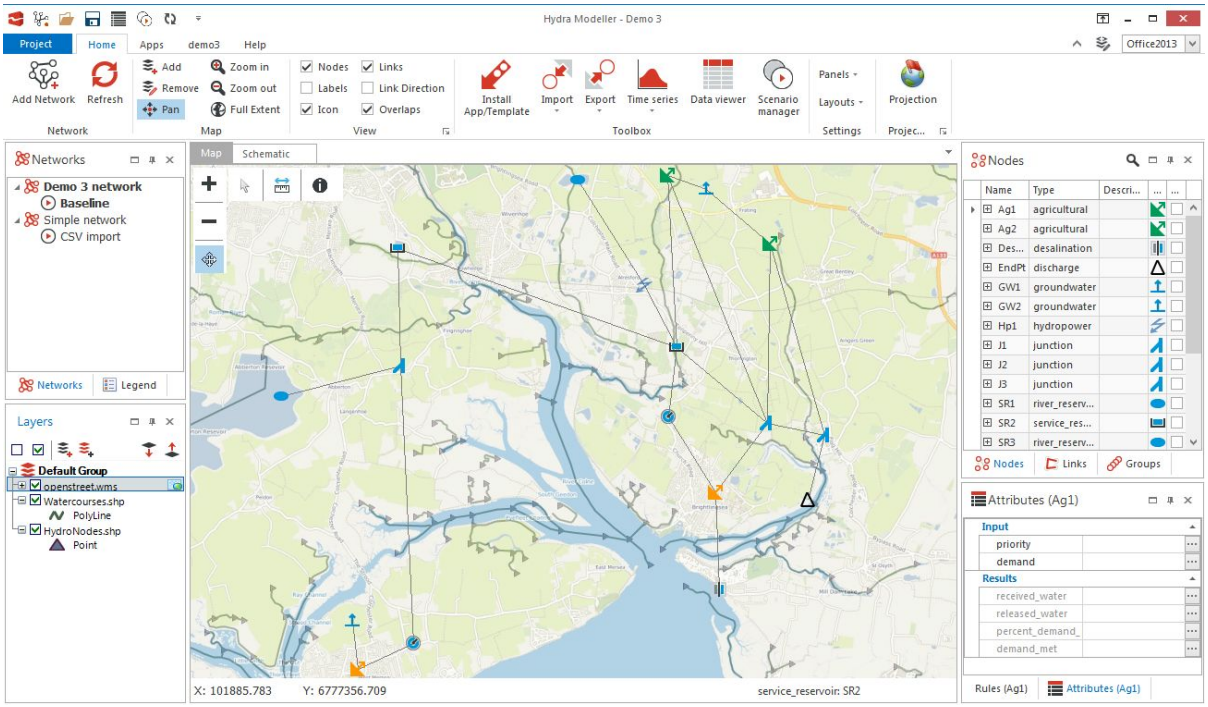
Back in Hydra Modeller, load the GIS layers on the bottom left pane like so:



and navigating to the GIS data.



In turn, add the HydroNodes.shp, Watercourses and openstreet.shp layers, and you will see something like this:



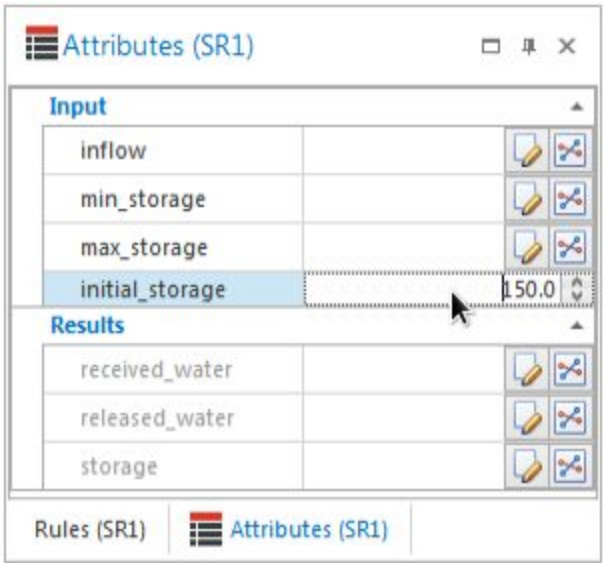
Managing Data

Scenarios

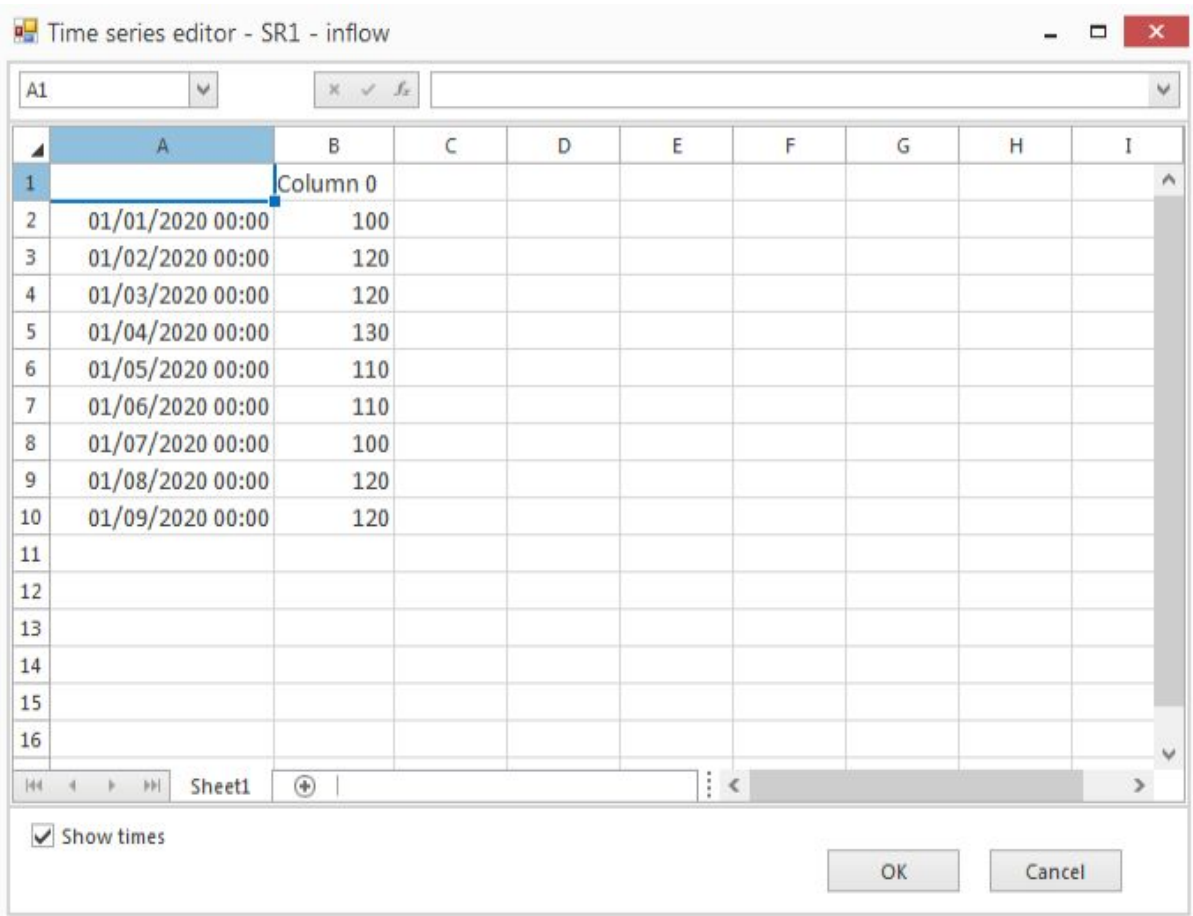
The scenario manager allows users to view and edit all the data related to the currently active scenario. A scenario is a container for data associated with the network. For example, in the water allocation model, the attribute ‘initial_storage’ on all reservoirs in the network can be decreased in a new scenario to represent a dry winter. First let’s look at how data in a given scenario can be accessed and edited.

Editing data in the main UI

The simplest and most convenient way to edit data in the current scenario is by editing the values directly from the attributes pane. The attributes pane is located on the bottom-right of the main UI. For scalar values, the value can be edited in place like so:

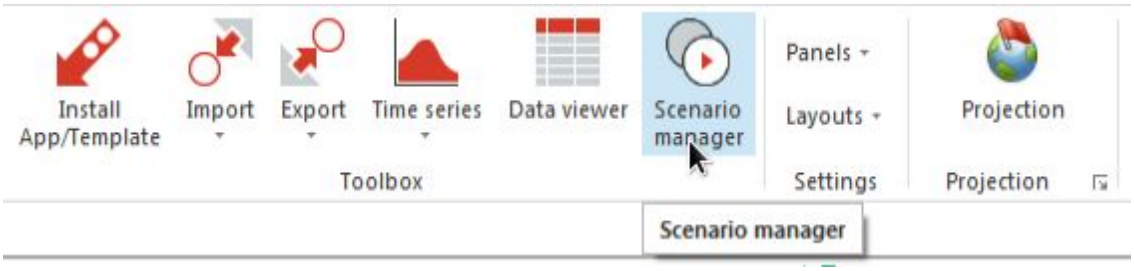


Time series can be edited in this fashion too, by clicking on the ‘edit’ icon, on the right-hand side of the input box. For example, for inflow attribute of a reservoir:

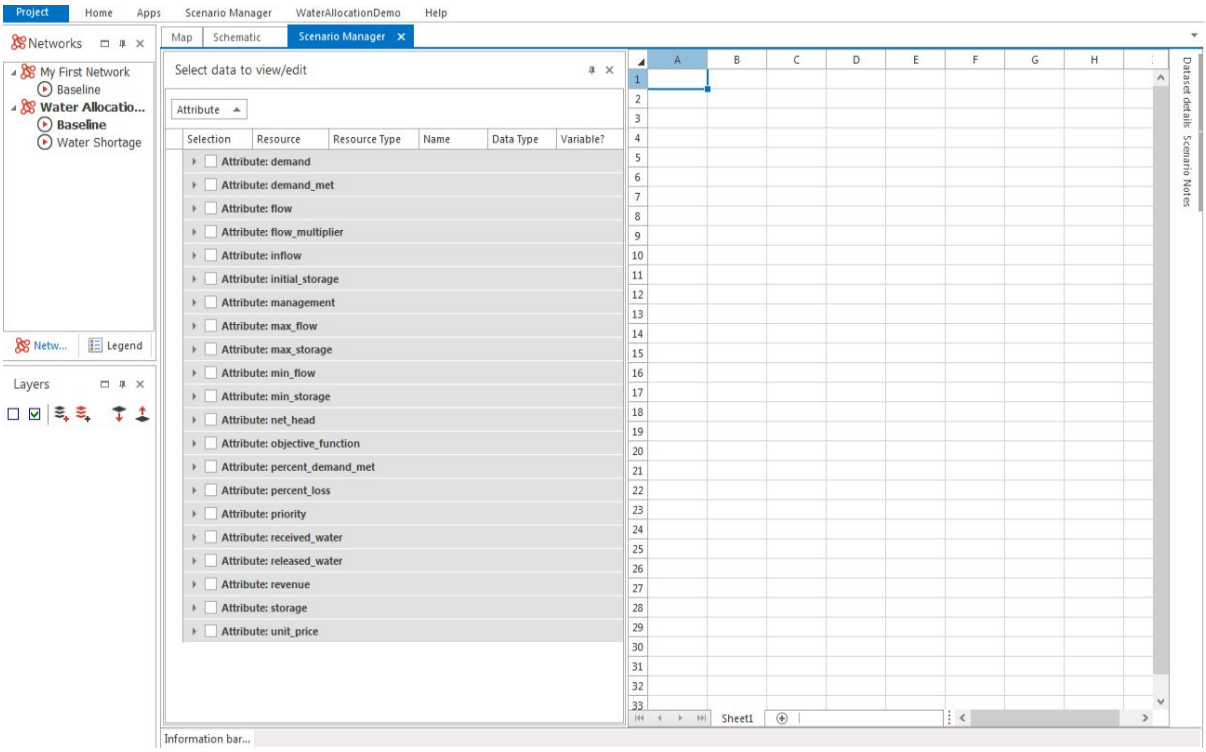


Scenario Manager

For more sophisticated data editing, comparison of attributes within and between scenarios, use the scenario manager. Access to the scenario manager is via the ‘Scenario Manager’ button in the ‘Home’ tab:



This will open a new window, similar to this. Notice the list of attributes on the left. This is a list of all the node, link, group and network attributes for this network:



To retrieve the data, select the attribute (or attributes) by checking the check box and then hitting ‘Extract data’ in the new Scenario Manager tab. In this example, we chose ‘demand’:

	A	D	E
1		Baseline (clone)	
2	Common Datetime	Ag1 (Column 1)	
3	01/01/2020	55	
4	01/02/2020	55	
5	01/03/2020	27	
6	01/04/2020	27	
7	01/05/2020	27	
8	01/06/2020	29	
9	01/07/2020	29	
10	01/08/2020	29	
11	01/09/2020	29	
12			

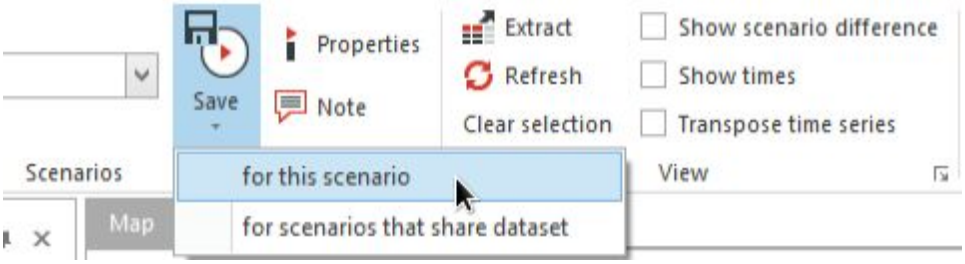
Editing Data

To edit a piece of data for this scenario, simply edit the value box. In this example, the consumption coefficient of node ‘Ag1’ has been changed to 0.5.

Changes are reflected by the cell turning orange.

	A	D	E
1		Baseline (clone)	
2	Common Datetime	Ag1 (Column 1)	
3	01/01/2020	54	
4	01/02/2020	55	
5	01/03/2020	27	
6	01/04/2020	27	
7	01/05/2020	27	
8	01/06/2020	29	
9	01/07/2020	29	
10	01/08/2020	29	
11	01/09/2020	29	
12			

To save this change, select ‘for this scenario’ from the ‘save’ panel on the top menu. The other options allow you to save the value for multiple scenarios at one time -- in case you find a value that’s wrong in all your data, you don’t have to go to each scenario in turn to fix it.

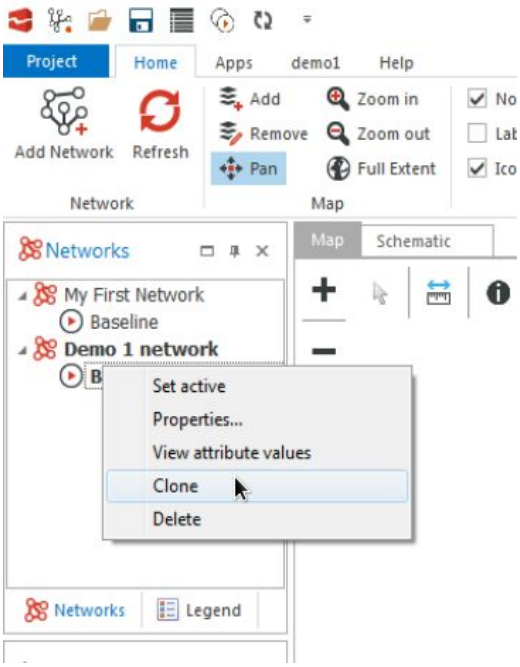


This will result in a message saying ‘Changes have been saved’ and the orange box turning white again, like so:

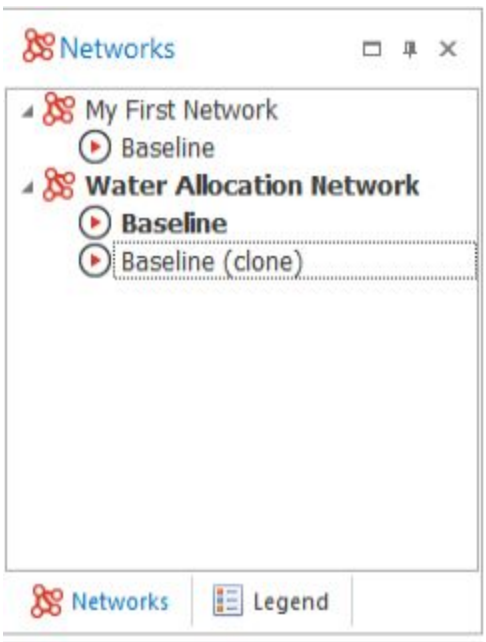
	A	D	E	F
1		Baseline		
2	Common Datetime	Ag1 (Column 1)		
3	01/01/2020	54		
4	01/02/2020	55		
5	01/03/2020	27		
6	01/04/2020	27		
7	01/05/2020	27		
8	01/06/2020	29		
9	01/07/2020	29		
10	01/08/2020	29		
11	01/09/2020	29		
12				
13				
14				
15				

Cloning a Scenario

A network can contain multiple scenarios. For the water allocation example, the default is the ‘Baseline’ scenario. Scenarios can be seen as sub-elements of networks in the ‘Networks’ pane. Creating a new scenario is done in two ways: by cloning an existing scenario or by importing new data via csv. To clone a scenario, right-click on a scenario (making sure the scenario is active) and click ‘Clone:



This will result in a second scenario appearing in the network menu, called ‘Baseline (clone)’:



After right-clicking on Baseline (clone) and selecting ‘Set active’, click on the ‘Scenario Manager’ button on the top ribbon. This will reveal a page, where you have the option to select the attribute you are interested in editing.

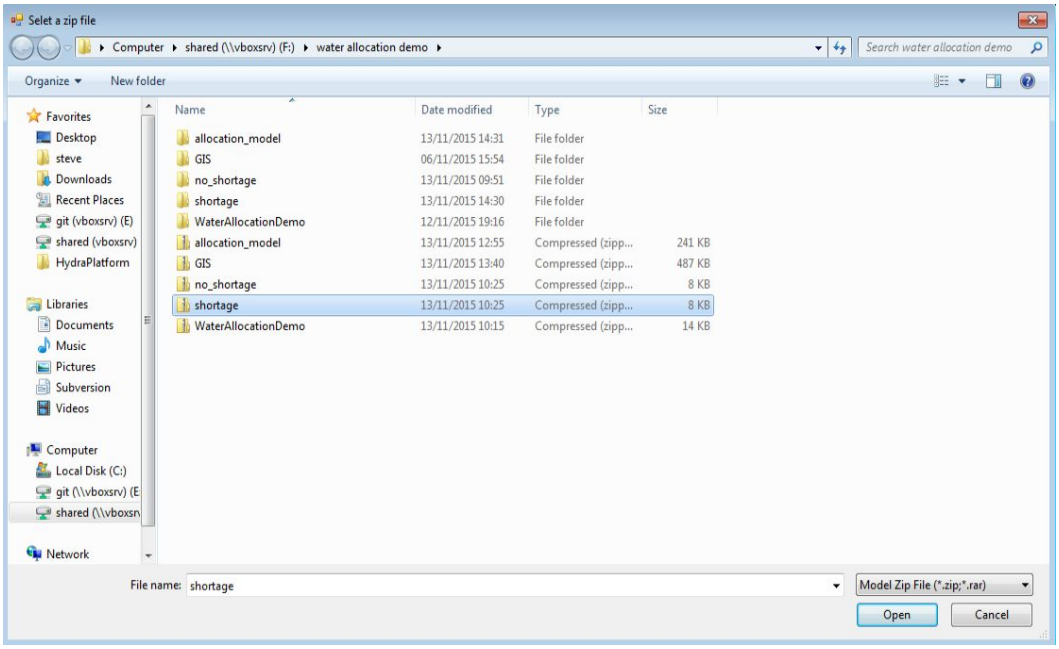
Adding a new scenario by CSV

The second way of adding a new scenario is to add data from an external source, such as a set of CSV files. In the water allocation model, there are two sets of csv files -- baseline and shortage. These csv files are almost identical, except that the values of some attributes are changed to represent a shortage of water.

First, search for and download the ‘Shortage data’ for the water allocation model on the hydra app store.

Next, click on ‘Import -> From CSV’

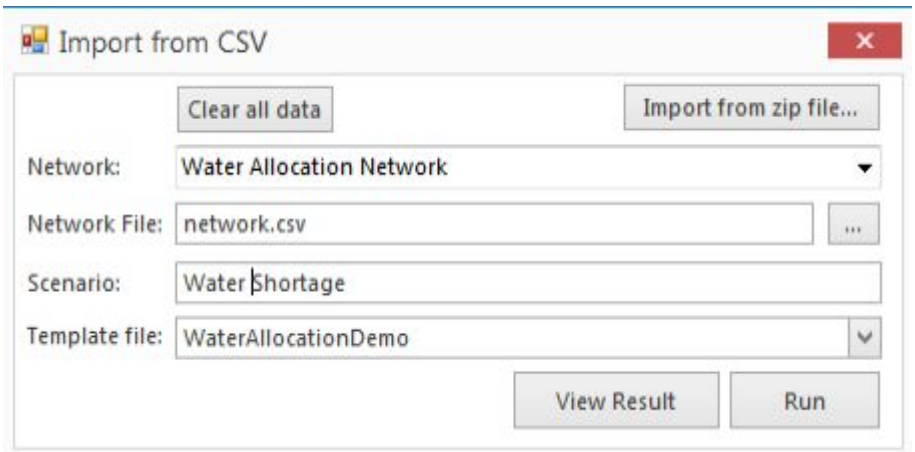
Click on ‘import from zip file’ and navigate to the new dataset:



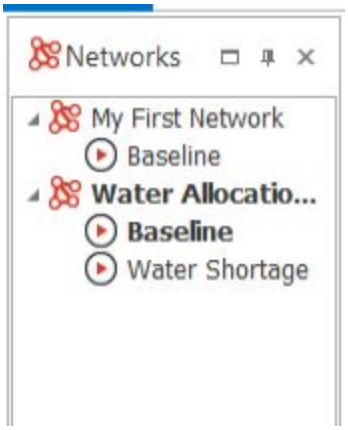
Call the new scenario ‘Water Shortage’.

Ensure that the network ‘Water Allocation Network’ is chosen, and so is the template:

This tells Hydra to import data as a second scenario in the same network, rather than building a whole new network.



Press ‘Run’ and wait for the import to complete. A new scenario will now be added to the network list. To activate the new scenario, right-click on it and hit ‘Set Active’.

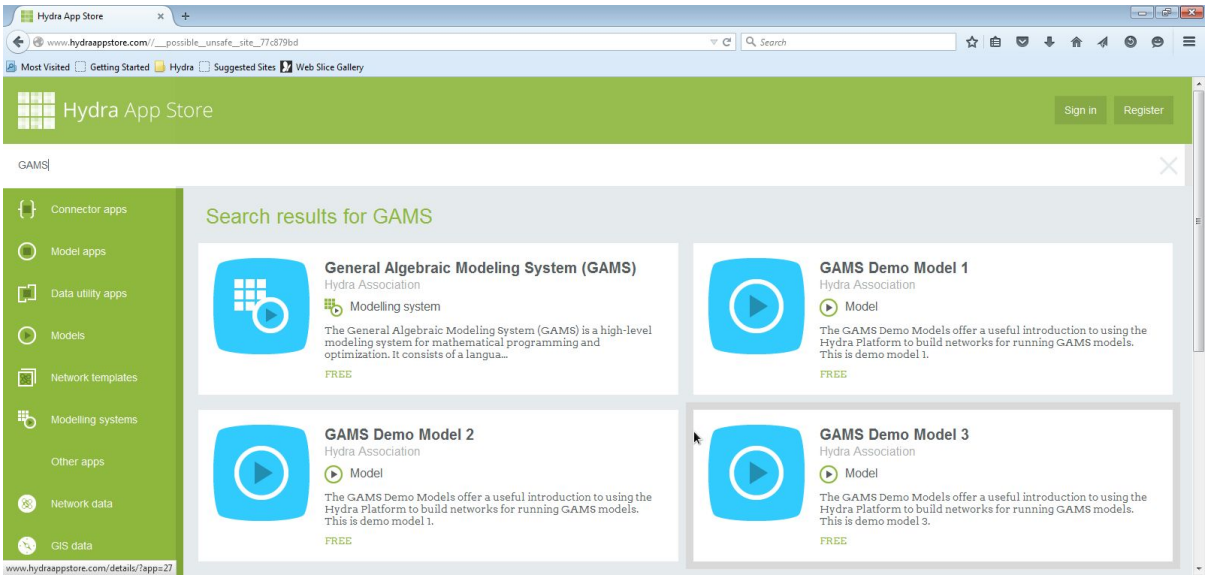


Installing an App

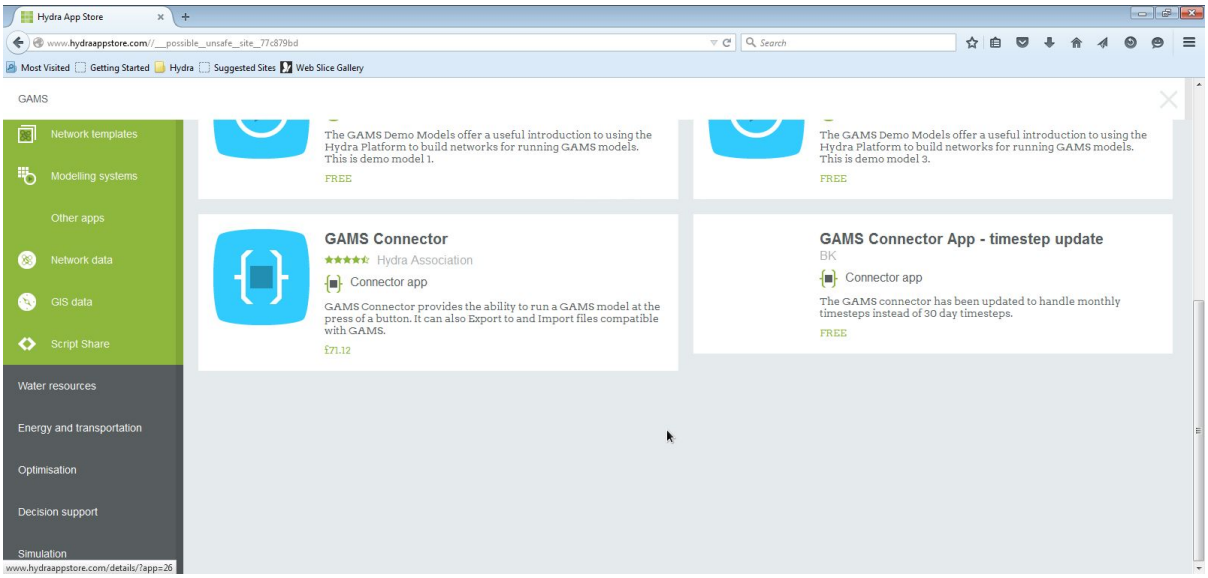
The first step in installing an app is finding the app itself. In this example, we will install the app with which we can use network we just installed.

In this example, we show how to install the ‘GAMS Connector App’. GAMS is a generic mathematical programming language commonly used in modelling. This app is designed to export a hydra network to a GAMS input file, then to run a GAMS model against this file and finally to extract the results of this model and store them back in Hydra for a user to view. This saves a user having to deal directly with GAMS input files, which can be time-consuming and error-prone.

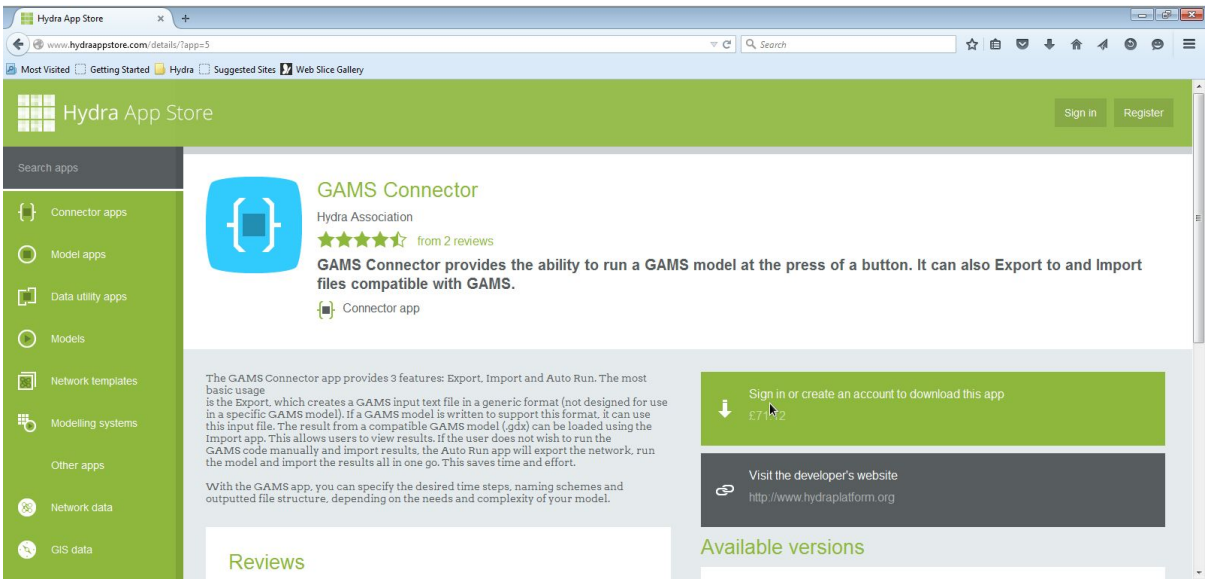
Navigate to www.hydraappstore.com, log in or register and then search for ‘GAMS’.



You will see several results, but notice their categories: ‘Modelling System’, ‘Model’ and ‘Connector App’. The modelling system is the GAMS software itself (required to run the gams connector app). A ‘model’ is the GAMS model we will run and the connector app is the app which Hydra Modeller will install and run. The connector app will be able to connect to any of the ‘Models’.

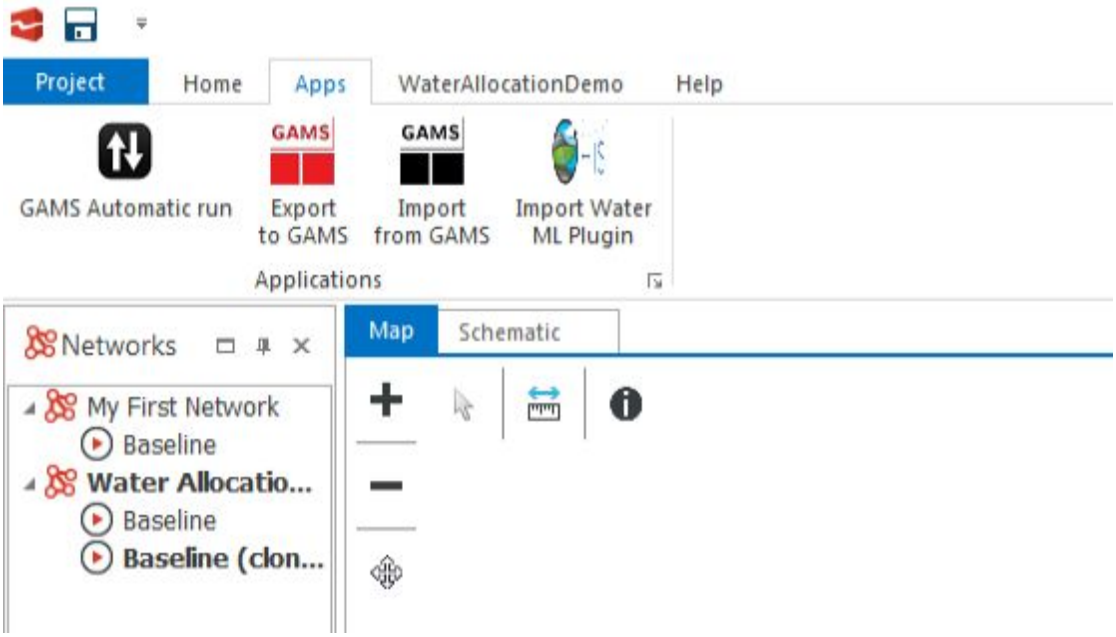


Click on GAMS Connector App and click download. The price for the gams app is currently fictitious, so can be ignored. This will download a zip file. Note the location of the download.



Now, back in Hydra Modeller, open the water allocation project and click ‘Install App/Template’. Navigate to the downloaded zip file and hit ‘OK’.

You will now see three new buttons in the ‘Apps’ tab in the main window. GAMS Automatic, GAMS Export and GAMS Import.



Clicking on GAMS Automatic, you will be presented with a set of inputs similar to those seen when importing the CSV files. To see what you need to enter for these, see the Water Allocation Demo Tutorial'.