LNAPL Volume and Extent Model Example

Example Description

Site Description

An extensive LNAPL body consisting mainly of diesel fuel exists in the subsurface. We would like to know the total volume of LNAPL and where we should place LNAPL recovery wells to begin removing LNAPL from the subsurface.

We have collected water level and LNAPL thickness data at 610 locations. We enters the **depth to the top and bottom of the LNAPL** into the location information template, along with the **X and Y coordinates** of each location, the **local LNAPL gradient**, and the **date of measurement**.

At each location, the soil lithology has been defined by the boring logs. We enter **soil lithology** data into the templates for each location.

We also check the **properties for each soil type** found in the borings in the template for soil properties. The soil types needs are listed and the properties are correct.

We enter the following fluid properties on the main tool page:
- water density = **1 g/cm³**
- LNAPL density = **0.8 g/cm³**
- LNAPL viscosity = **2 cp**
- Air/water interfacial tension = **65 dyn/cm**
- Oil/water interfacial tension = **15 dyn/cm**
- Air/oil interfacial tension = **25 dyn/cm**
- "f" factor for residual LNAPL saturation = **0.2**

Inputs and Outputs in Toolbox

Output and Interpretation

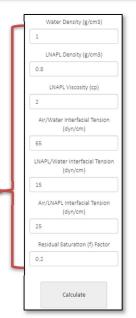|	A	B	C	D	E	F	G
1	Monitoring Well	Date	Latitude	Longitude	LNAPL Top Depth Below Ground Surface (m)	LNAPL Bottom Depth Below Ground Surface (m)	LNAPL Gradient (m/m)
2	TF-01	2009-06-25	53.4792235	-31.6370004	6.03	6.03	0.0086
3	TF-02	2009-06-25	53.4787581	-31.6367291	6.46	6.46	0.0086
4	TF-03	2009-06-25	53.4788652	-31.6367142	6.44	6.45	0.0086

	A	B	C	D
1	Monitoring Well	Layer Top Depth Below Ground Surface (m)	Layer Bottom Depth Below Ground Surface (m)	Soil Type
2	TF-01	2.44	3.66	Clay
3	TF-01	3.66	6.40	Silt
4	TF-01	6.40	7.01	Loamy sand
5	TF-01	7.01	8.54	Silt loam
6	TF-01	8.54	10.98	Silty clay
7	TF-01	10.98	12.80	Sand
8	TF-01	12.80	13.11	Clay
9	TF-02	2.44	3.05	Clay
10	TF-02	3.05	4.27	Silt

	A	B	C	D	E	F	G	H
1		Soil types 1 through 12 from Carsel and Parrish (1988)				van Genuchten Parameters		
2	Soil Num	Soil_Type	Porosity	Ks (m/d)	Theta_wr	N	alpha (1/m)	M
3	1	Clay	0.38	0.048	0.068	1.09	0.8	0.08
4	2	Clay loam	0.41	0.062	0.095	1.31	1.9	0.24
5	3	Loam	0.43	0.25	0.078	1.56	3.6	0.36
6	4	Loamy sand	0.41	3.5	0.057	2.28	12.4	0.56
7	5	Silt	0.46	0.06	0.034	1.37	1.6	0.27
8	6	Silt loam	0.45	0.11	0.067	1.41	2	0.29
9	7	Silty clay	0.36	0.0048	0.07	1.09	0.5	0.08
10	8	Silty clay loam	0.43	0.017	0.089	1.23	1	0.19
11	9	Sand	0.43	7.1	0.045	2.68	14.5	0.63
12	10	Sandy clay	0.38	0.029	0.1	1.23	2.7	0.19
13	11	Sandy clay loam	0.39	0.31	0.1	1.48	5.9	0.32
14	12	Sandy loam	0.41	1.1	0.065	1.89	7.5	0.47
15	*Add additional rows as needed.*							

Water Density (g/cm3)

1

LNAPL Density (g/cm3)

0.8

LNAPL Viscosity (cp)

2

Air/Water Interfacial Tension (dyn/cm)

65

LNAPL/Water Interfacial Tension (dyn/cm)

15

Air/LNAPL Interfacial Tension (dyn/cm)

25

Residual Saturation (f) Factor

0.2

Calculate

After clicking "Calculate" the Tool shows a map that can display each of the following the following data at each individual location:

- LNAPL specific volume;
- LNAPL mobile specific volume;
- Average LNAPL relative permeability;
- Maximum elevation of free LNAPL;
- LNAPL hydraulic conductivity;
- LNAPL transmissivity;
- LNAPL flux per unit width of formation; and
- LNAPL average seepage velocity.

To determine where to place LNAPL recovery wells, we use the tool to display LNAPL mobile specific volume at each location.

Together with a plot of LNAPL transmissivity at each location, we determine where LNAPL recovery efforts will be most successful.

We then view the interpolation to determine the area-weighted that the **LNAPL specific volume** is **749,290 L** and **recoverable specific LNAPL volume** is **599,432 L**.