

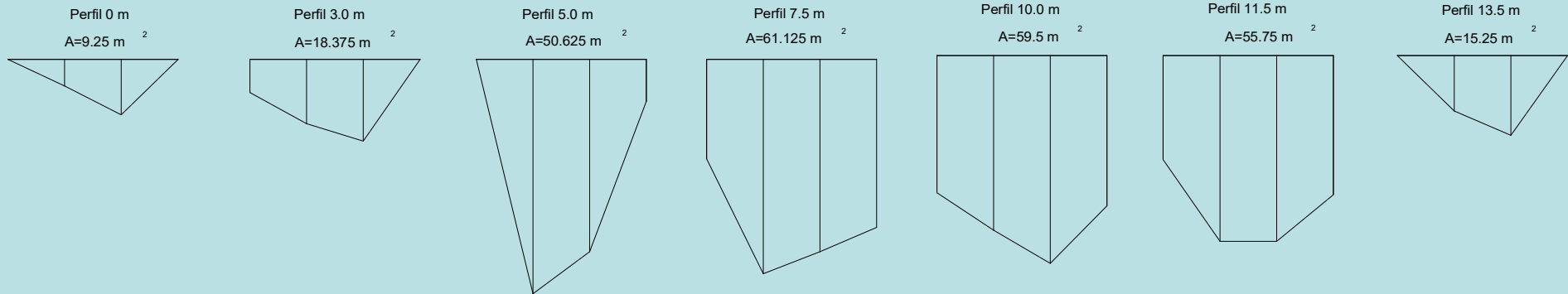
Topografia Aplicada – movimento de terras

Exemplo: em planta, uma vala para irrigação mede 7.5 m de largura por 13.5 m de comprimento. Utilizando a tabela seguinte, que traduz a profundidade, em metros, nos pontos indicados, estime o volume de escavação que foi necessário efectuar (supondo naturalmente o terreno original horizontal).

m/m	0	3.0	5.0	7.5	10.0	11.5	13.5
0	0.0	1.5	0.0	4.5	6.2	4.7	0.0
2.5	1.2	2.9	10.6	9.7	7.9	8.4	2.5
5.0	2.5	3.7	8.7	8.7	9.4	8.4	3.6
7.5	0.0	0.0	1.9	7.6	6.8	6.3	0.0

Topografia Aplicada – movimento de terras

Considerando os 7 perfis transversais seguintes, tem-se:



$$A_1 = \frac{1}{2} \begin{bmatrix} 0 & 2.5 & 5.0 & 7.5 & 5.0 & 2.5 & 0 \\ 0 & 0 & 0 & 0 & 2.5 & 1.2 & 0 \end{bmatrix} = 9.25 \text{ m}^2$$

$$A_2 = \frac{1}{2} \begin{bmatrix} 0 & 2.5 & 5.0 & 7.5 & 5.0 & 2.5 & 0 & 0 \\ 0 & 0 & 0 & 0 & 3.7 & 2.9 & 1.5 & 0 \end{bmatrix} = 18.375 \text{ m}^2$$

$$A_3 = \frac{1}{2} \begin{bmatrix} 0 & 2.5 & 5.0 & 7.5 & 7.5 & 5.0 & 2.5 & 0 \\ 0 & 0 & 0 & 0 & 1.9 & 8.7 & 10.6 & 0 \end{bmatrix} = 50.625 \text{ m}^2$$

$$A_4 = \frac{1}{2} \begin{bmatrix} 0 & 2.5 & 5.0 & 7.5 & 7.5 & 5.0 & 2.5 & 0 & 0 \\ 0 & 0 & 0 & 0 & 7.6 & 8.7 & 9.7 & 4.5 & 0 \end{bmatrix} = 61.125 \text{ m}^2$$

$$A_5 = \frac{1}{2} \begin{bmatrix} 0 & 2.5 & 5.0 & 7.5 & 7.5 & 5.0 & 2.5 & 0 & 0 \\ 0 & 0 & 0 & 0 & 6.8 & 9.4 & 7.9 & 6.2 & 0 \end{bmatrix} = 59.5 \text{ m}^2$$

$$A_6 = \frac{1}{2} \begin{bmatrix} 0 & 2.5 & 5.0 & 7.5 & 7.5 & 5.0 & 2.5 & 0 & 0 \\ 0 & 0 & 0 & 0 & 6.3 & 8.4 & 8.4 & 4.7 & 0 \end{bmatrix} = 55.75 \text{ m}^2$$

$$A_7 = \frac{1}{2} \begin{bmatrix} 0 & 2.5 & 5.0 & 7.5 & 5.0 & 2.5 & 0 \\ 0 & 0 & 0 & 0 & 3.6 & 2.5 & 0 \end{bmatrix} = 15.25 \text{ m}^2$$

$$V_1 = \frac{1}{2} (A_1 + A_2) \times 3 = 41.4375 \text{ m}^3$$

$$V_2 = \frac{1}{2} (A_2 + A_3) \times 2 = 69.0 \text{ m}^3$$

$$V_3 = \frac{1}{2} (A_3 + A_4) \times 2.5 = 139.6875 \text{ m}^3$$

$$V_4 = \frac{1}{2} (A_4 + A_5) \times 2.5 = 150.78125 \text{ m}^3$$

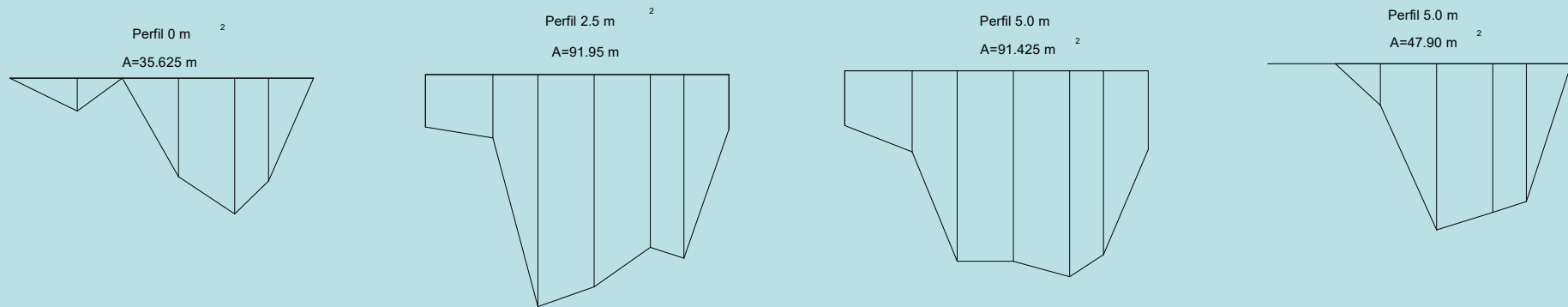
$$V_5 = \frac{1}{2} (A_5 + A_6) \times 1.5 = 86.4375 \text{ m}^3$$

$$V_6 = \frac{1}{2} (A_6 + A_7) \times 2 = 71.0 \text{ m}^3$$

$$V_{\text{total}} = 558.34375 \text{ m}^3$$

Topografia Aplicada – movimento de terras

Como alternativa, podem utilizar-se os 4 perfis longitudinais seguintes:

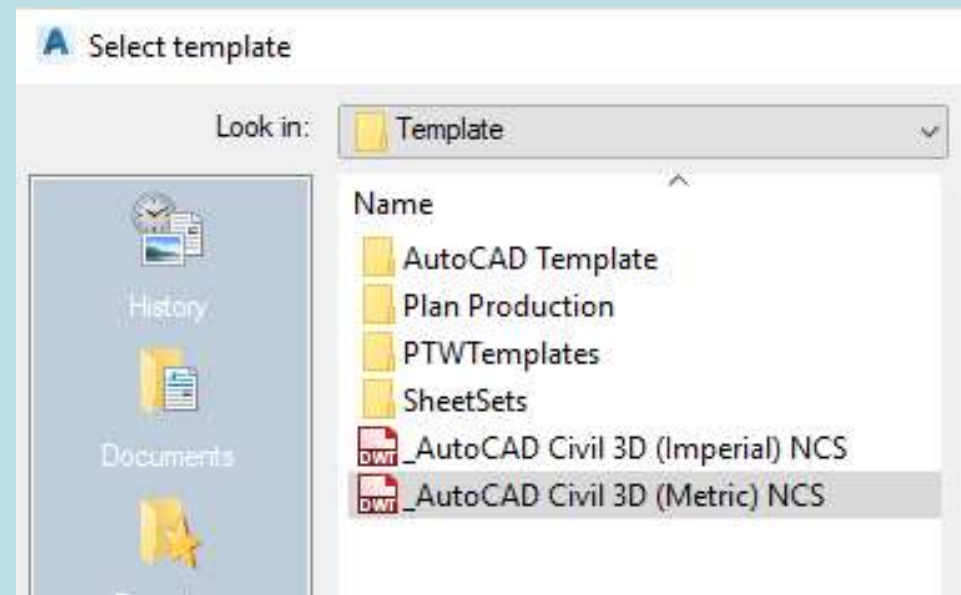
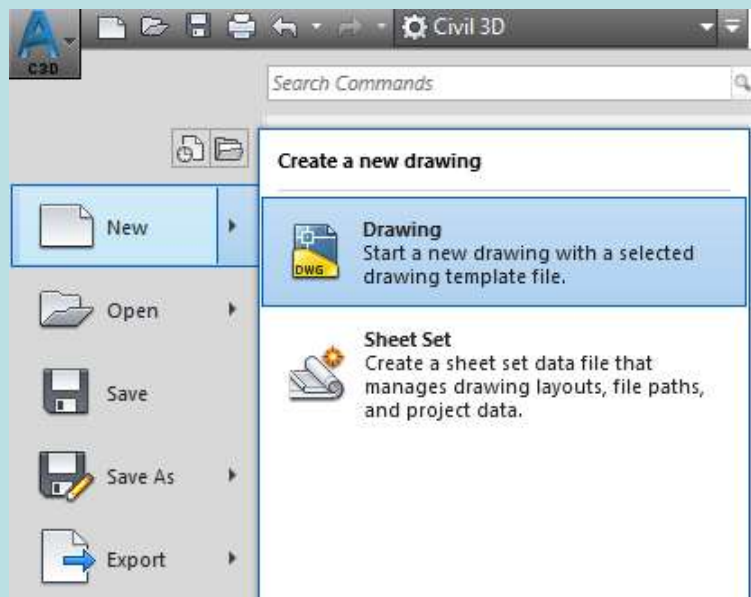


$$V_{\text{total}} = 562.84375 \text{ m}^3$$

Posicionamento Geoespacial II

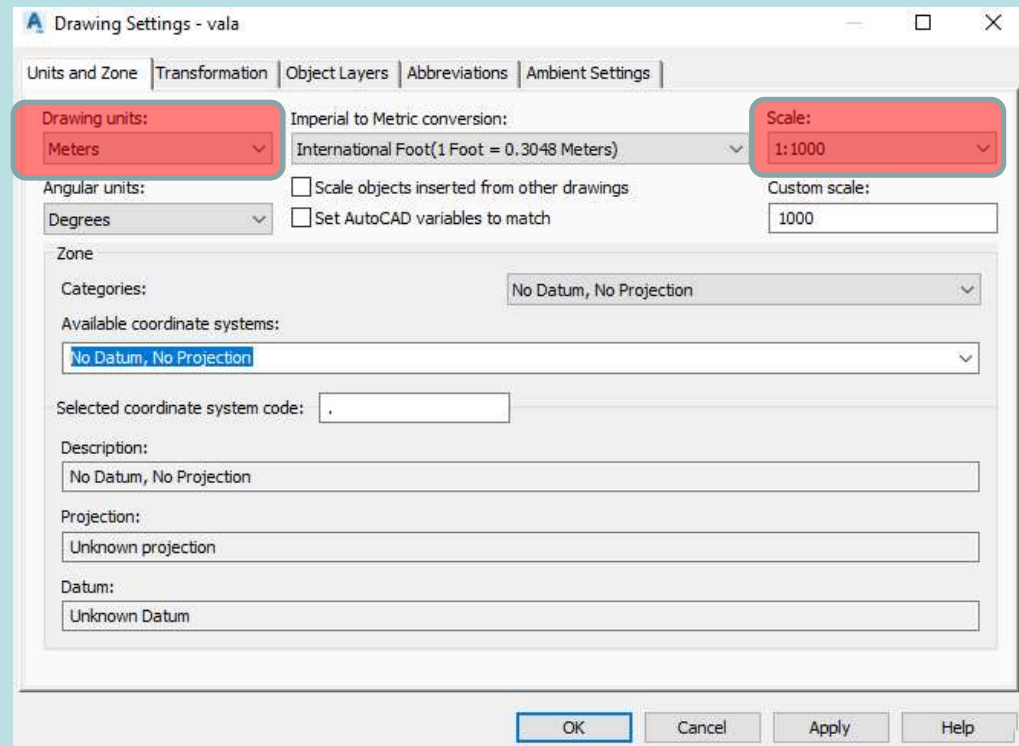
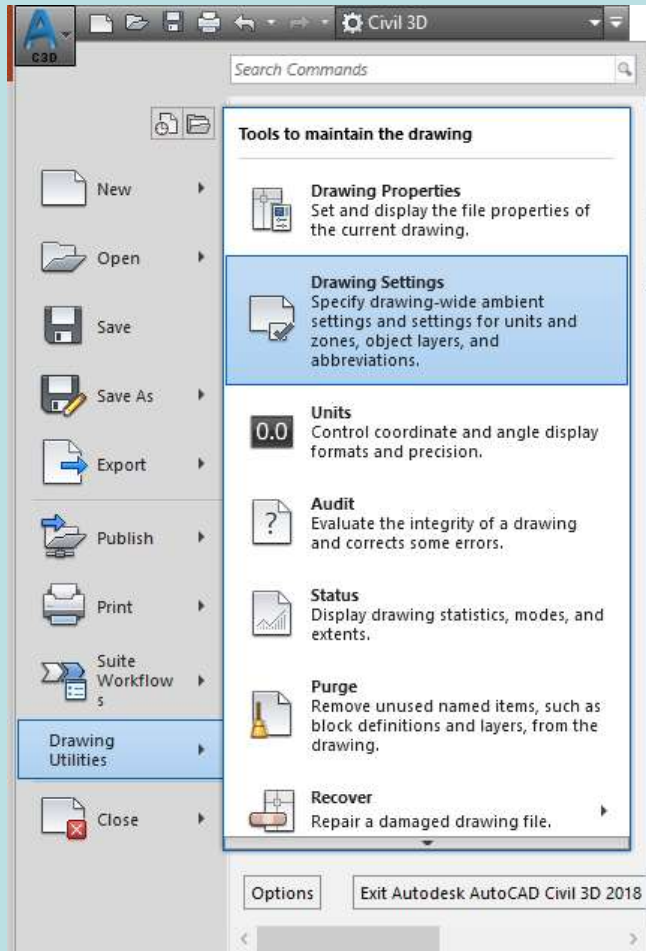
Resolução do problema com o Civil3D:

1. Abrir um ficheiro novo utilizando o template AutoCAD Civil 3D (Metrics) NCS e fazer Save As **vala.dwg**.



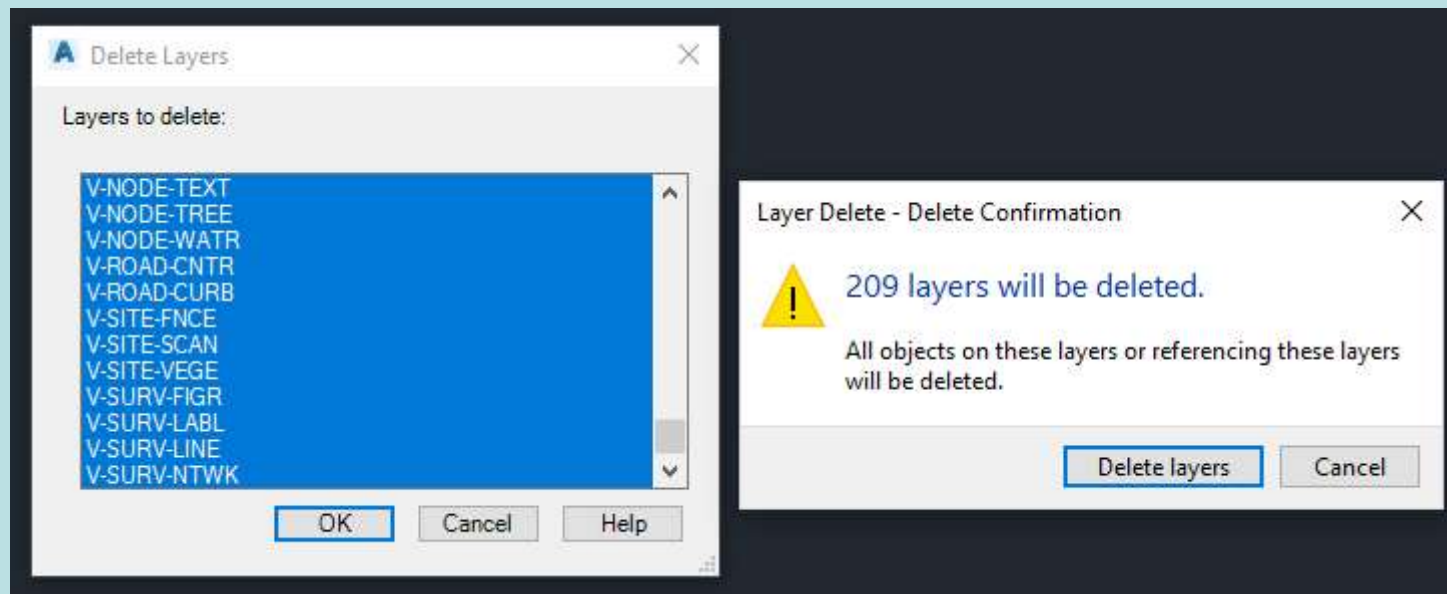
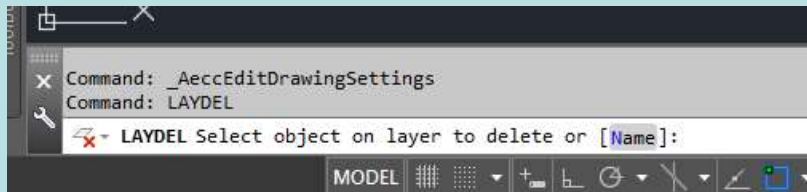
Posicionamento Geoespacial II

2. Confirmar as unidades e a escala:



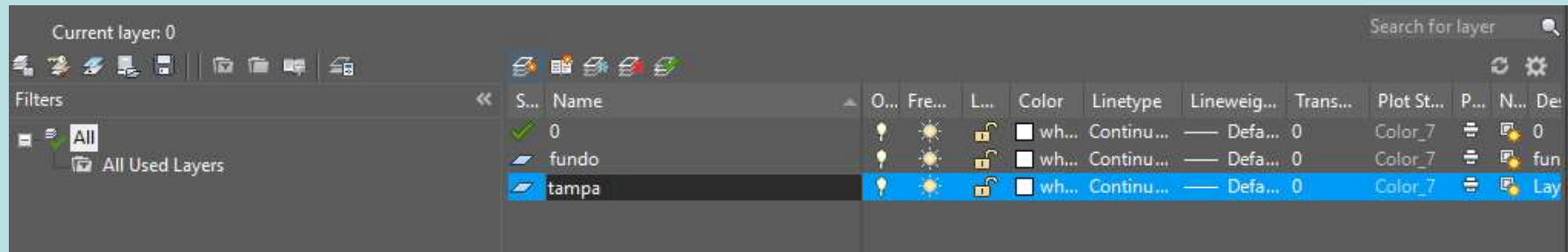
Posicionamento Geoespacial II

3. Apagar layers pré-definidos:



Posicionamento Geoespacial II

4. Criar os layers **fundo** e **tampa**:



Posicionamento Geoespacial II

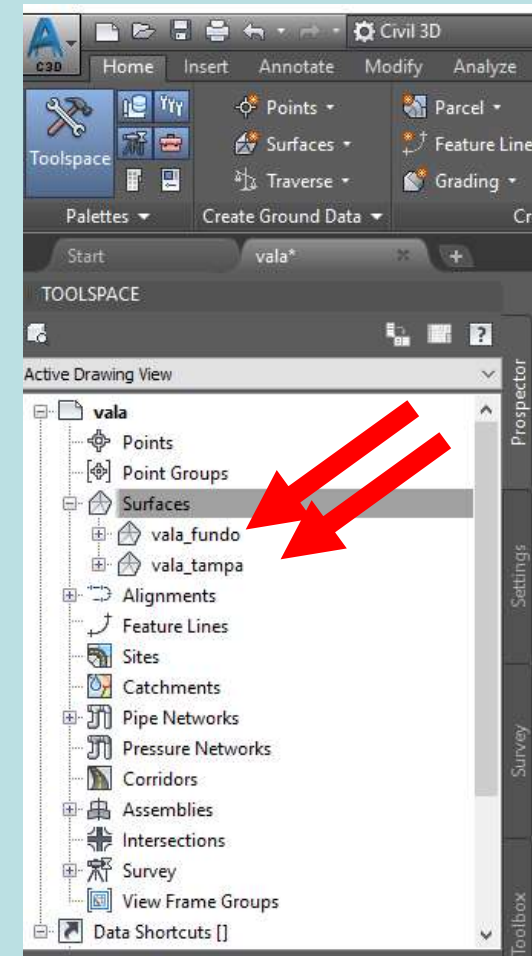
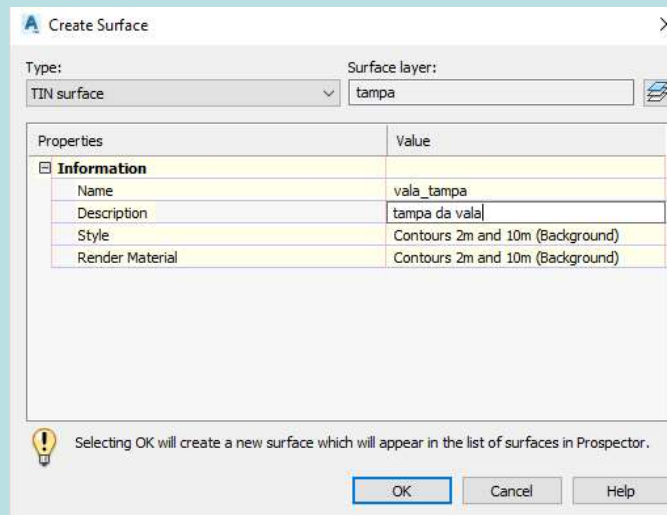
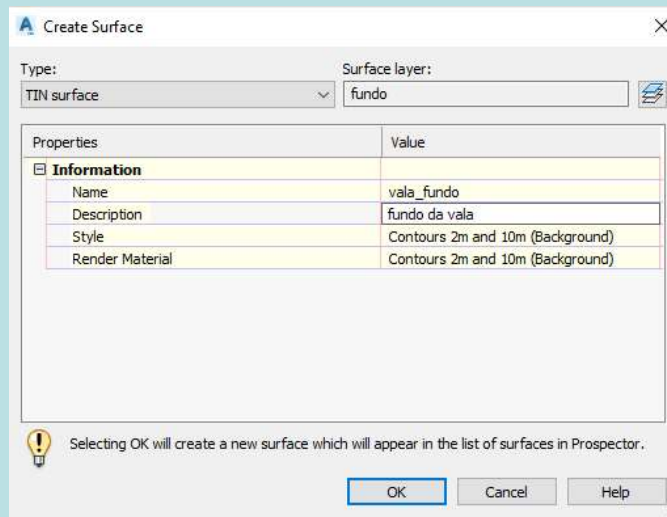
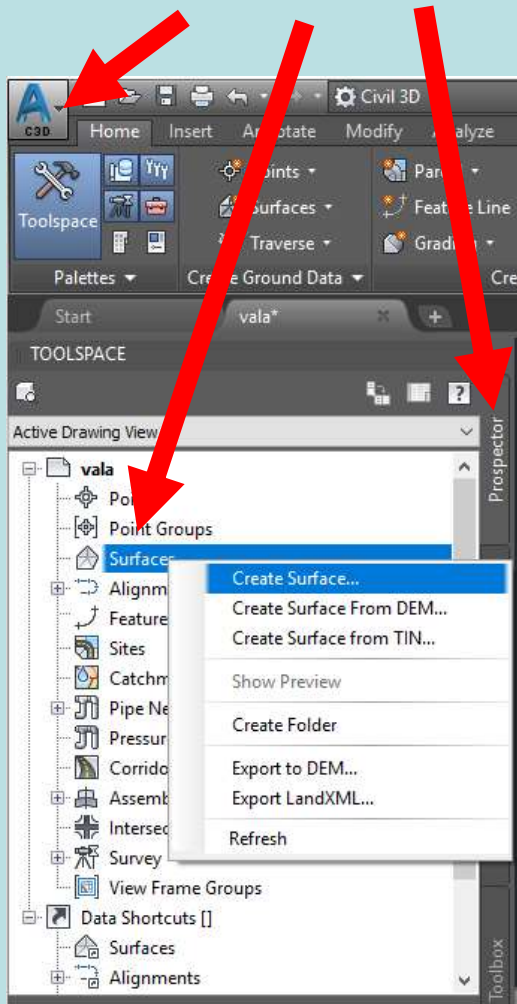
5. Criar os ficheiros de texto com as coordenadas que definem as 2 superfícies, cuja estrutura é **num, M, P, C**:

```
vala_fundo - Notepad
File Edit Format View Help
1,0.0,0.0,0.0
2,0.0,3.0,-1.5
3,0.0,5.0,0.0
4,0.0,7.5,-4.5
5,0.0,10.0,-6.2
6,0.0,11.5,-4.7
7,0.0,13.5,0.0
8,2.5,0.0,-1.2
9,2.5,3.0,-2.9
10,2.5,5.0,-10.6
11,2.5,7.5,-9.7
12,2.5,10.0,-7.9
13,2.5,11.5,-8.4
14,2.5,13.5,-2.5
15,5.0,0.0,-2.5
16,5.0,3.0,-3.7
17,5.0,5.0,-8.7
18,5.0,7.5,-8.7
19,5.0,10.0,-9.4
20,5.0,11.5,-8.4
21,5.0,13.5,-3.6
22,7.5,0.0,0.0
23,7.5,3.0,0.0
24,7.5,5.0,-1.9
25,7.5,7.5,-7.6
26,7.5,10.0,-6.8
27,7.5,11.5,-6.3
28,7.5,13.5,0.0
```

```
vala_tampa - Notepad
File Edit Format View Help
1,0.0,0.0,0.0
2,0.0,13.5,0.0
3,7.5,0.0,0.0
4,7.5,13.5,0.0
```


Posicionamento Geoespacial II

6. Criar as superfícies fundo e tampa:



Posicionamento Geoespacial II

7. Importar os ficheiros de pontos que definem a superfície fundo:

Indicar a localização do ficheiro de coordenadas

Seleccionar a estrutura do ficheiro de coordenadas

Seleccionar esta opção para ser possível manipular os pontos de uma superfície ao mesmo tempo e indicar um nome para esse grupo

Import Points

Selected Files:

File Name	Status
✓ C:\topo_aplic\vala_fundo.txt	Matches selected point file for...

Specify point file format (filtering ON):

- NEZ (comma delimited)
- XYZ_LIDAR Classification (c...
- PENZ (comma delimited)**
- PENZD (comma delimited)

Preview: PENZ (comma delimited) | vala_fundo.txt

Point Number	Easting	Northing	Point Elevator
1	0.0	0.0	0.0
2	0.0	3.0	-1.5
3	0.0	5.0	0.0

Add Points to Point Group.

Point File Formats - Create Group

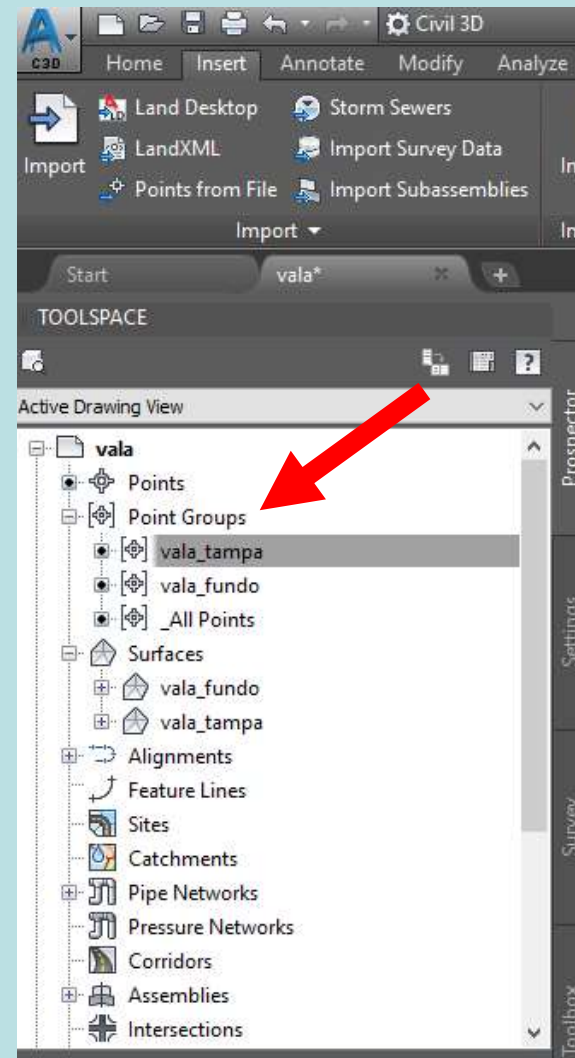
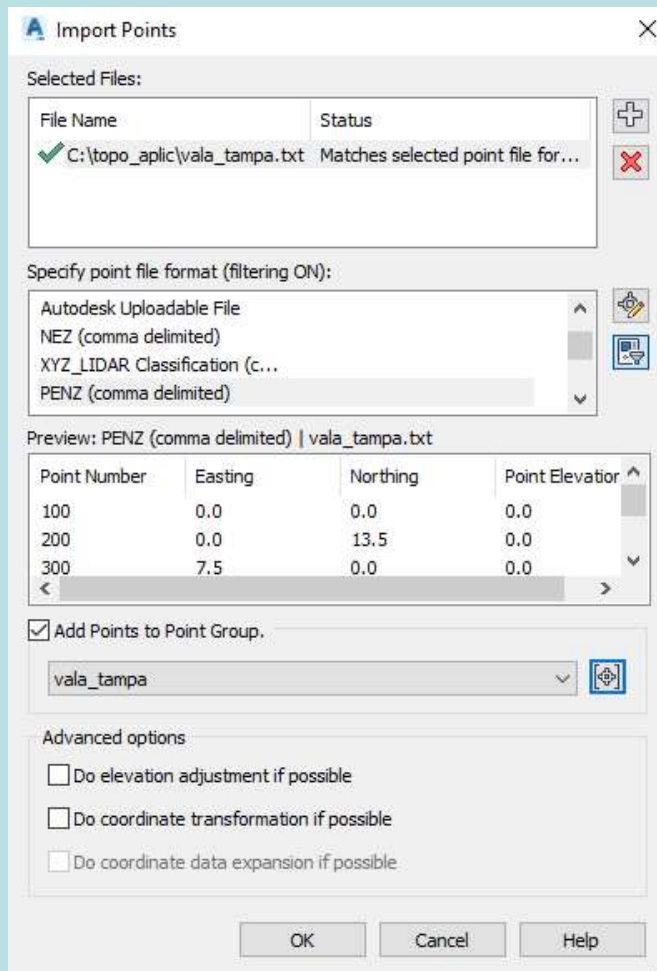
Enter the name of the group to create. If a group already exists by this name, then it will be used.

vala_fundo

OK Cancel Help

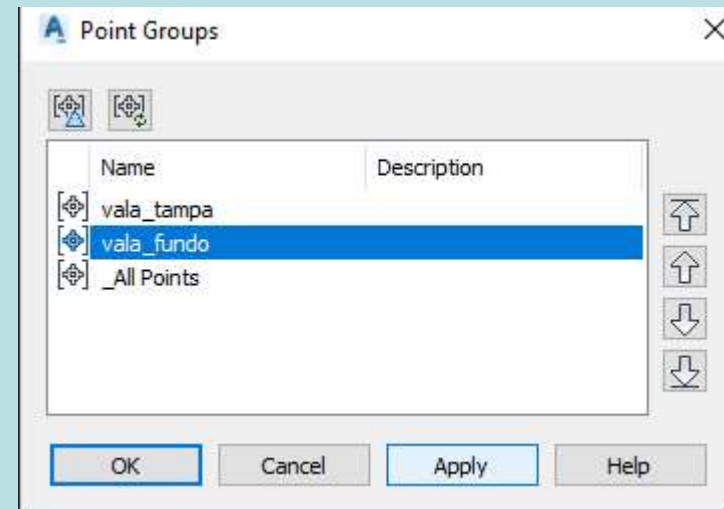
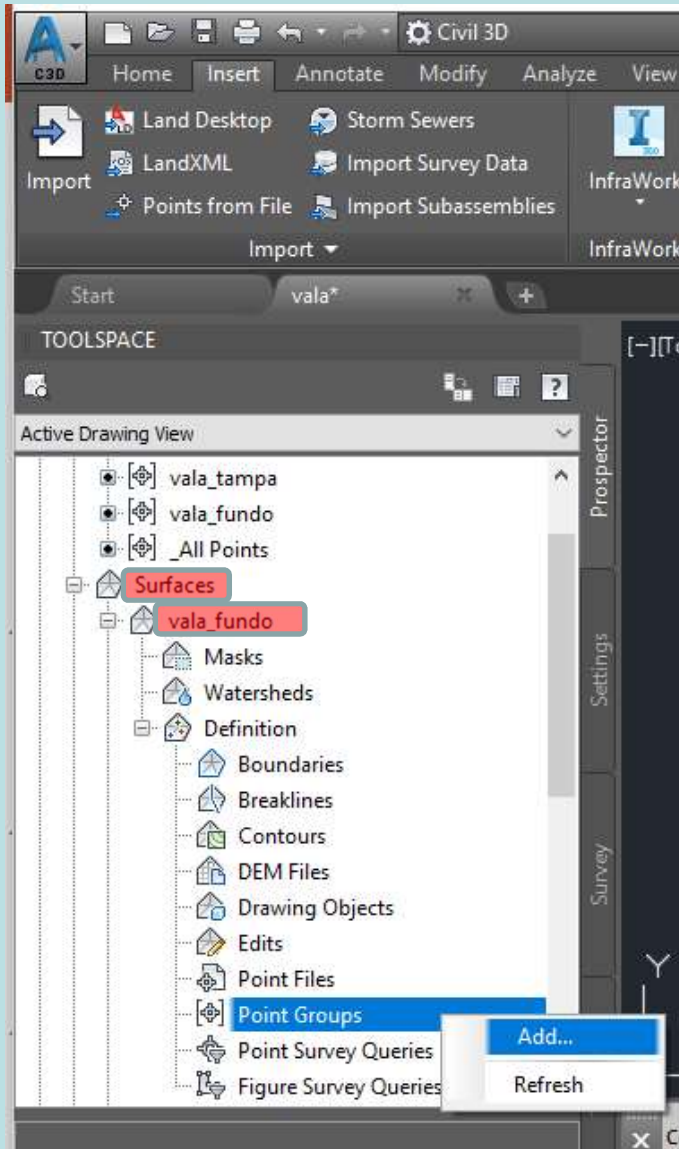
Posicionamento Geoespacial II

Repetir a importação para os pontos que definem a superfície tampa:

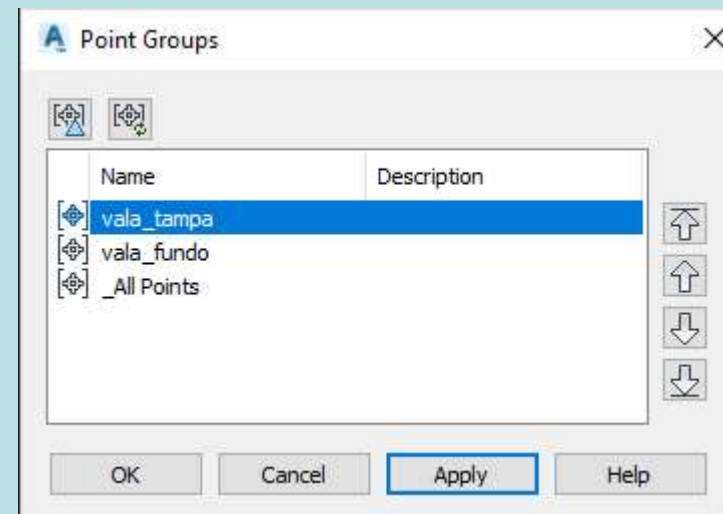
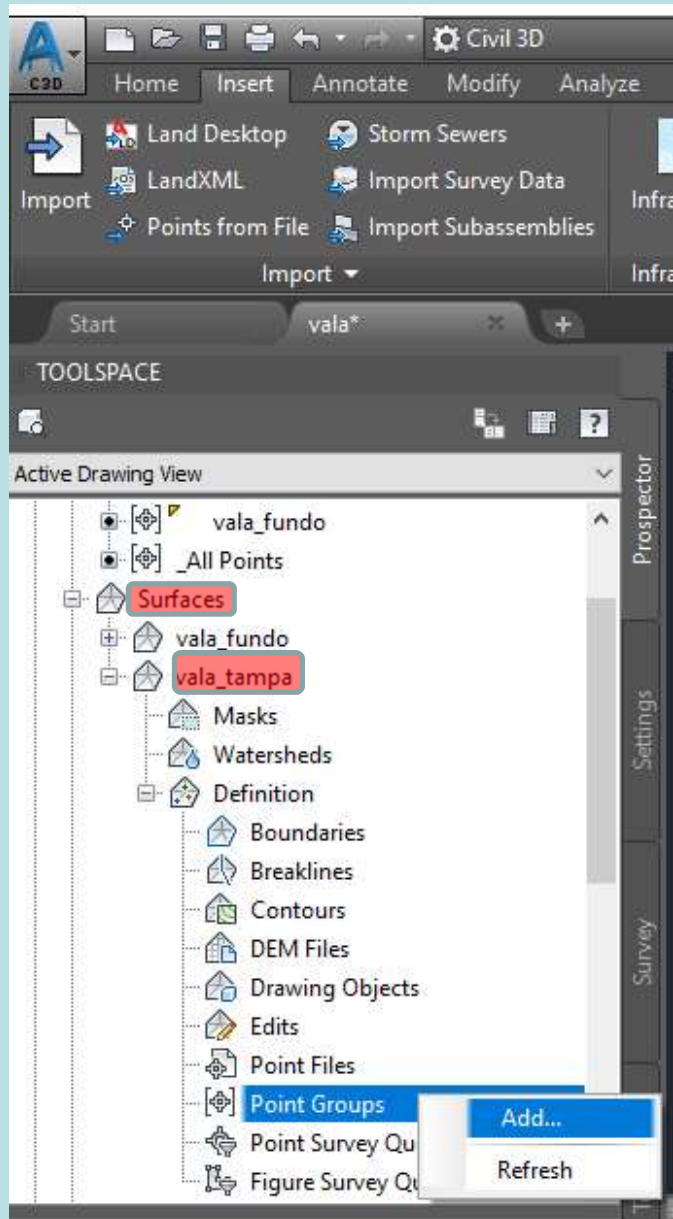


Posicionamento Geoespacial II

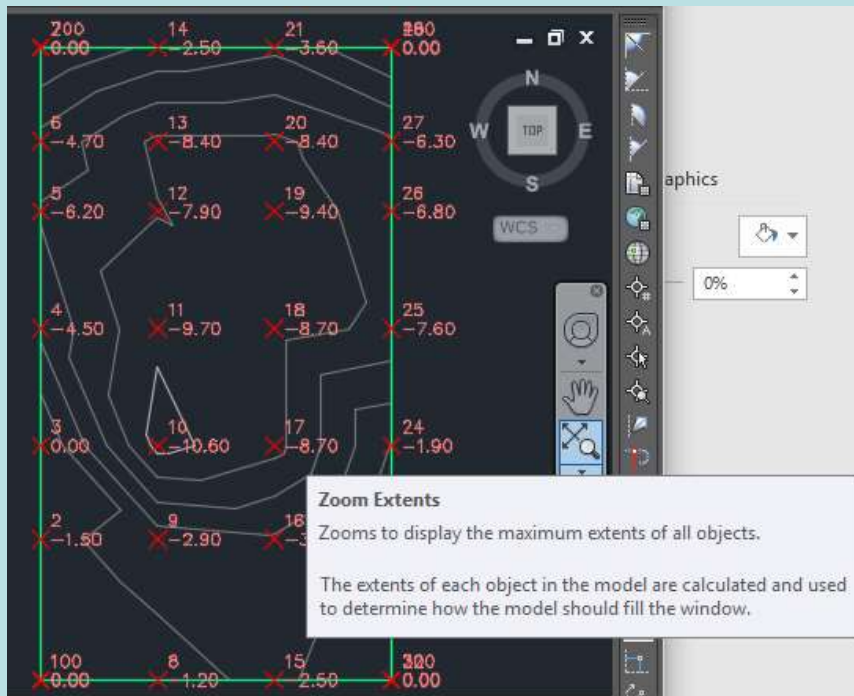
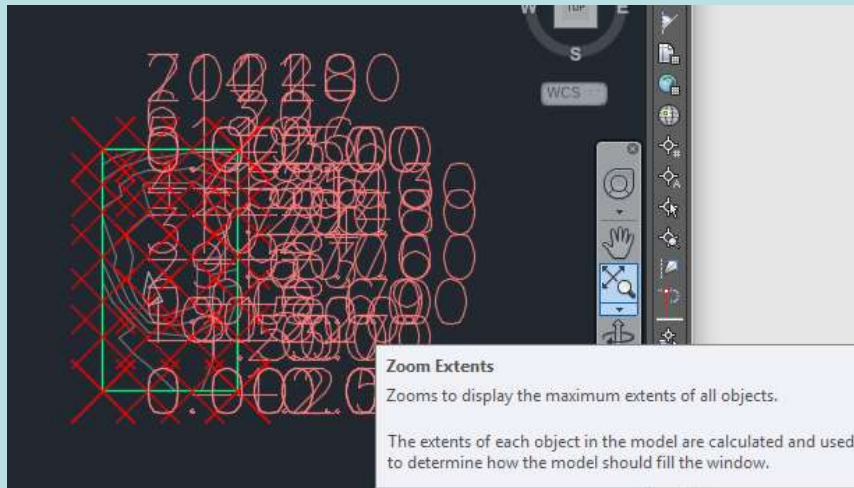
8. Gerar DTM's das 2 superfícies:



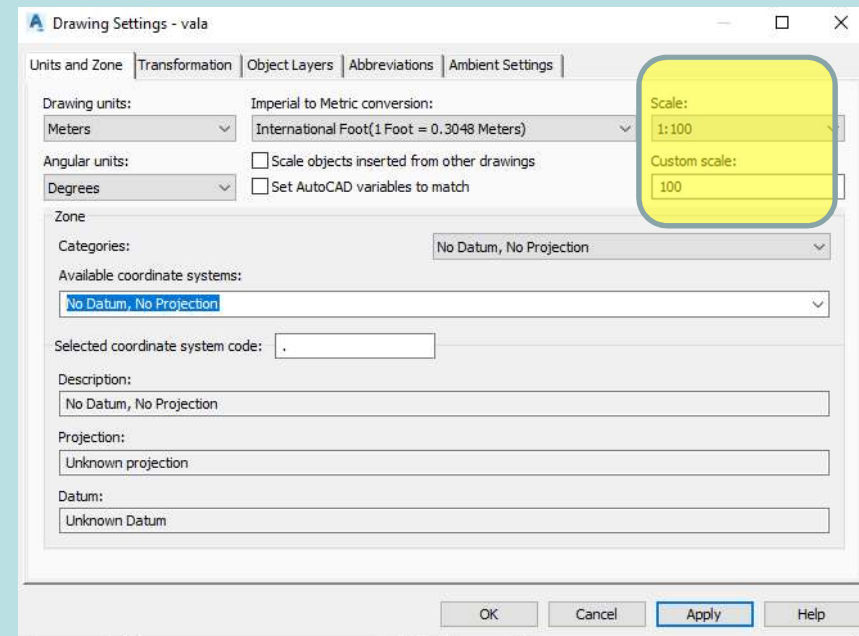
Posicionamento Geoespacial II



Posicionamento Geoespacial II

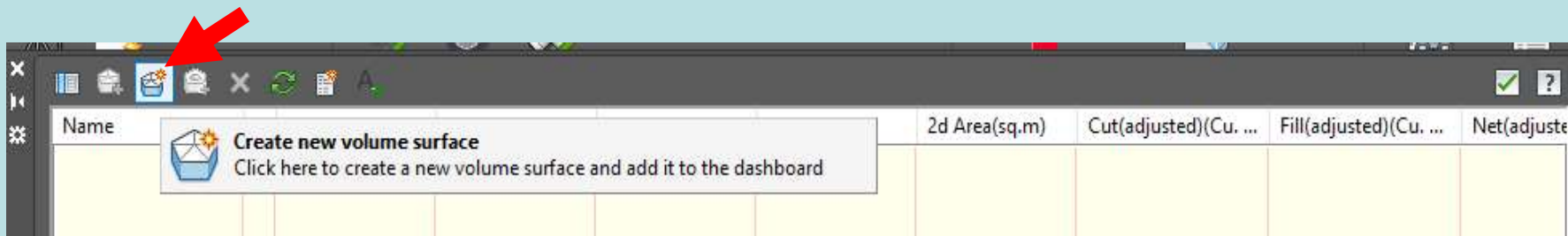
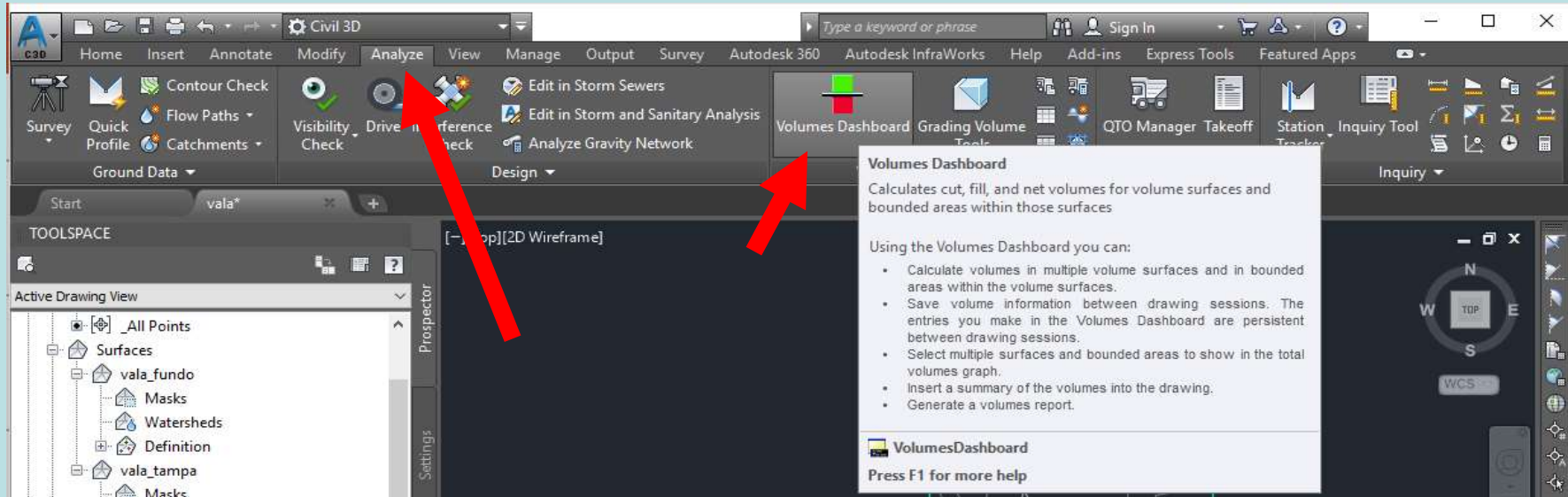


9. Ao fazer Zoom os textos e os pontos aparecem muito grandes: alterar a escala.



Posicionamento Geoespacial II

10. Calcular o volume envolvido na escavação da vala:



Posicionamento Geoespacial II

Create Surface [Close]

Type: TIN volume surface | Surface layer: C-TOPO

Properties	Value
Information	
Name	Surface <[Next Counter (CP)] >
Description	Description
Style	Contours 2m and 10m (Background)
Render Material	Contours 2m and 10m (Background)
Volume surfaces	
Base Surface	vala_tampa
Comparison Surface	vala_fundo
Cut Factor	1.000
Fill Factor	1.000

Selecting OK will create a new surface which will appear in the list of surfaces in Prospector.

OK Cancel Help



Name	B	Mid-Ordinate ...	Cut Factor	Fill Factor	Style	2d Area(sq.m)	Cut(adjusted)(Cu. ...	Fill(adjusted)(Cu. ...	Net(adjusted)(Cu. ...	Net Graph
..... <input checked="" type="checkbox"/> Surface1			1.000	1.000	Contours 2...	101.25	559.15	0.00	559.15<Cut>	