



# Pond Design

Pond design will use a combination of the civil tools to create the 3D and terrain. Different methods, procedures, and analysis tools will be utilized as required by the design constraints of the existing topography, site limitations, and pond characteristics.

The method shown in the chapter uses tools that have not been introduced, such as horizontal geometry, linear templates and terrain model creation. The methods only show the user the basic concepts to get started. After creation of the terrain model, it will be exported as a tin file for legacy tool usage.

## FILE SETUP

A pond can be created in its own file or the same file as an adjoining corridor. Similar to a corridor, any components of the pond should be contained in this file with limited references to external data. The exception to this is any existing ground terrain file or target corridor.

The dgn file for this chapter already is been created from a new seed file with the cp1 and terrain model attached. See Chapter 1, Terrain Model for information on importing existing ground to a terrain model.

## CREATE USING CIVIL GEOMETRY

Horizontal civil geometry tools will be used to create the bottom of pond geometry in the 2d file. Simple lines and arcs will be used for the basic shape and then made complex into an alignment.

Civil Geometry elements retain the associations with other elements (rules) that are used to create or modify the element. By thoughtfully selecting the drawing tool, drawing order, snap type, and snap location, element relationships will be properly set, such that when an element is updated and the associated elements also update, the original design intent is retained.



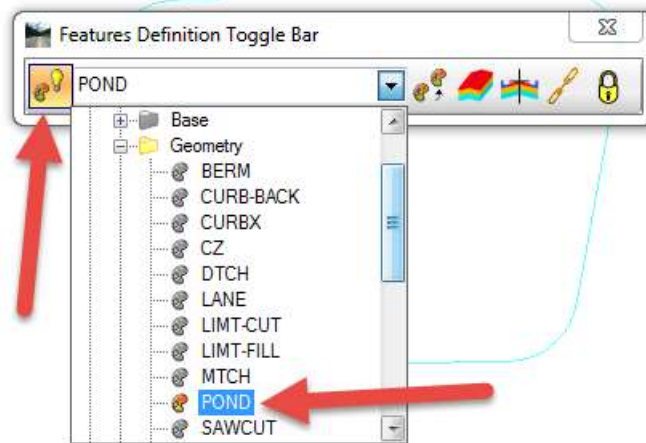
### *Create Pond Bottom Geometry*

1. Open *d340814\_svx.dgn*.

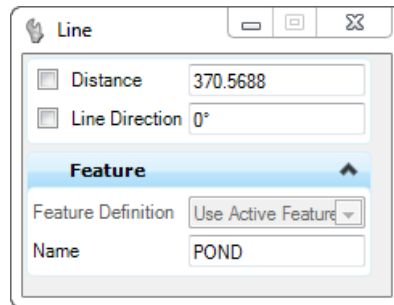
- From the Civil Tools >Horizontal Geometry Tasks, turn on the Feature Toggle Bar Tool.



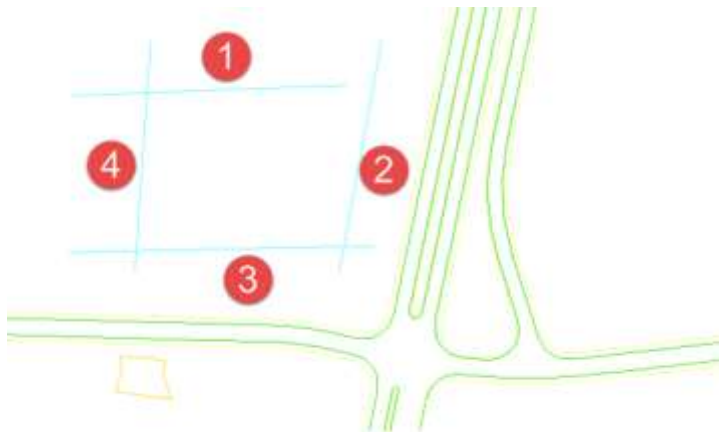
- Set the Feature definition to Linear > Geometry > POND and verify the Use Active Feature is depressed.




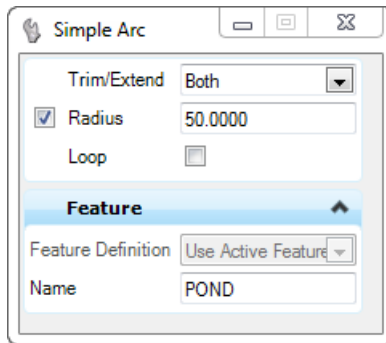
- From the Civil Tools >Horizontal Geometry Tasks, click the Line Between Points Tool.
- The Feature definition should be greyed out and set to use active feature from the Feature Toggle Bar if the Use Active Feature is depressed.



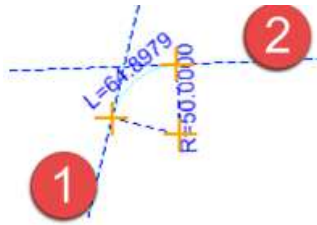
- Draw lines to delineate the bottom of the pond geometry in the NW corner of the intersection. When placing the lines, draw them in a clockwise fashion so the geometry is heading in a similar direction.



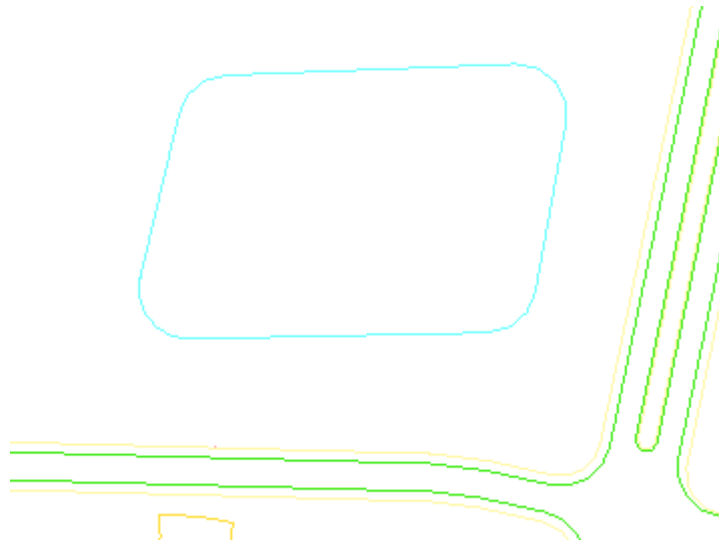
7. From the Civil Tools >Horizontal Geometry Tasks, click the Simple Arc Tool. 
8. Set the following settings.




9. Follow the prompts. Select the first component and then the second to create a fillet in each corner, trimming both elements. As you did with the lines, draw them in a clockwise fashion so the geometry is heading in a similar direction.



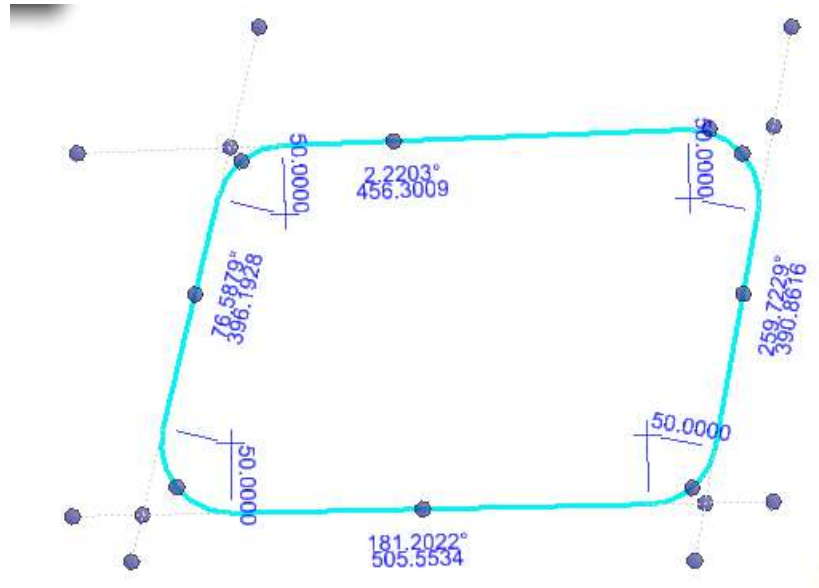
10. Continue until each corner has a radius. The bottom should look similar to below.



11. From the Civil Tools >Horizontal Geometry Tasks, click the Complex by Elements Tool. 
12. Change the name of the Feature to SSTPOND in the tool settings.
13. Hover over the first element being aware of the direction arrow is pointing clockwise. The direction arrow determines the direction of the alignment. Data point to select it.
14. The entire boundary should highlight. Data point to Create.

## MODIFY LINEAR GEOMETRY

Civil Geometry elements have Element Handlers, or Element Manipulators, associated with them. These are annotations which can also be selected and used to edit the element. For example, a line will have Element Handlers at the start and end which allow graphic repositioning of the start and end points, as well as annotation showing line length and direction which can be selected for key-in editing. The Element Handlers are hidden until the element is selected.



### *Modify Pond radii*

1. Select the complex element.
2. Hover over the round manipulator points to get tips on what action the grip performs.
3. Use the element manipulators to change the radii or modify the lines.
4. Notice how the Geometry updates.

## TERRAIN - ACTIVE TERRAIN / CONTOURS

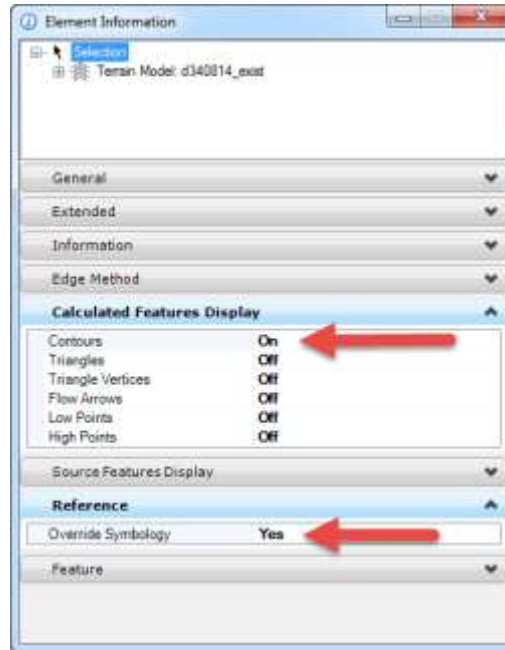
In order for corridors or linear templates to target a terrain, it must be set as active in the file. Otherwise the end conditions will not solve.

In order to get an idea of the existing ground terrain, turn on the view of the contours. When referenced, the terrain inherits its display from how it is set up in the original file. This can be overridden by selecting the terrain and changing the Override and then modifying the Calculated Features display.

---

**Note:** At this time, text displayed from a calculated terrain can NOT be printed. Either legacy tools would have to be used or contours manually labeled using the Terrain Tools.

---



### *Set Active Terrain - Turn on Contour Display*

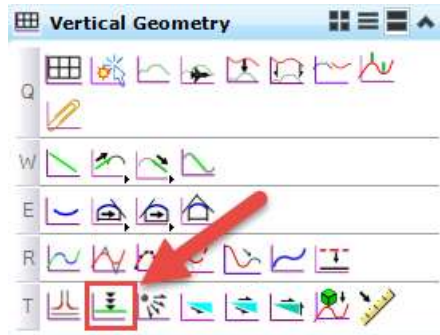
1. Select the Existing ground boundary element.
2. Using the context sensitive tools, Set as Active Terrain.
3. Using either the context sensitive tools or the element information, override the terrain display and enable the contours.
4. In the Element Information dialog, expand the plus next to the Terrain model and calculated features. Highlight the Contours and modify the interval of the view display to 0.5 Minor and 5 Major.



5. Return the settings back to Major Interval 5 and Minor Interval 1.

## **ASSIGN VERTICAL GEOMETRY - CONSTANT ELEVATION PROFILE**

Once the alignment is constructed, a vertical profile must be created to assign the z value. With this information, the Default-3D model is created along with the 3d geometry for the complex element.

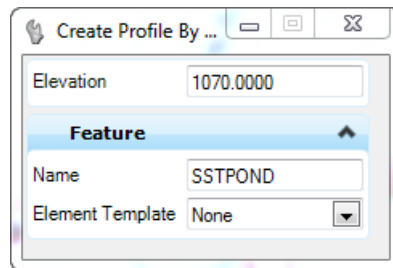


### ***Apply Constant Elevation Profile to Pond Bottom***

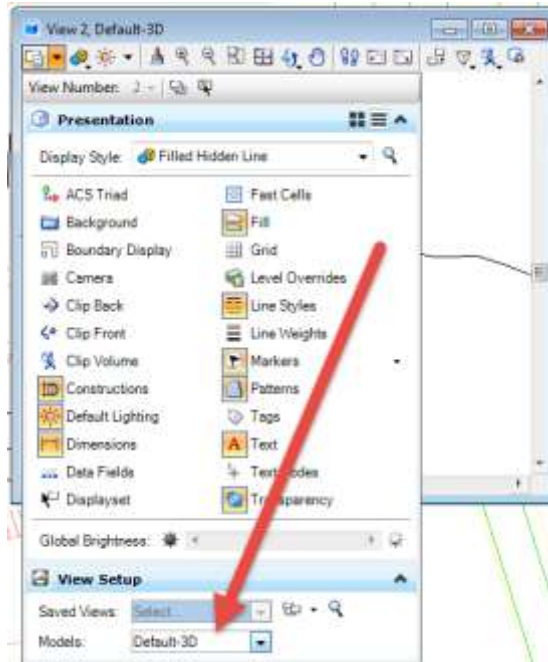
1. From the Civil Tools >Vertical Geometry Tasks, click the Profile by Constant Elevation Tool.



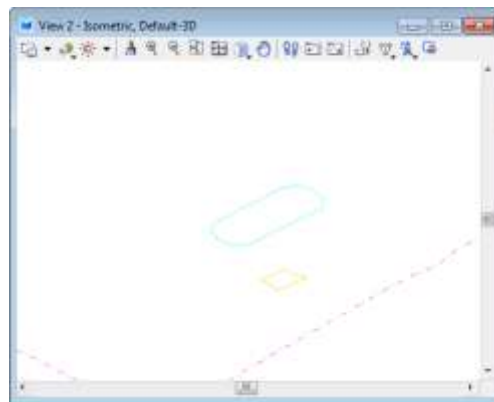
2. Change the elevation and name settings as follows.



3. Locate the complex element created for the pond bottom.
4. Accept.
5. Open View 2 and set the Model to the Default-3D. Arrange the views if desired.



6. Using the MicroStation view tools, rotate the View to Isometric.
7. Verify that the 3D element for the pond bottom was created.
8. Zoom to the pond location.



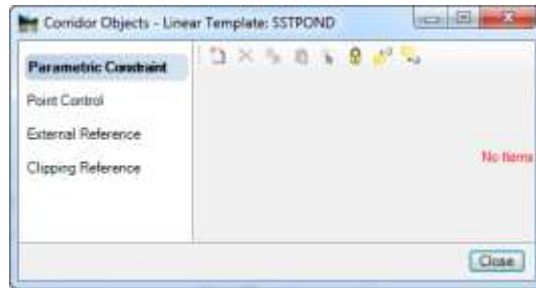
## LINEAR TEMPLATE

Linear Templates are useful in creation of site type objects in a design, such as a pond, parking lot or intersections..

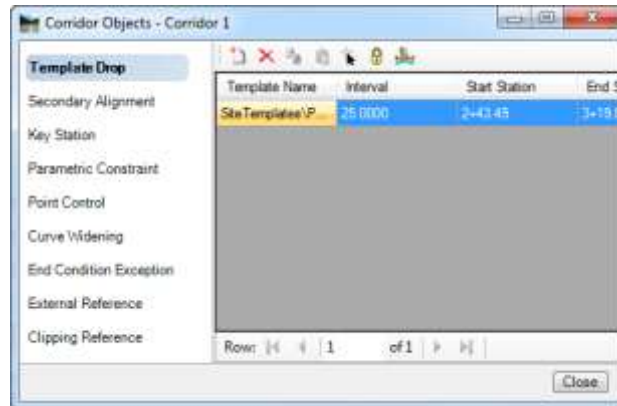
They can use the same templates as a corridor and should be stored in project library like the remainder of your project. Linear templates contain a single template drop and have fewer features than a full corridor.

When comparing Linear Template objects to Corridor objects one can see that Linear templates are a scaled down version of a corridor. Many of the corridor tools still pertain to linear templates.


## LINEAR TEMPLATE OBJECTS:



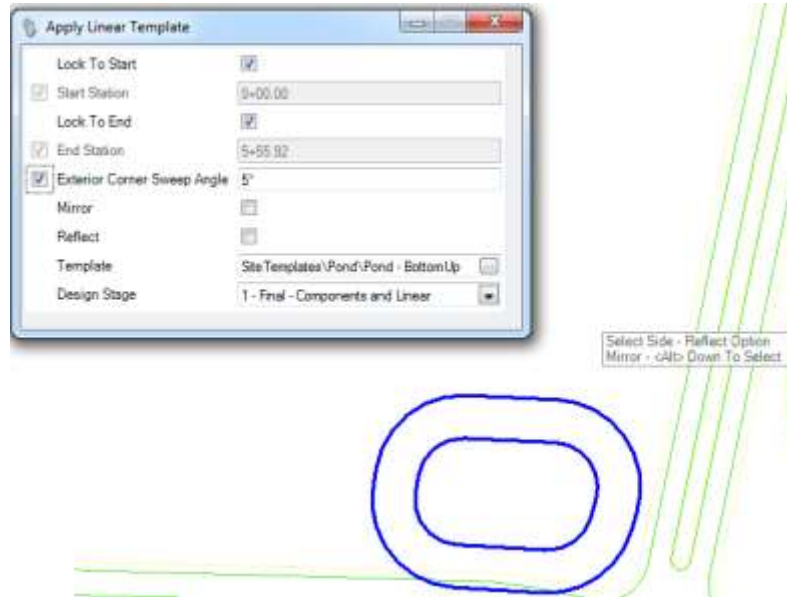
## CORRIDOR OBJECTS:



### *Apply Linear Template to Pond Bottom*

1. Make View 1 your active view in MicroStation.
2. Turn off the contours on the Existing Ground Terrain to get a better view of the elements.
3. From the Civil Tools > 3D Geometry Tasks, click the Apply Linear Template Tool. 
4. Select the bottom of pond geometry.
5. Follow the prompts using the settings as below:
  - Lock to the start and end so alignment modifications are accounted for.
  - Make sure the geometry is drawn to the outside and accept.





6. The pond geometry is drawn and ties to ground.

---

**Warning:** If you did not set the Terrain to active previously the elements will not tie. A process will have to be done in order to get the terrain to tie. At this time the “Corridor Process” does not work with linear templates. A modification to the template would have to occur to trigger an update.

---

## MODIFY LINEAR TEMPLATE

The pond bottom was created with the civil geometry and rules were assigned. Modification to this geometry will update associated geometry. Other potential modifications are to change the linear template geometry or use the corridor objects tools to make modification to the applied linear template.

1. Select the template drop, click the Edit Template tool.
2. Change the berm width to 12’ and modify the inslopes to be 1:3 (33%).
3. Select the alignment and modify so that the limits of the pond fit the roadway geometry.

## CREATE TERRAIN MODEL FROM ALTERNATE SURFACE

In order to obtain volumes for the pond a terrain must be generated from the graphics. Since we have linear template the component quantities could be used, but then you would need to compute the volume for the center of the pond separately. Instead we will create a terrain for the entire pond to get the volume in one operation.

There are multiple methods that could be used to create the terrain. One method is to use the graphics added as break lines. A terrain model is a 3D element, but since the 2D graphical features from the template are linked to the 3D they can be used.

---

**Note:** The method used in this lab creates a terrain for the finished surface.

---

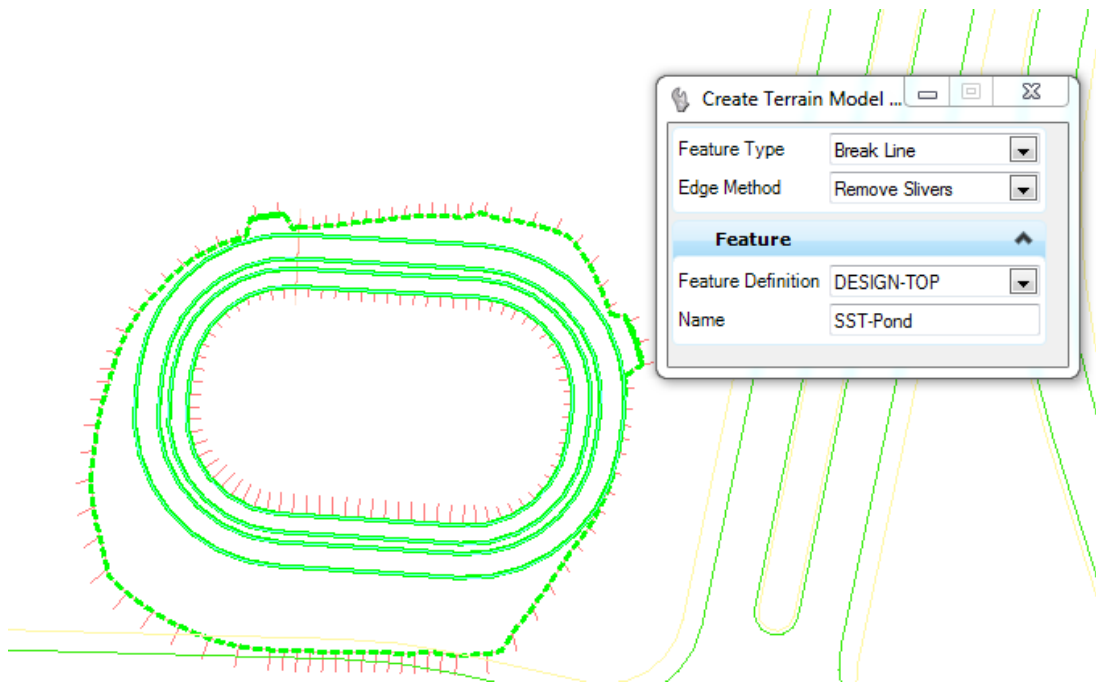


### *Create Terrain Model*

1. With View 1 active, turn off the display of the self-referenced 3D-Default model.
2. From the Civil Tools > Terrain Model Tasks, select the Create from elements tool.



3. With the following settings, select the pond graphics and create the terrain, be sure to include all the elements:

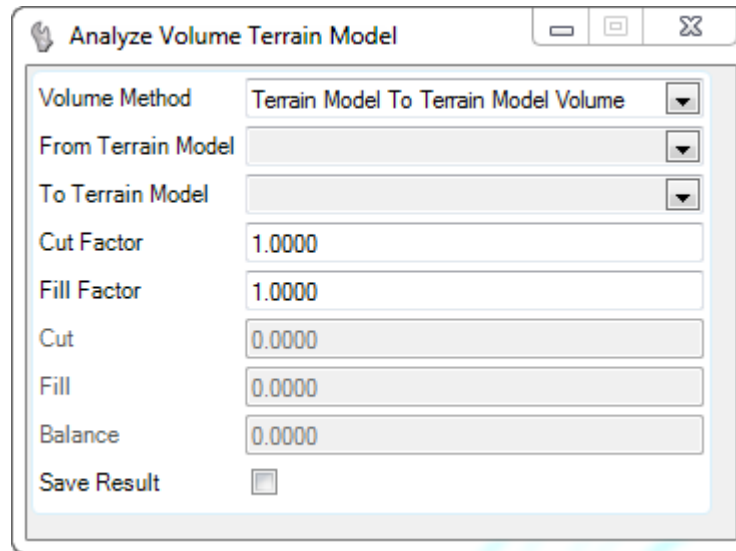


4. The terrain is created in the Default-3D model.

## ANALYZE TERRAIN VOLUMES

Once a terrain is created the volume can be analyzed with the terrain tools. This is a simple tool that reports the cut and fills either to a plane or an alternate terrain. An adjustment factor can be added if desired.





### *Analyze Terrain Volumes*

1. Select the Analyze Volume from the Terrain Model Task menu.
2. Choose the Method Terrain Model to Terrain Model Volume.
3. Choose the existing ground (d340814\_exist) as the “From” terrain.
4. Choose the pond (SST-Pond) as the “To” terrain.
5. Use a cut and fill of 1.0 and no boundary.
6. The result will display.

---

**Note:** If you select the wrong “From” terrain the cut and fill volume will be flipped.

---

## EXPORT TERRAIN TO GEOPAK TIN

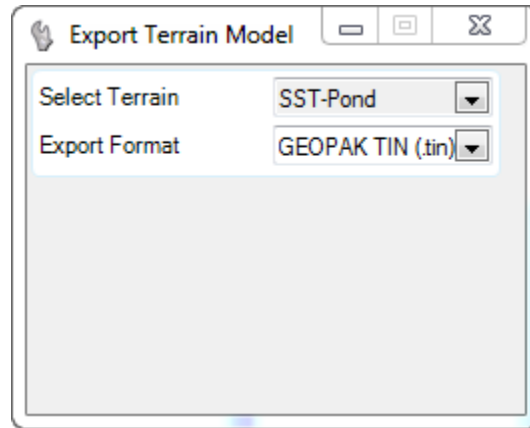
In order to use legacy tools, the terrain must be exported to a tin file. This is possible using the Export to file tool in the Terrain Model task.





### ***Export Terrain to TIN***

1. Choose the Export to File tool.
2. Set the terrain and the format.



3. Save the tin to your student working folder in PW.