Using Revit's Graded Region Function

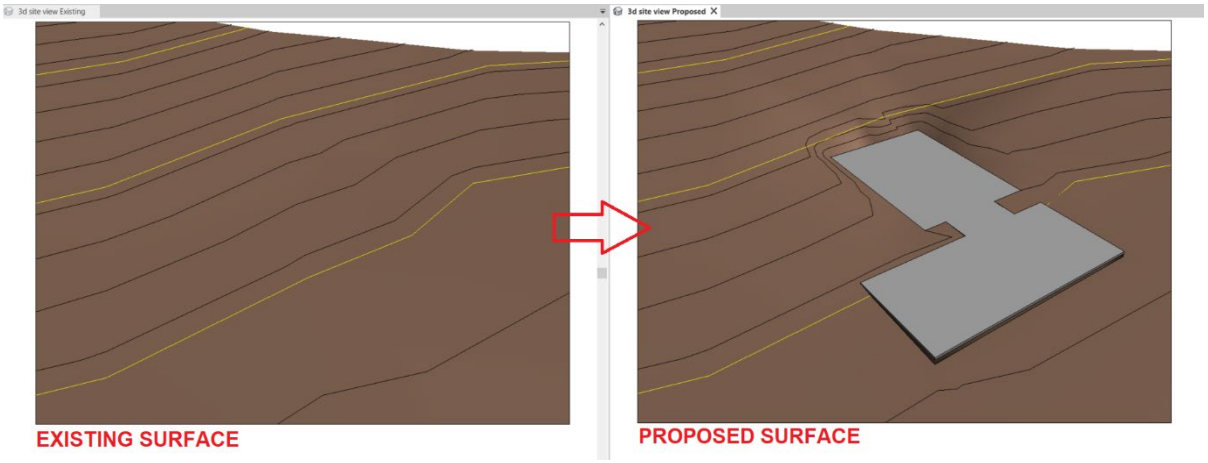


Fig. An existing surface (left) and a proposed design with surface grading applied around the building pad (right).

Revit's surface tools enable users to create topographic surfaces via a variety of different means, from creating points individually using a CAD drawing reference or CSV based survey point data.

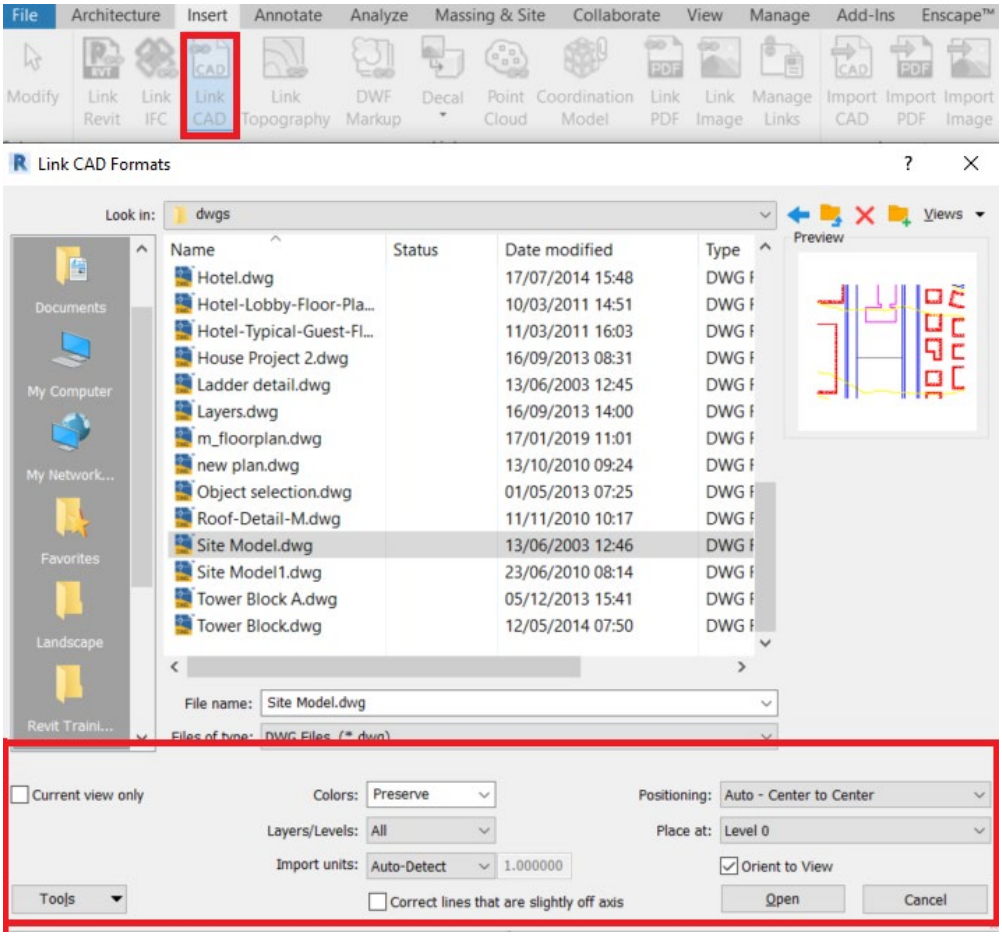
This surface is frequently the existing surface that needs to be developed and forms the basis of the proposed or design surface. Rather than modelling these surfaces in different files, they are modelled in the same project and graded region tools are used to adjust the model and show the different stages via Phase and Phase Filter settings.

However, although the surface is created the grading and phasing process is the same. This paper will use the CAD import technique which has been within Revit for many years. If using newer versions of Revit other methods of defining a surface will be possible.

Within the project a CAD drawing is linked into the project.

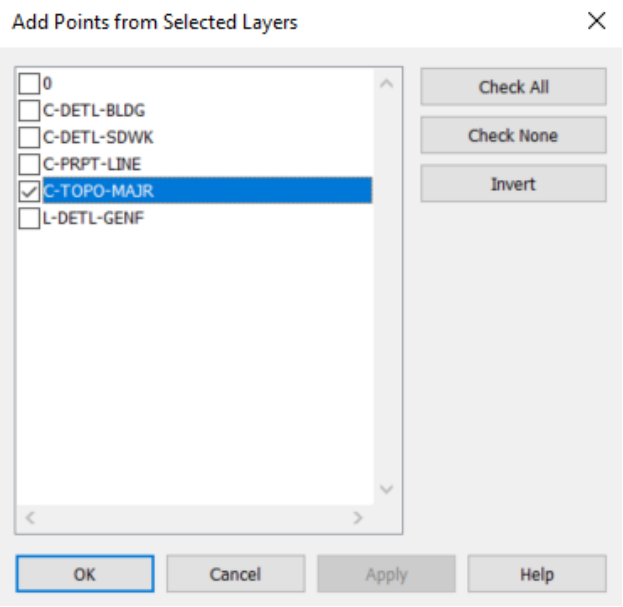
Typical settings

- Current View only (Unselected)
- Colours – Preserve
- Layers – Visible Only
- Units – Auto-select
- Correct off axis lines – (Unselected)
- Positioning – Auto – Centre to Centre

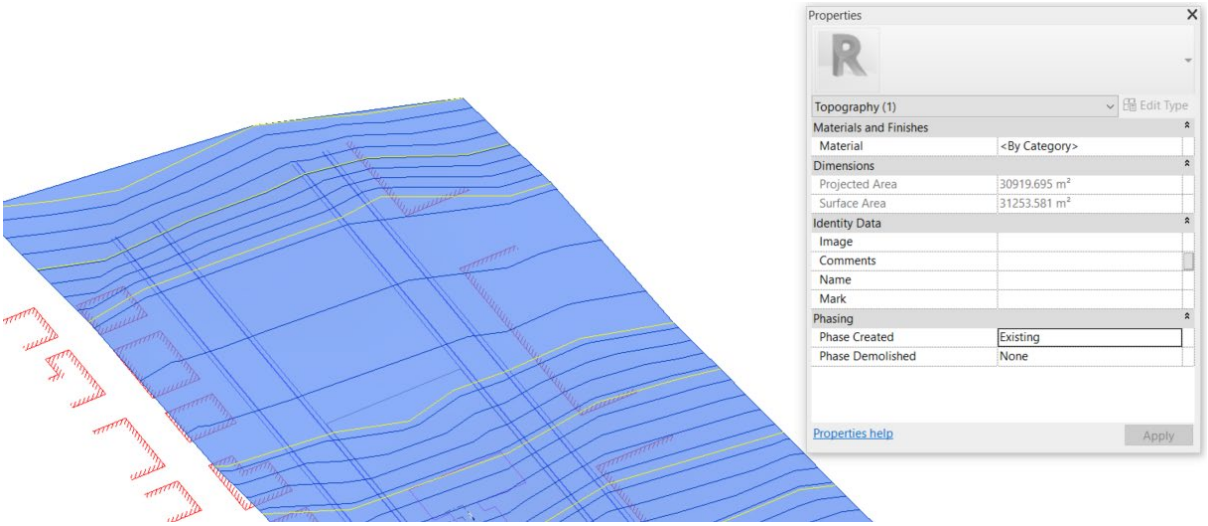


Once visible, go to the Massing and site tab and choose Toposurface, Create from Import. Select the Import instance on the drop-down menu and click on the linked CAD file.

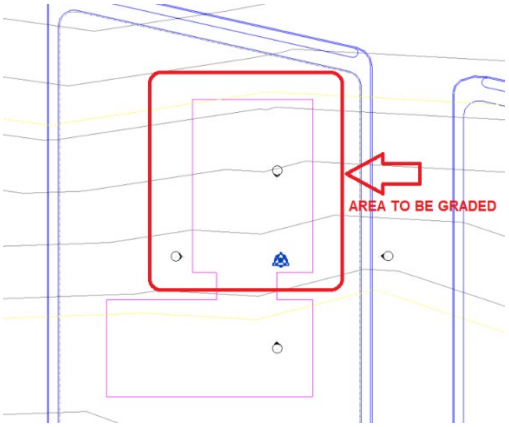
Once selected a dialogue box will appear asking what CAD Layers/Levels will participate in the creation of the surface. This will typically be layers containing 3d information such as contour lines. Click OK when complete.



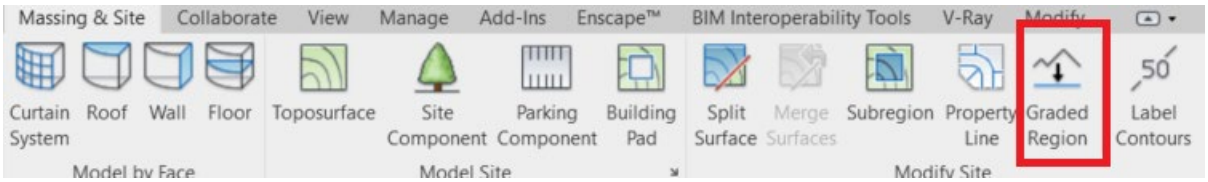
The surface should now be created. As this is the original surveyed surface, modify its phase created property to ‘existing’. This is a setting in the element properties dialogue.



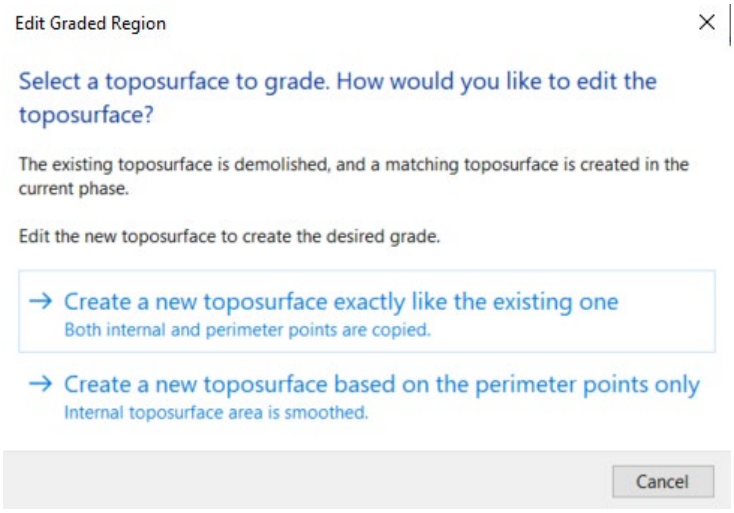
Once complete, switch to a ‘new construction’ site view. The existing surface should appear grey due to the phase filter applied to that view. Locate the Graded Surface tool to modify the existing site and create a flattened area to add a building pad.



The marked area needs to be flattened. Note the contours crossing over the area to be a building pad. The surface can be graded to create a flat area to build upon and can be scheduled to see how much material needs to be removed or added to site.



Revit's site tools lack such features like break lines so to control the shape of the surface, additional spot heights are added to define the bottom and top edges of banking. This will be achieved with the grading tool. Click the existing surface to grade will display the following message.



Choose the first option 'exactly like the existing one'. This will ensure surface modelling accuracy. Use the perimeter points option only on simple flat surfaces. This will create a new surface which can be adjusted to suit design intent. Most situations will usually require the former option.

Click on the surface to grade and place points that will be the top of a new bank feature. Point elevations to be set at zero offset, relative to existing surface.

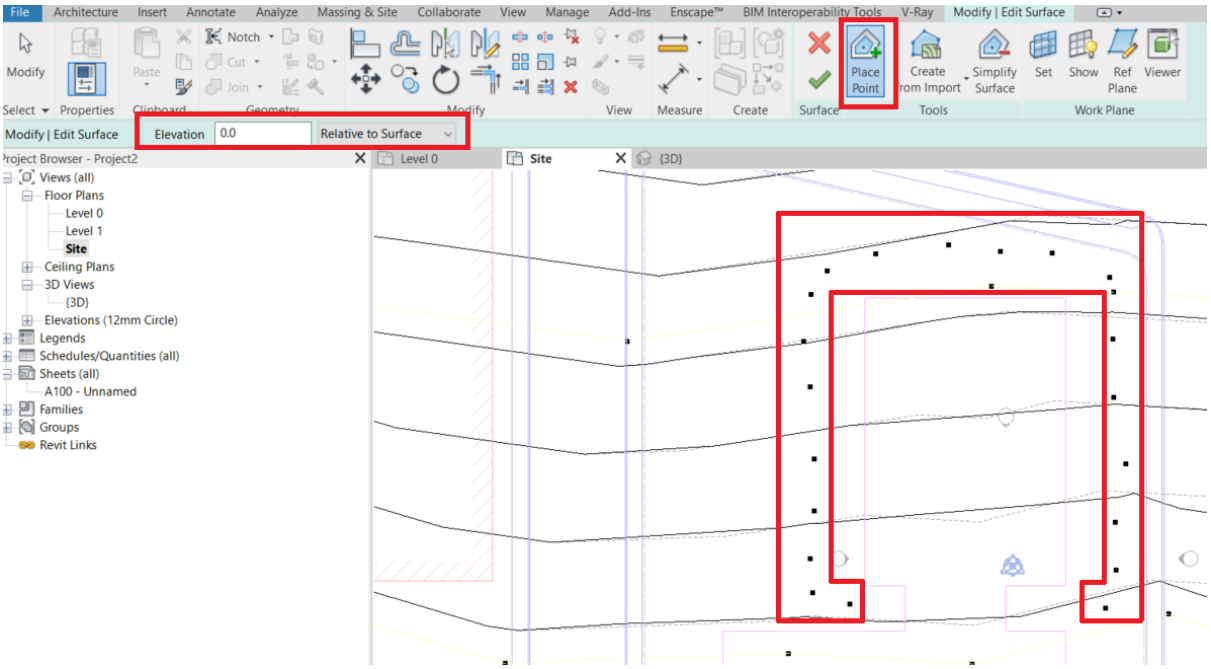


Fig. Creating 'top of bank' spot heights relative to surface.

Once the top of the bank has been established create some additional points at a suitable explicit elevation to represent the level of the proposed groundwork/building pad. To determine what height these points should be, place at place a section view through the site and create or adjust a level line element to establish a suitable height to build from. The Level line should display a height value that will be used to determine a 'Z' value for the bottom of bank points.

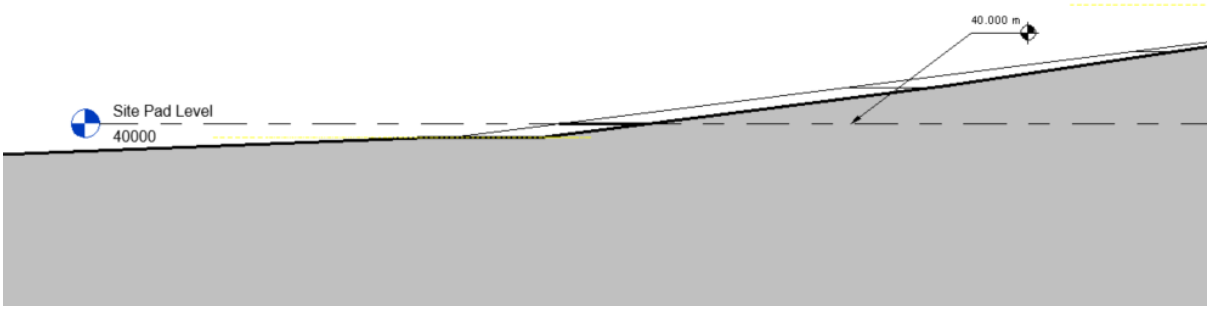


Fig. Determining the level for the building slab

As these points are created the contours of the surface will adjust to the updated topography arrangement.

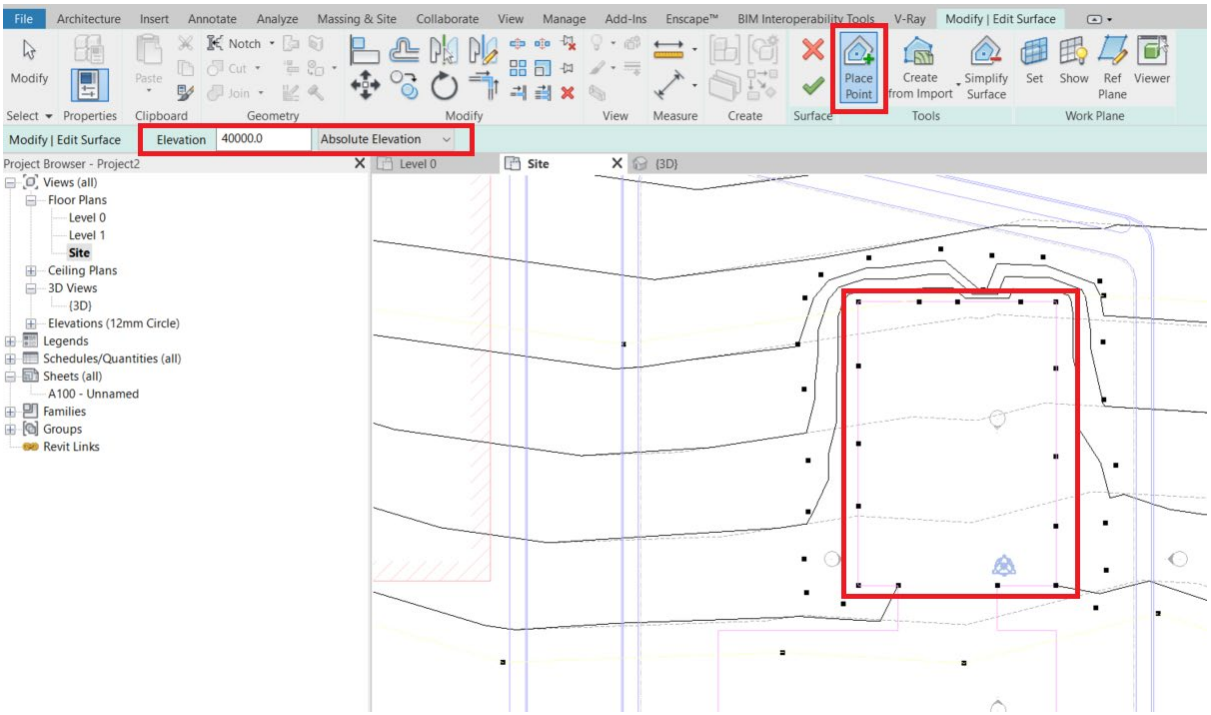
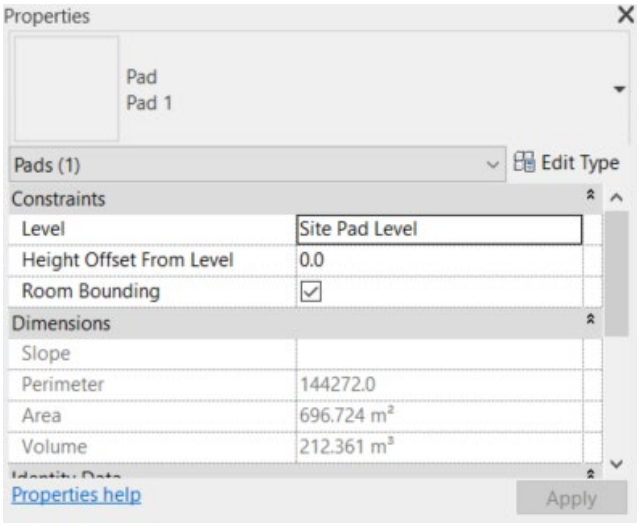


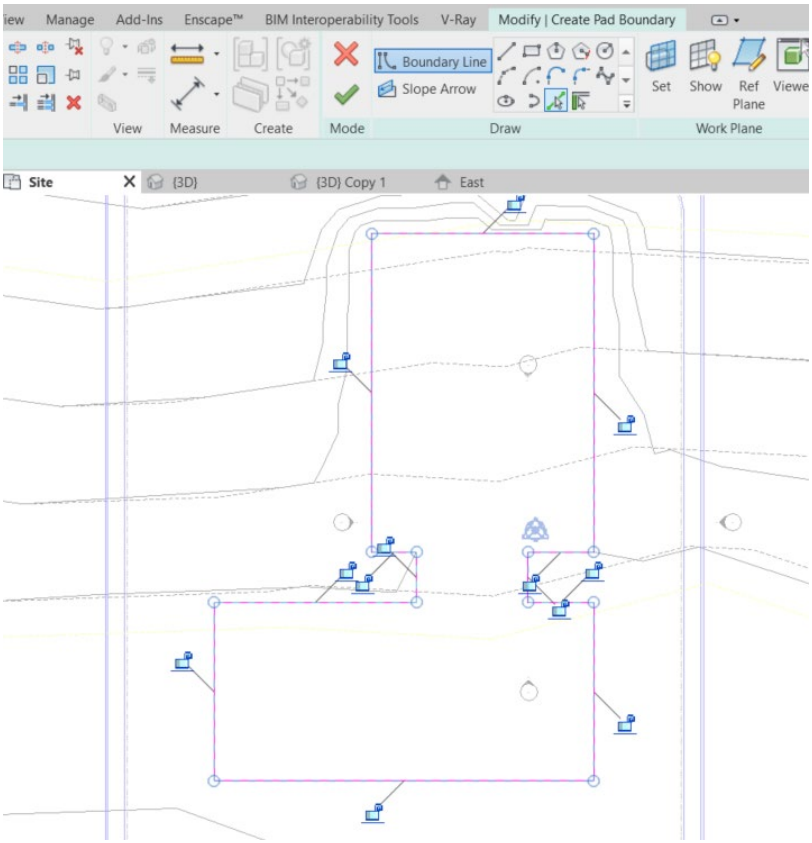
Fig Creating 'bottom of bank' spot heights at an explicit elevation

Once complete click Finish.

If required a building pad can be added which will serve as a basis for any building, structure and can be used to excavate a toposurface to form an underground structure like a car park or basement.

This pad will default to the lowest level, but the properties can always be altered to suit the nature of the site.





To see the existing and proposed toposurfaces, duplicate the view and name them to Existing and Proposed Site, or similar. Ensure that the Views properties are set as follows:

For Existing Site

- Phase: Existing
- Phase Filter: Show New

For Proposed Site

- Phase: New Construction (or similar)
- Phase: Show Complete

Phasing	
Phase Filter	Show Complete
Phase	New Construction

Lining the two plans alongside should show how the grading will affect the proposed site plan.

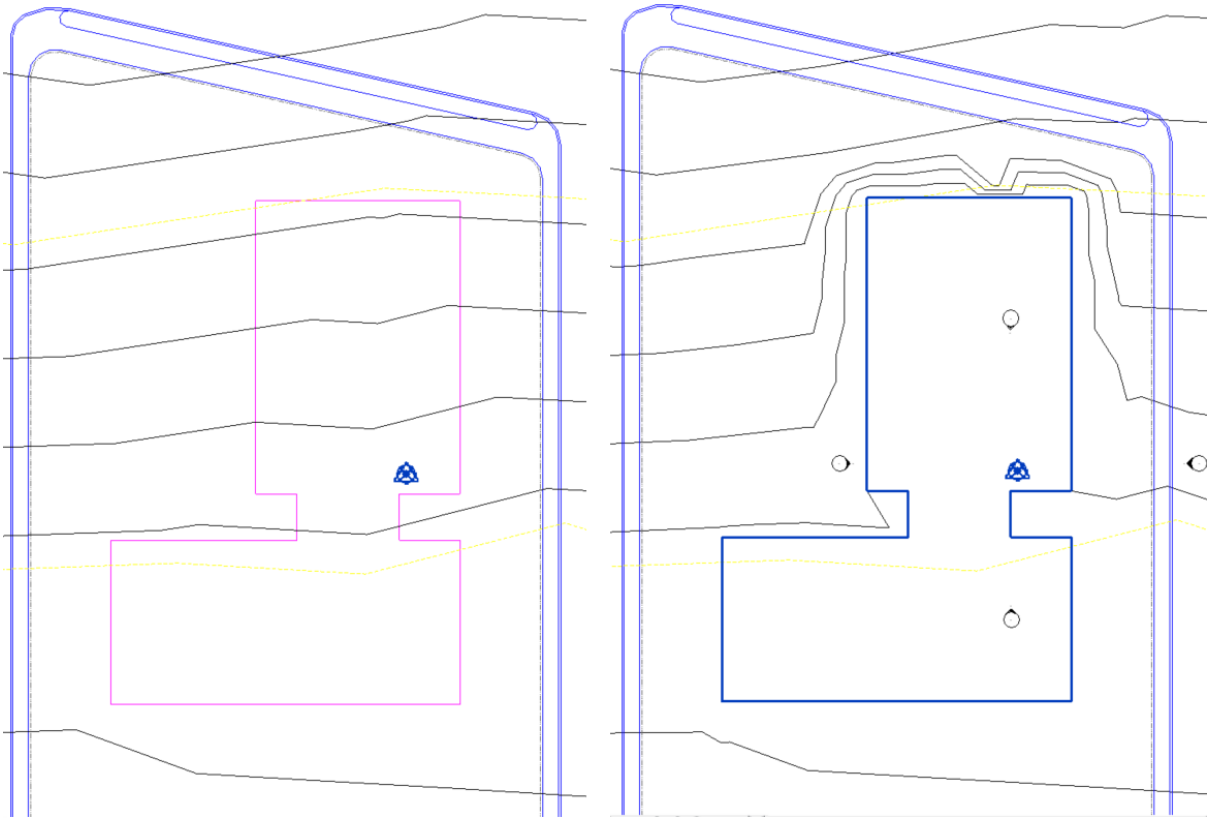


Fig. The Original Site plan, along with the original survey, and the proposed graded site, with the modified contours.

The change in surface volume can be seen in the Topography schedule with a negative total of cut/fill indicating the amount of material to be removed or distributed elsewhere on site.

<Topography Schedule>			
A	B	C	D
Comments	Surface Area	Net cut/fill	Phase Created
Original Surface	31254 m²		Existing
Proposed Surface	30610 m²	-98.90 m³	New Construction
Area around Pad	697 m²	-632.47 m³	New Construction
Grand total: 3		-731.37 m³	