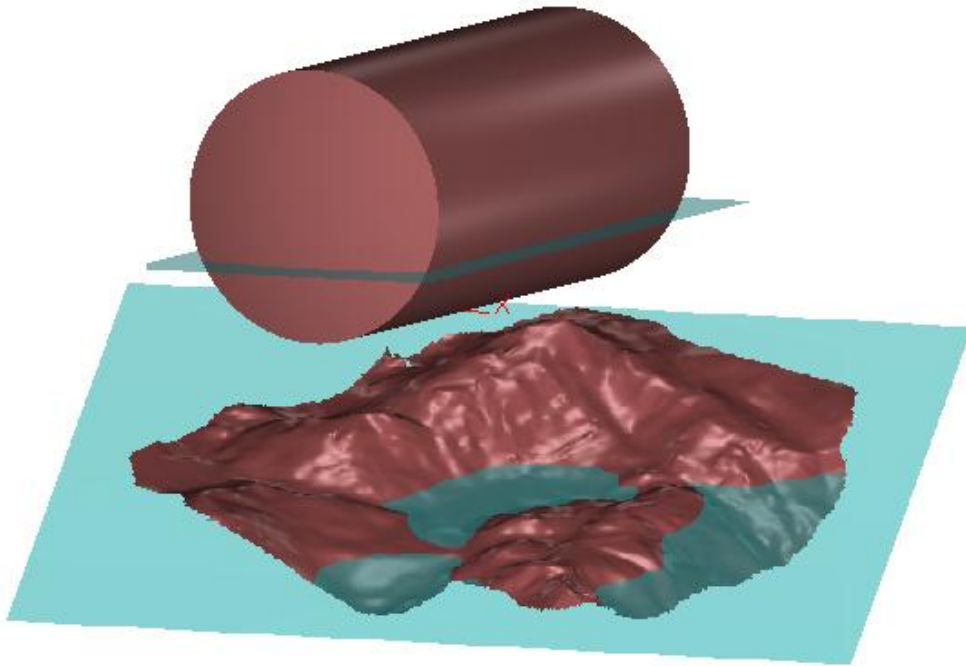# Exercise 6: Computing volumes

Reshaper V7...

In Reshaper you can calculate volumes in different situations:

Volume of a closed surface.

Volume at a certain level of liquid.

Volume between two superimposed surfaces (not illustrated here, but some examples are presented in the standard Reshaper help and (or) tutorial). The two surfaces must not have holes.

In this exercise, we will see how to:

Calculate directly the volume of a closed surface

Calculate the volume at a certain level of liquid.

Evaluate the maximum level of a mountain lake.

Calculate intersections between surfaces.

Make a "constraint meshing".

➢ Open the file: 3DReshaper-Practise/ VolumeCubature / FuelTank.rsh

➢ Display the property sheet

The surface of this tank is completely closed
>*Select the object.*
>*Right click to open the contextual menu.*
>*Take the command "property"*
>*You should see a volume of 4m³.*

Note: in the case of surface with holes or free borders, the volume is not computed.

Note: in Reshaper, there is no explicit unit. Here the unit is the meter because the scan data used to make the model was in meter. This is the reason why the result is 4m³.
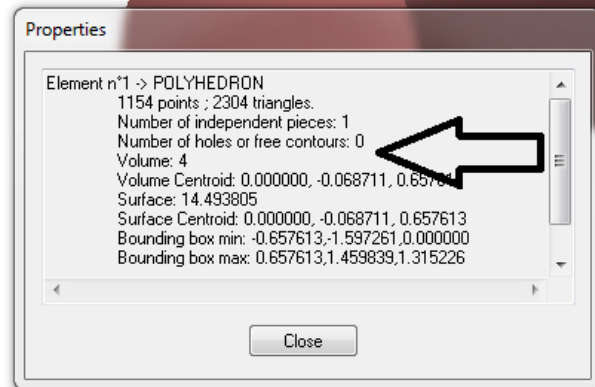
Figure 1: When a surface contains no hole or free contour, the volume is automatically calculated in the property sheet.

➢ Compute the level at a certain height of liquid

>*Select the object.*
>*Launch the command "**Measure** -> **Volume / Cubature**"*
>*Reshaper automatically calculates a horizontal plane in the middle of the object, which represents the level of liquid.*
>*Enter a level of liquid of 0.5.*
>*Press OK*

Reshaper creates two spheres on each side of the liquid level and tells you:
>*The value and where is the biggest volume.*
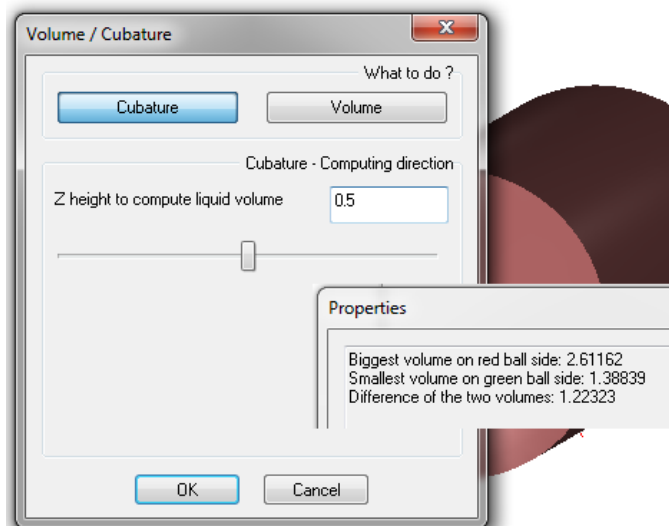>*The value and where is the smallest volume.*

Figure 2: At a liquid level of 0.5m, the volume is 1.38m³ and the volume left free over the liquid level is 2.61m³

>*Note that you can create a local coordinate system if you want to change the direction axis of the 3D model.*

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➢ Open the file: Reshaper-Practise/ VolumeCubature / MountainLake.rsh

➢ Determining the maximum water height

The model represents a mountain landscape and the goal is to evaluate the maximum capacity of a mountain lake.

Select the object.

*Launch the command "**Measure -> Volume / Cubature**".*

Adjust the water height to find the maximum water height. For this, you must zoom on the white arrow zone to verify that there is no junction here between the inside and the outside of the lake.

You can also adjust manually the height and normally you should have 2339.6m
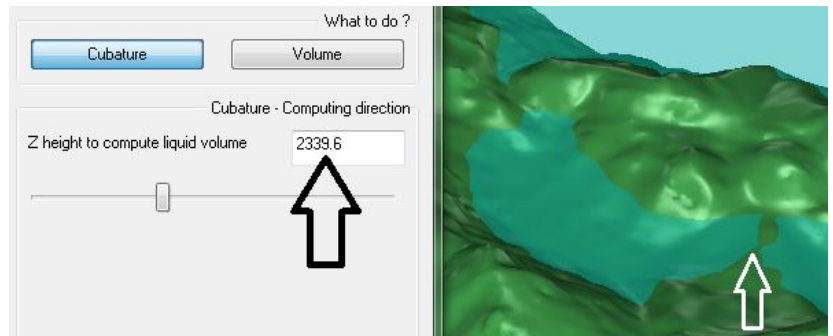
Press OK

Figure 3: Adjusting the water level to find the maximum capacity of the mountain lake.

The result of the volume calculation, here, is not meaningful because it represents the sum of the volumes inside AND outside the lake. Here we need only the volume inside.

➢ Computing the contour of the lake

Select both the mountain surface and the water level and "right click" to show only these two objects.

*Launch the command "**Create -> Intersection**" and click on the two surfaces to compute the intersection between the selected entities.*

You should see that the intersection contours are calculated.

Click "OK exit" to keep the result.

*Select the water level and right click to "**hide**" this water level object.*

*Note that when selecting the 2 entities, you can also use the command "**Polyligne -> Intersect 2 meshes**".*

Figure 4: Using the command intersection to calculate the contour of the lake

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➢ Separate the lake surface from the rest of the mountain

Select both the mountain surface and the contours.
*Launch the command "**Mesh -> Constraint meshing**".*
Put the options as on the right picture.
Click "OK" to calculate the result.
At the end the aspect on the screen should not change, but if you click on the lake you should see that it is now a separate entity.
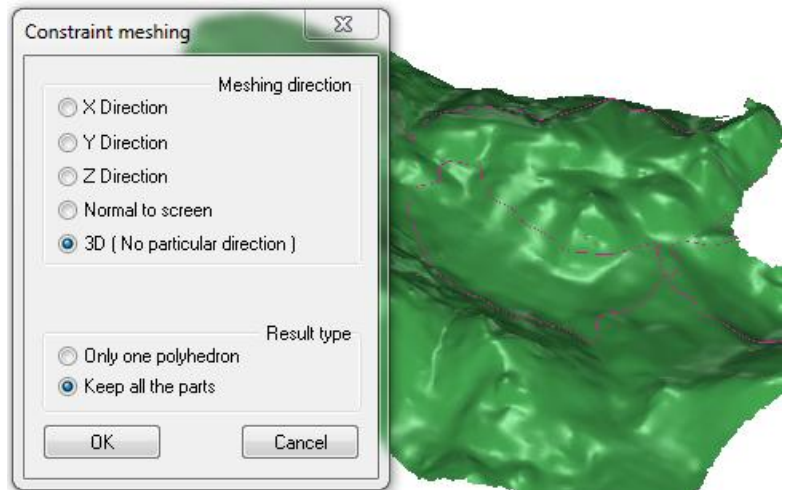
Figure 5: Using the command intersection to calculate the contour of the lake

➢ Calculate the volume of the lake

*Click on the lake and right click to "**show only**" this object.*
*Launch the command "**Measure -> Volume / Cubature**".*
Adjust the water height to be at the maximum water height.
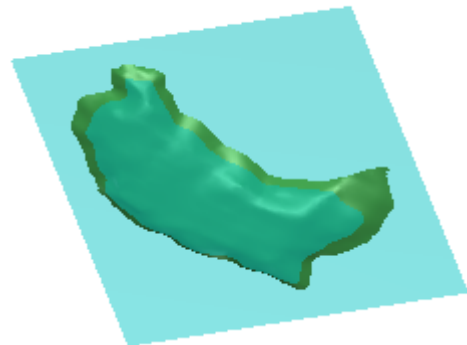*Click OK.*
You should obtain a volume of 5.66 millions of m^3.

Figure 6: Computing the volume of the lake: 5.66 million m^3.