1. From Lecture 4, pg 4, solubility of mixture is:

$$C_w = X_t C_w^o$$

where C_w = solubility of compound in contact with mixture

C_w^o = solubility in contact with pure product

X_t = mole fraction of compound in mixture

Calculation of mole fraction - assume 1 Kg of mixture

	M.W.	mass	moles	mole fraction
TCE	131.5	.4	3.04	0.40
TCA	133.4	.6	4.50	0.60
total		1	7.54	
	gm/mole	Kg	mol	

Calculation of C_w

	C_w^o	X_t	C_w
TCE	1100	0.4	440 mg/L
TCA	1500	0.6	900 mg/L

2. Problem statement indicates generally north to south flow. This plus elevations used to draw map (attached)

$$i = \frac{\Delta h}{\Delta L} = \frac{97.7 - 86.7}{2000\ m} \quad \text{(MW-2 to lake)}$$

$$= 0.0055$$

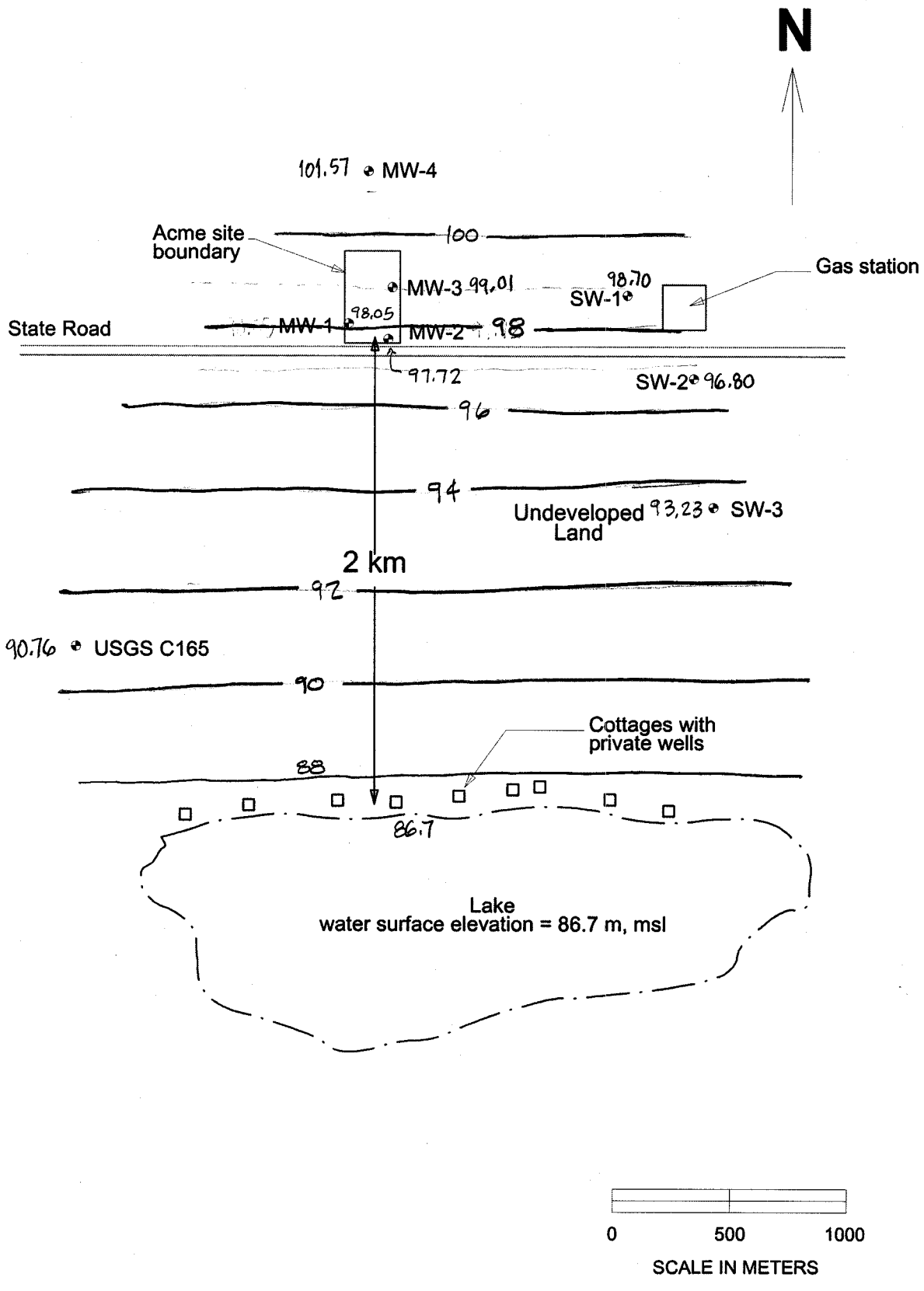


Figure 1
Acme site vicinity map

3. From Lecture 8 = $W = \frac{Q_w}{T_i}$

$T = KB$ $\quad K = 1.6 \times 10^{-2}$ cm/s $= 14$ m/d (average of slug tests)

B = aquifer thickness
≈ 3 meters

(based on 2 meters to water table (top of aquifer) and 5 meters to clay (bottom of aquifer)

$$T = 14 \frac{m}{d} \cdot 3\ m = 42 \frac{m^2}{d}$$

Desired $W = 200$ m (width of site)

$$200\ m = \frac{Q_w}{42 \frac{m^2}{d} \cdot 0.0055}$$

$$\longrightarrow \quad Q_w = 46\ m^3/d$$

4. See spreadsheet solution for capture zone

$$x_s = \frac{Q_w}{2\pi T i} = 31\ m$$

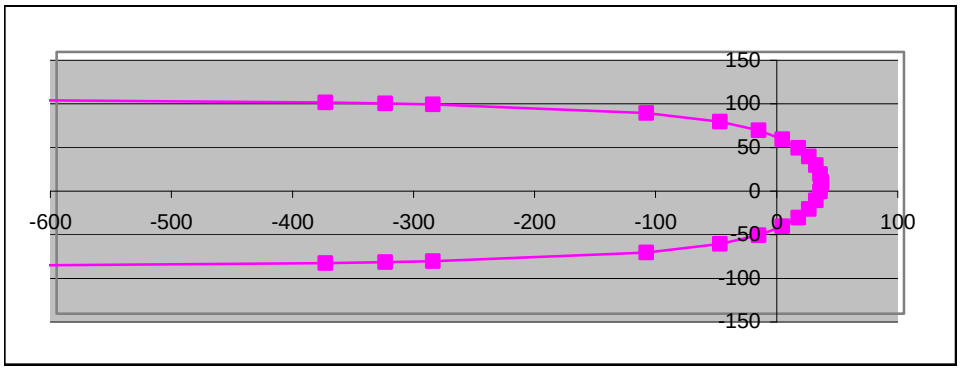
Solve for x given y

x = y / tan (2*pi*T*i*y/Qw)

Hydraulic gradient, i	0.0055	
Transmissivity, T	42	m^2/d
Pumping rate, Q_w	46	m^3/d

Stagnation point, x_s 31.69319

x	y
-5532.17	-99
-1980.35	-98
-654.679	-95
-377.973	-92
-328.406	-91
-289.034	-90
-112.68	-80
-51.8878	-70
-20.0403	-60
-0.34148	-50
12.7556	-40
21.60901	-30
27.37009	-20
30.63439	-10
31.68267	-1
31.69319	-0.001
31.69319	0.001
31.68267	1
30.63439	10
27.37009	20
21.60901	30
12.7556	40
-0.34148	50
-20.0403	60
-51.8878	70
-112.68	80
-289.034	90
-328.406	91
-377.973	92
-654.679	95
-1980.35	98
-5532.17	99



5. $\frac{s}{Q} = \frac{1500}{T}$

$T = 42 \frac{m^2}{d} = 452 \frac{ft^2}{d} \times 7.5 \frac{gal}{ft^3} = 3,400 \frac{gpd}{ft}$

$Q = 46 \frac{m^3}{d} = 1600 \frac{ft^3}{d} = 12,100 \frac{gal}{d} = 8.4 \text{ gpm}$

$s = \frac{1500\ Q}{T} = 3.7 \text{ ft} = 1.1 \text{ m}$

3 meters are available for drawdown so one well should be OK. It is a bit marginal and field tests will be needed to confirm the rough estimate.

6. Don't drill through DNAPL!

If you must, double-case wells and be extraordinarily careful