Computing Pit-Fill Volumetrics with RockWorks

12/15/24/JPR

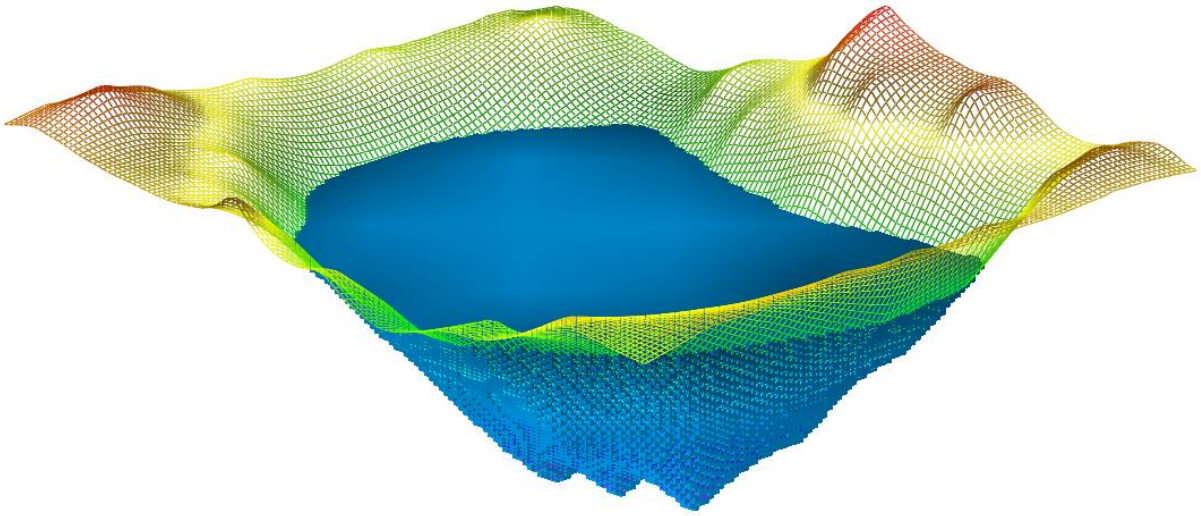

Figure 1

This tutorial will show how to compute the volume of a lake that fills a pit based on digitized elevation points within the pit (Figure 1).

- We'll start with a *Datasheet* that contains a list of XYZ coordinates for points within an open-pit mine (Figure 2). In this example, the points were digitized from Google Earth (Figure 3). The digitizing/import process is described within a separate PDF (digitizing_in_google_earth_01.pdf).

Datasheet (Points)

File Edit Search View Filter

Row#	Use	X (Easting)	Y (Northing)	Z Elevation
		UTM Meters	UTM Meters	Meters
1	☑	297,155.0	3,829,127.0	594
2	☑	297,174.0	3,829,334.0	695
3	☑	297,189.0	3,829,520.0	747
4	☑	297,218.0	3,829,831.0	889
5	☑	297,235.0	3,830,018.0	1026
6	☑	297,244.0	3,830,180.0	1151
7	☑	297,239.0	3,830,361.0	1191
8	☑	297,158.0	3,828,933.0	672
9	☑	297,166.0	3,828,691.0	785
10	☑	297,179.0	3,828,426.0	960
11	☑	297,188.0	3,828,191.0	1049
12	☑	296,822.0	3,828,151.0	1123

Figure 2

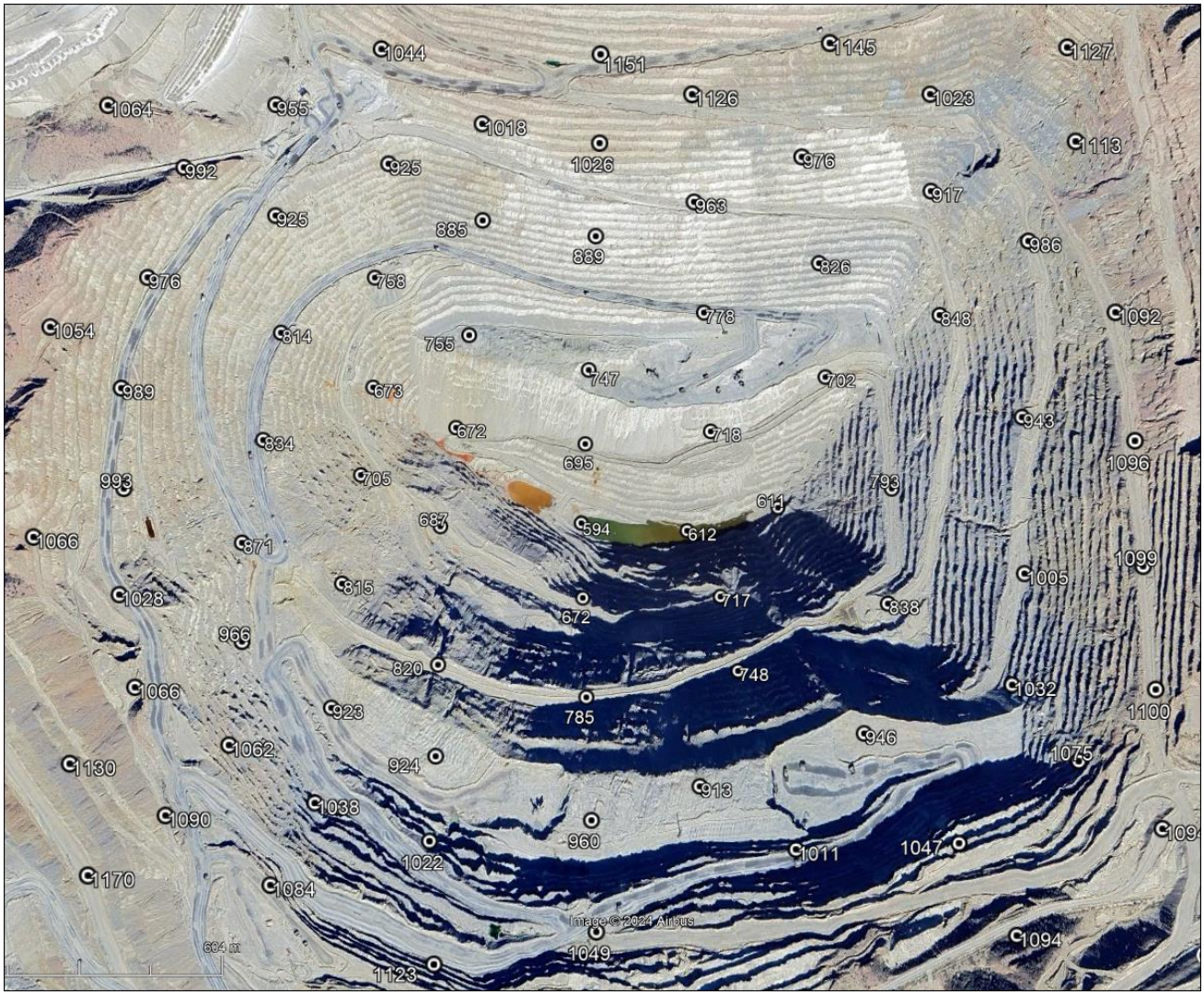

Figure 3

- Set the *Project Dimensions* to enclose the control points by clicking the *Dimensions* tab and selecting the *Datasheet -> Dimensions* option (Figure 4).

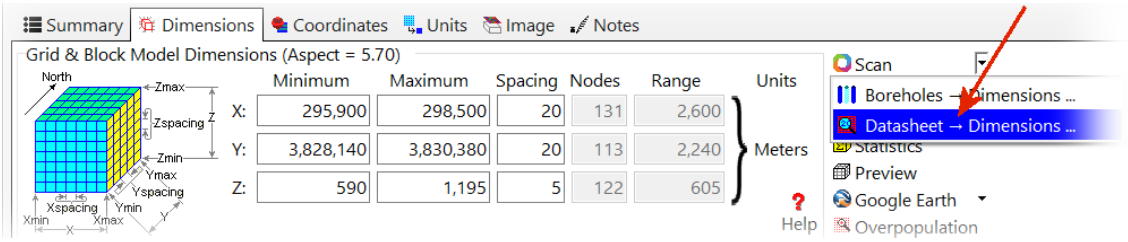

Figure 4

- Set the X, Y, and Z-Columns to the appropriate columns within your *Datasheet* (Figure 5).

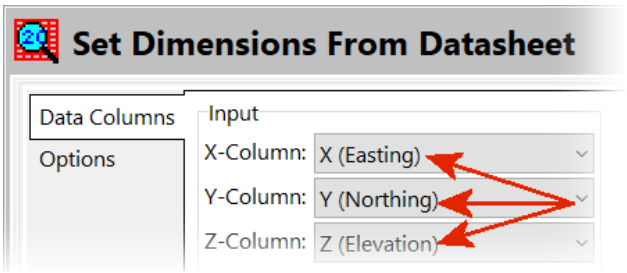

Figure 5

- Click on the *Options* tab and configure the program to scan the *XYZ Data* (Figure 6).

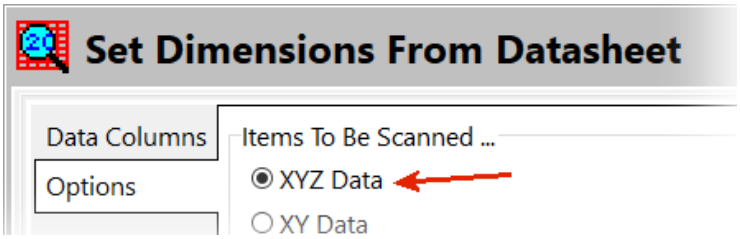

Figure 6

- Upon completion, the *Project Dimensions* (Figure 7) will represent a parallelopiped that encloses the control points.

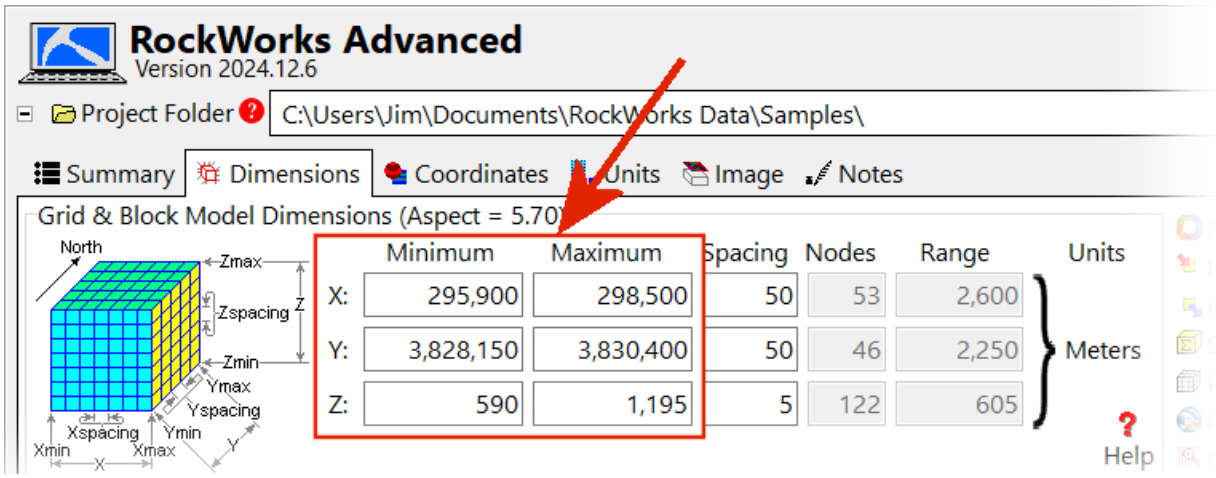

Figure 7

- Select the *ModOps / Create / XYZ -> Grid* option (Figure 8).

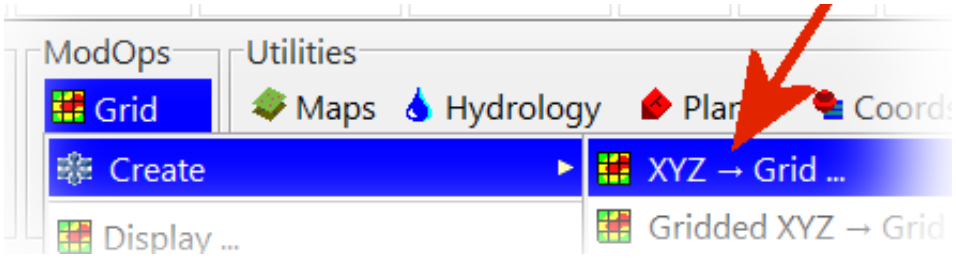

Figure 8

- Set the X, Y, and Z *Data Columns* (Figure 9) to read from the columns within the *Datasheet* that we imported from Google Earth.

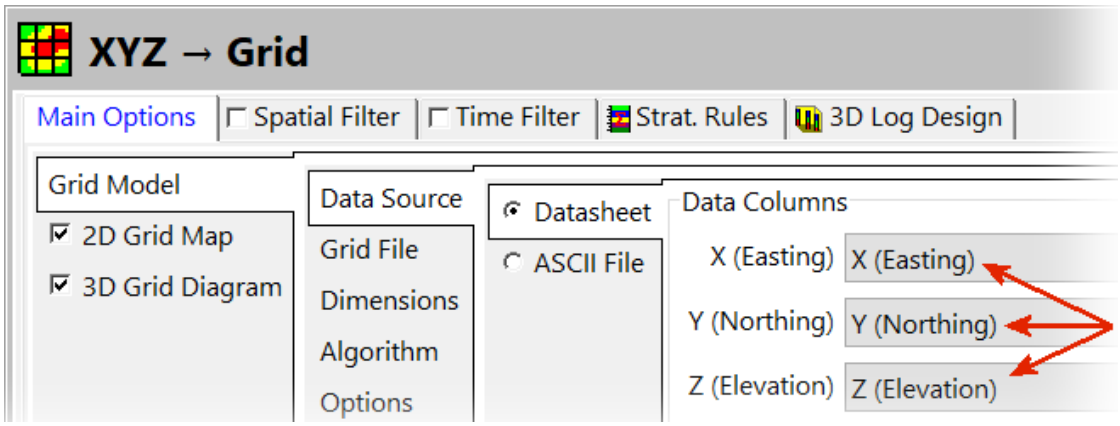

Figure 9

- Set the name of the *Grid File* to “Pit.RwGrd” (Figure 10).

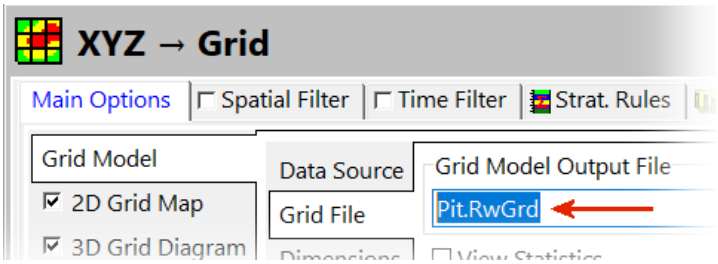

Figure 10

- Set the interpolation *Algorithm* to *Kriging / Single Spoke* (Figure 11).

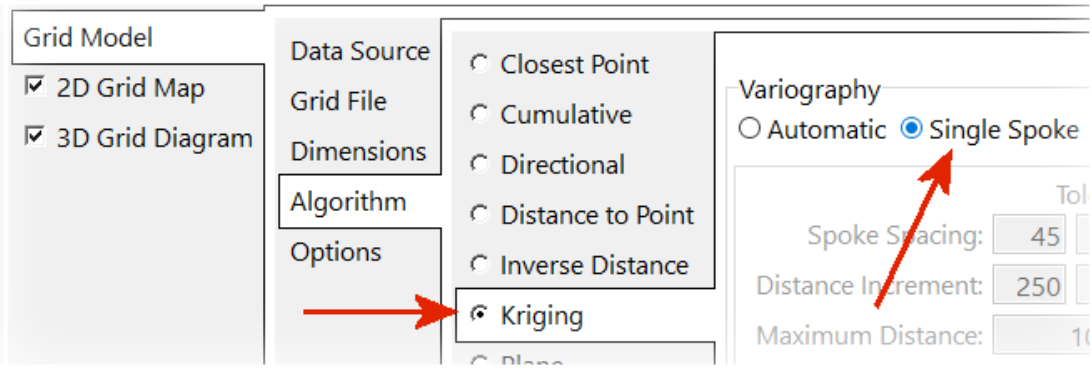

Figure 11

- Click the *Continue* button and a contour map and 3-D surface diagram (Figure 12) will be created. Your results may vary depending upon settings within the *2D Grid Map* and *3D Grid Diagram* sub-menus.

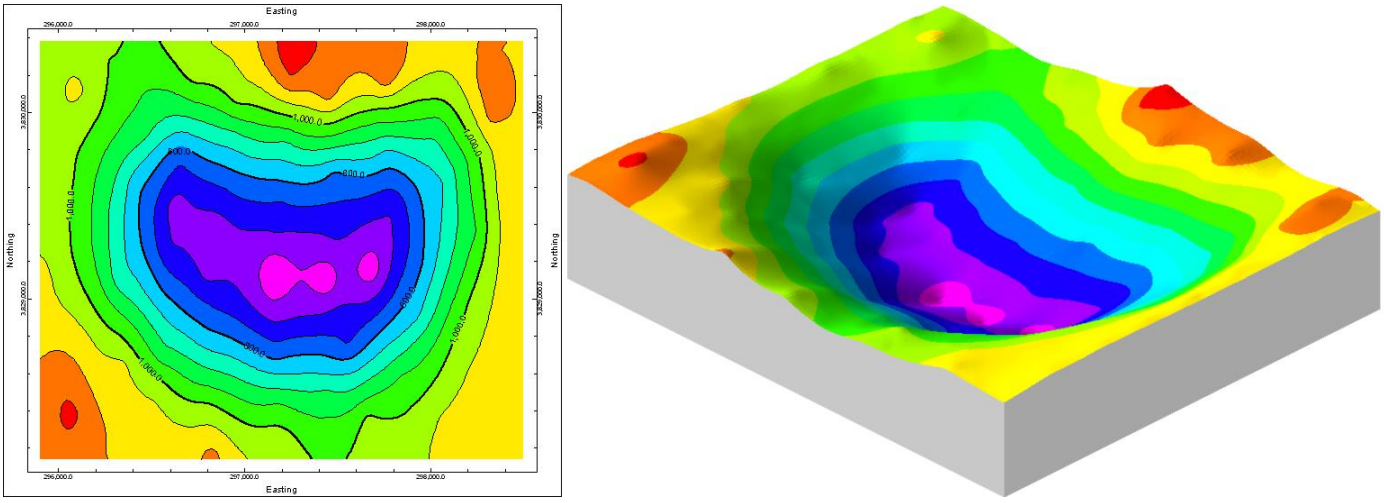

Figure 12

- In this next step, we will create a model of the water that would fill the pit up to a surface elevation of 950 meters above sea level. Select the *ModOps / Solid / Filters / Solid & Grid(s)* program (Figure 13).

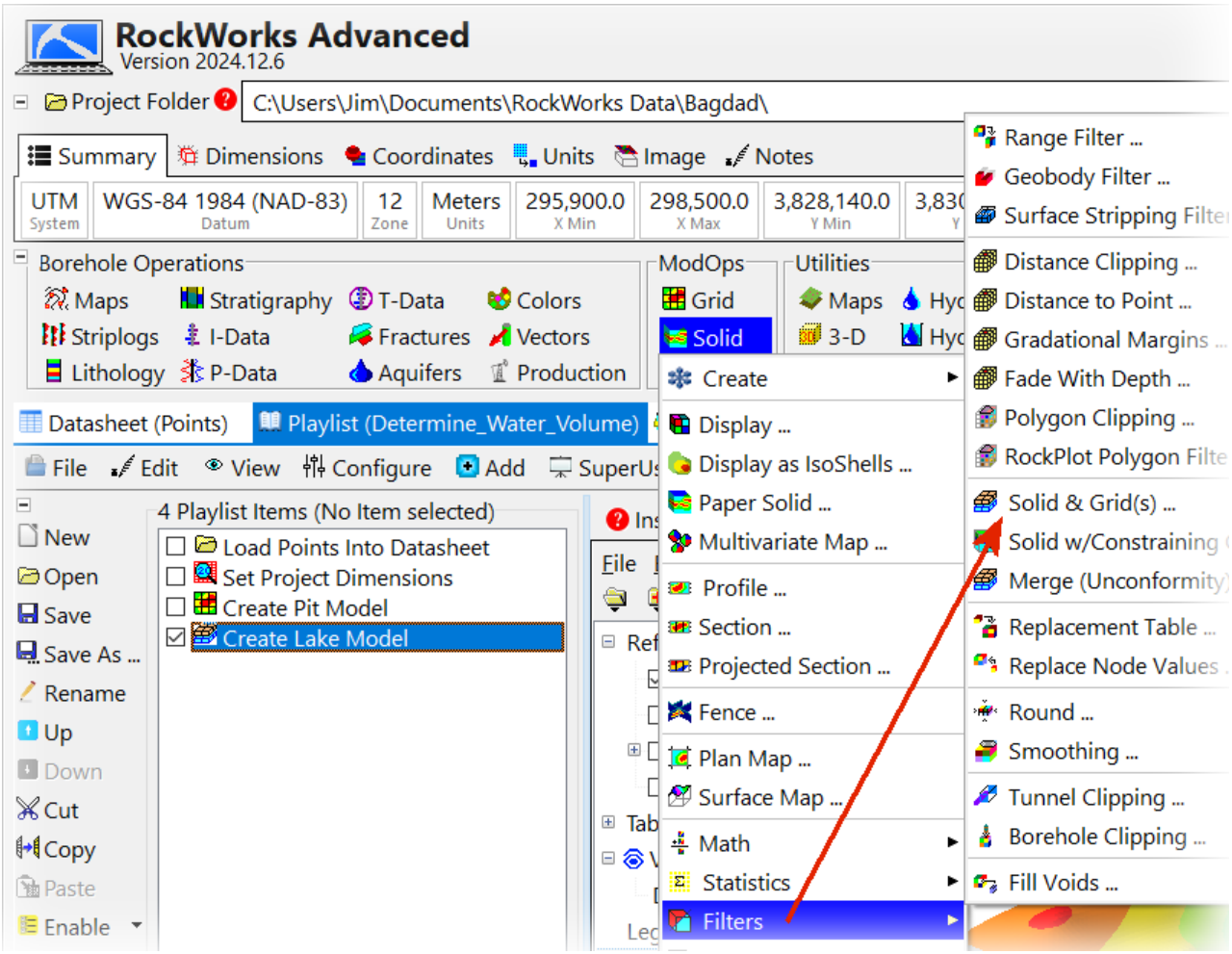

Figure 13

- Within the *Solid & Grid(s) Filter* program menu, select the *Input / Output* tab and (1) select the *Create New Solid Model* option, (2) set the name of the *Solid Model* to "Lake.RwMod", and (3) set the *Default G-Value* to 1.0 (Figure 14).

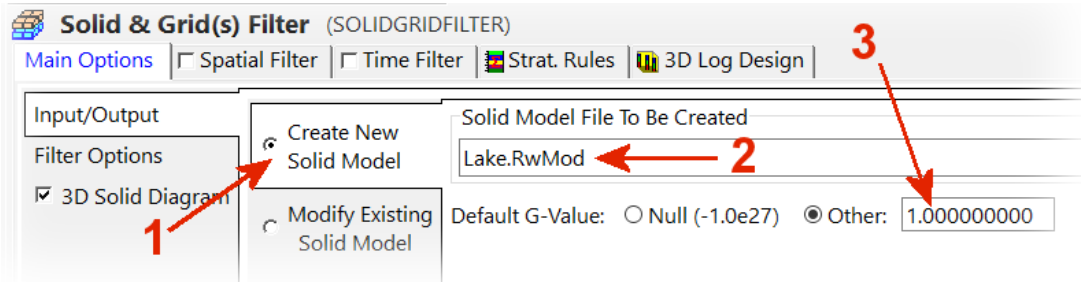

Figure 14

- As shown in Figure 15, set the *Filter Options* (1) to *Two Surfaces* (2), and set the *Upper Surface Type* to be a *Horizontal Plane* (3) at an *Elevation* of 950 (4).

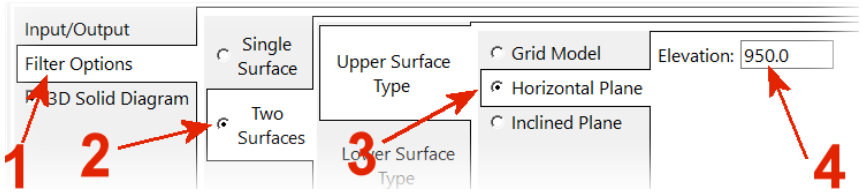

Figure 15

- As shown in Figure 16, set the Lower Surface Type (1) to be the previously-generated Grid Model (2) titled "Pit.RwGrd" (3).

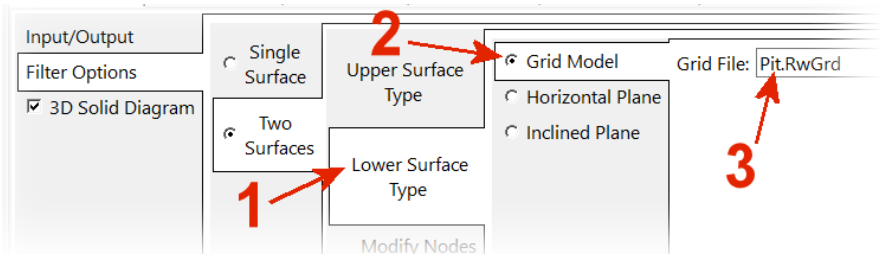

Figure 16

- Configure the program (Figure 17) to *Replace All Nodes Above the Upper Surface* (i.e., the *Horizontal Plane* at 950 meters) with a *Null* value.

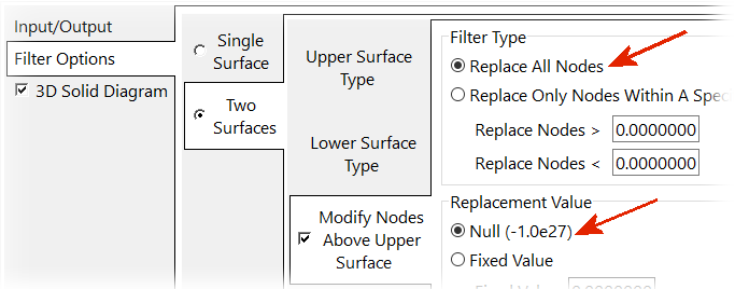

Figure 17

- In a similar fashion, configure the program (Figure 18) to *Replace All Nodes Below the Lower Surface* (i.e., the "Pit.RwGrd" surface) to a *Null* value.

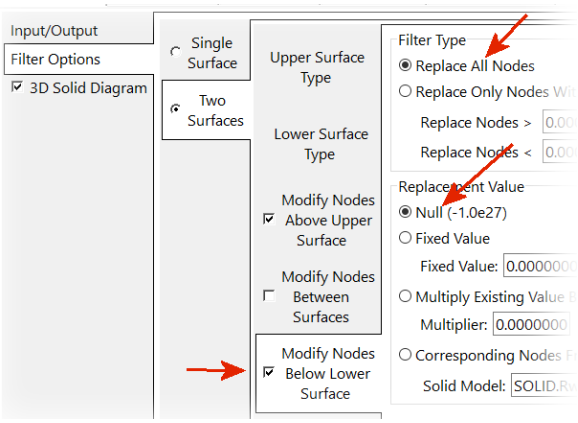

Figure 18

- Set up the *3D Solid Diagram* to plot the solid as *Voxels* (Figure 19).

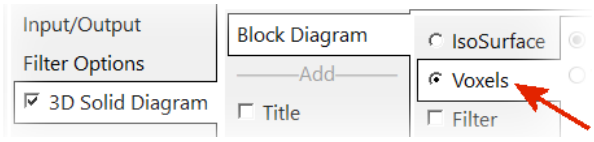

Figure 19

- Configure the *3D Solid Diagram* (Figure 20) such that a *Logical Color Scheme* will be used to set the color for the *Voxels* between the two surfaces (horizontal plane and pit base) to blue (i.e., *Voxels* with a g-value of 1).

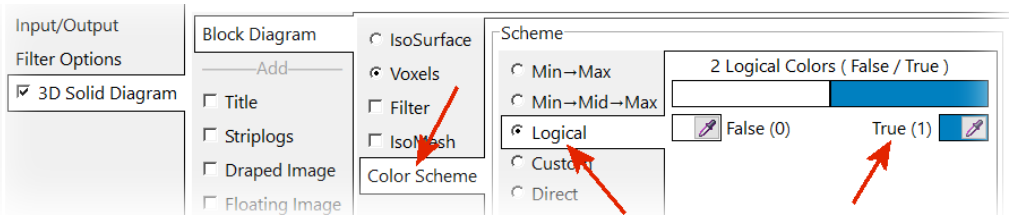

Figure 20

- Click the *Continue* button and a diagram (Figure 21) will be generated that depicts the "Lake Model".

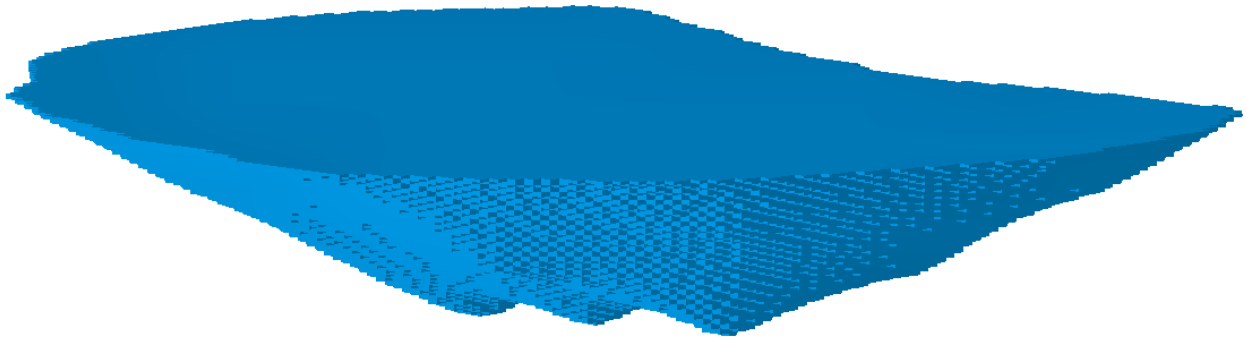

Figure 21

- When combined with the 3D pit diagram (via the Plot3D / File / Append option), the lake is nestled within the pit (Figure 22).

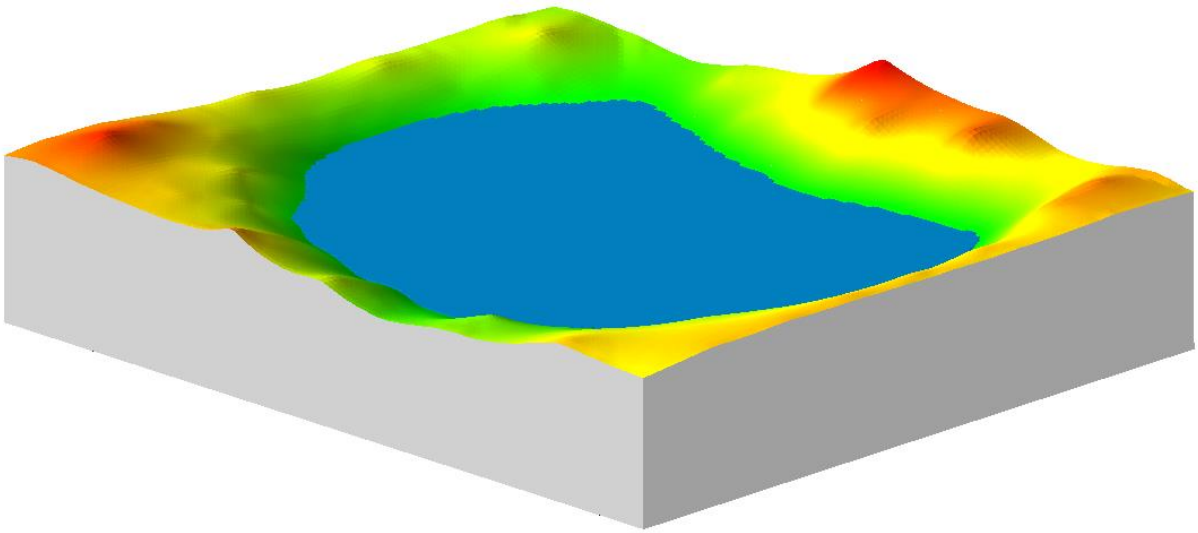

Figure 22

- Next, select the *ModOps / Solid / Statistics / Report* option (Figure 23).

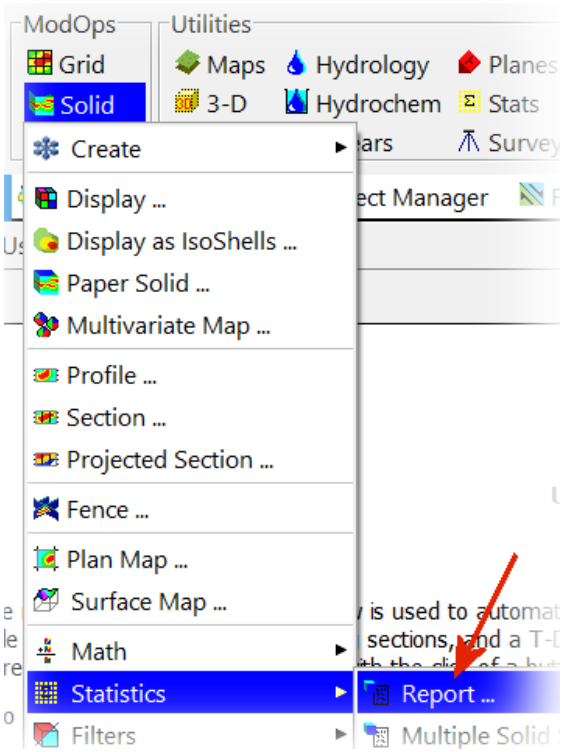

Figure 23

- Enter "Lake.RwMod" for the name of the Solid Model File within the Solid -> Statistical Report program menu (Figure 24) and press the Continue button.

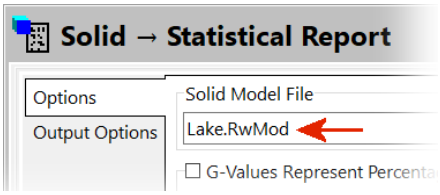

Figure 24

- The *Non-Zero Volume* with the *Statistical Report* (Figure 25) indicates that the pit will hold 387,684,000 cubic meters of water.

	A	B	C
1	Solid Information		
2		Solid Name:	Lake.RwMod
3		File Date:	45,641.7
4		XY Units:	Meters
5		Z Units:	Meters
6		Volume Units:	Cubic Meters
7	Dimensions		
8		X-Min():	295,900.0
9		X-Max():	298,500.0
10		X-Spacing():	20.0
11		X-Nodes:	131.0
12		Y-Min():	3,828,140.0
13		Y-Max():	3,830,380.0
14		Y-Spacing():	20.0
15		Y-Nodes:	113.0
16		Z-Min():	590.0
17		Z-Max():	1,195.0
18		Z-Spacing():	5.0
19		Z-Nodes:	122.0
20	Volumetrics		
21		Voxel Volume:	2,000.0
22		Total Voxels:	1,805,966.0
23		Model Volume:	3,611,932,000.0
24		Center of Mass X:	297,210.7
25		Center of Mass Y:	3,829,246.3
26		Center of Mass Z:	847.4
27	Voxel Statistics		
28		Null Voxels:	1,612,124.0
29		Minimum Voxel Value:	1.0
30		Minimum Non-Null Voxel Value:	1.0
31		Maximum Voxel Value:	1.0
32		Mean Voxel Value:	1.0
33		Mean Voxel Value for Values > 0:	1.0
34		Sum of All Voxel Values:	193,842.0
35		Standard Deviation:	0.0
36		Non-zero and Null Voxels:	193,842.0
37		Non-zero Volume:	387,684,000.0
38		Percentage-Based Material Volume:	n/a

Non-zero and Null Voxels:	193,842.0
Non-zero Volume:	387,684,000.0
Percentage-Based Material Volume:	n/a

Figure 25

- This volume translates to 388 billion liters (102 billion gallons) of water weighing 387 thousand metric tonnes (427 thousand US tons).