

Infinite Horizontal Extent Aquifer Assumption

Problem Statement

One of the major assumptions of the Theis solution is an aquifer of infinite horizontal extent. To evaluate the ramifications of this assumption, simulate the radial extent of the cone of depression at 10 days, 100 days, 1000 days and 10,000 days for a Q of $400 \text{ m}^3/\text{d}$, $T = 400 \text{ m}^2/\text{d}$, $S = 0.0001$.

Infinite Horizontal Extent Aquifer

Constants: $Q = 400 \text{ m}^3/\text{d}$
 $T = 400 \text{ m}^2/\text{d}$
 $S = 0.0001$

Drawdown near well Radial extent of capture zone

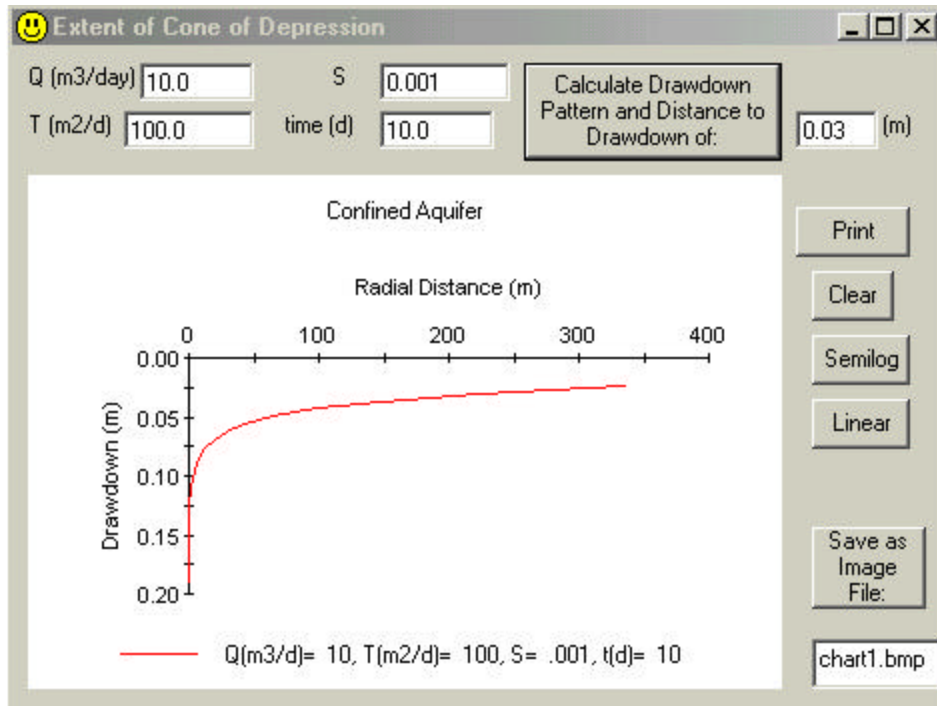
Time (d)	s (m) at 0.1 m	r (m) when s < 0.03 m
10		
100		
1000		
10000		

What happens to the cone of depression with time? In reality, do you believe the cone of depression extends out infinitely? What could cause the radial spread of the cone of depression to stop?

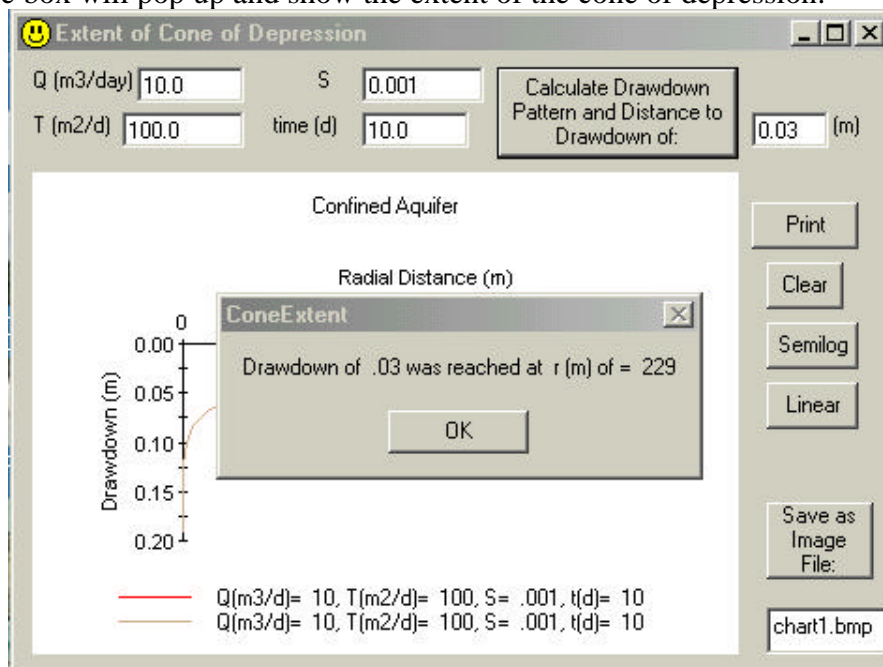
Solution

Use example spreadsheet in Theis.xls

Or use a Visual Basic calculator provided for easy assessment of the extent of the cone of depression. ConeExtent can be used by the instructor or provided to students for quick assessment and plots of cones of depression:



A message box will pop up and show the extent of the cone of depression:



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Constants: $Q = 400 \text{ m}^3/\text{d}$
 $T = 400 \text{ m}^2/\text{d}$
 $S = 0.0001$

Time (d)	Drawdown near well		Radial extent of capture zone
	s (m) at 0.1 m		r (m) when s < 0.03 m
10	1.8		10,550
100	2		33,361
1000	2.2		105,494
10000	2.4		333,605

What happens to the cone of depression with time?

Spreads out farther with time

In reality, do you believe the cone of depression extends out infinitely?

No

What could cause the radial spread of the cone of depression to stop?

This solution assumes only source of water is from aquifer storage. If another source of water (surface recharge, recharge boundary, etc.) is captured by the well and the recharge provides enough water to supply the pumping rate, the spread of the cone of depression will stop. Impermeable boundaries will also stop the spread of the cone of depression but only in the area of that boundary.