

## Physical Hydrogeology

### Problem Set 4

Due: 4/30/09

1. Two electrical measurements were taken with a Wenner electrode array: (1) at an electrode spacing of 1 meter the voltage drop is 215 volts and (2) at an electrode spacing of 10 meters the voltage drop is 23 volts. In both cases, the current is 1 ampere.
- What is the apparent resistivity at each electrode spacing?
  - What can you infer about the geology of the region?

2. A seismic line was run with the following first-arrival time results:

Distance (m)	Time (ms)
10	13.4
20	26.7
30	40.1
40	53.4
50	66.7
60	80.1
70	88.3
80	95.2
90	102.1
100	109.0
110	115.9
120	122.8

Determine the velocities,  $V_1$  and  $V_2$ , the critical angle,  $i_c$ , and the depth to the interface,  $Z$ . How long would it take for a reflected wave to reach the geophone at 120 m from the source?

3. A capture well is pumping at a rate of  $2500 \text{ m}^3/\text{day}$  from a confined aquifer with a hydraulic conductivity of  $1375 \text{ m/day}$ , an initial hydraulic gradient of  $0.001$ , and a saturated thickness of  $25 \text{ m}$ .
- What is the maximum width of the capture zone?
  - What is the distance from the well to the stagnation point?
4. A coastal aquifer has a mean hydraulic conductivity of  $1.2 \text{ m/day}$ . The density of fresh water is  $1.000 \text{ g/cm}^3$  and the density of underlying saline water is  $1.025 \text{ g/cm}^3$ . The ground-water discharge per unit of the coastline is  $0.0035 \text{ m}^3/\text{day}$ .
- What is the depth to the salt-water interface at a point  $100 \text{ m}$  inland?
  - What is the elevation of the water table above mean sea level at a point  $100 \text{ m}$  inland?
  - What is the depth to the salt-water interface at the shoreline?
  - What is the width of the outflow face?
5. A landfill is leaking an effluent with a concentration of sodium of  $1250 \text{ mg/L}$ . It seeps into an aquifer with a hydraulic conductivity of  $7 \text{ m/day}$ , a gradient of  $0.003$ , and an effective porosity of  $0.2$ . A down-gradient monitoring well is located at  $30 \text{ m}$  from the landfill. What would the sodium concentration be in this monitoring well  $350$  days after the leak begins? Note: In this problem you will need to find  $\text{erfc}(-x)$ , which is equal to  $1 + \text{erf}(x)$ . See Appendix in Fetter.