

**School of Natural and Built Environments**

Semester 1, 2005

**Water Quality Processes (CIVE 4026)**

**General instructions to candidates**

**Total time allowed is 3 hours + 10 minutes reading time**

**Open Book exam**

**Use separate answer books for section 1 and 2**

**Calculator required (no programmable calculators)**

**Please ensure front of all answer books are completed with your name and student I.D.**

**Attempt only four questions. Students are not allowed to select more than two questions from each section.**

**Question 1**

- (a) Starting with a mention of John Snow's pioneering epidemiological study of the cholera epidemic in 1850's London, discuss the topic:

Water, Microbiology and Public Health.

Indicate within this discussion the current concerns of the drinking water industry in Australia.

Comment also on the history of development projects in other countries focussed on the provision of safe drinking water. Suggest how the performance of projects can be improved.

[10 marks]

- (b) How important is the water treatment regime in the above content?

[5 marks]

- (c) How important is the water distribution system? (List three dot points)

[3 marks]

- (d) How important is on-going research?

[2 marks]

**Question 2**

- (a) Drinking water utilities throughout Australia are focussing a great deal of attention at present on the problem of a decline in our surface and groundwater supplies.

What alternative sources are available to us?

How successful have we been at making use of them?

Are there are dangers to be confronted?

What efforts are being made to conserve our supplies?

[Give specific examples where you can.]

[10 marks]

(b) List five characteristics of a 'healthy' stormwater wetland. [Dot points]

[5 marks]

(c) Contamination of groundwater reserves is a serious problem particularly in the current challenging times.

Discuss the remediation strategies available and if possible, give some indication of their relative expense.

[5 marks]

### Question 3

(a) Compare the extent of stormwater run-off from a variety of surfaces beginning with the situation of good ground cover (forested) to highly impervious surfaces (heavily urbanised). You probably have this information in the form of a series of diagrams. Constructing a simple table would be sufficient here.

[5 marks]

What moves are being made to redress this situation in more recent planning?

[2 marks]

Likewise, compare the levels of suspended solids, total nitrogen, total phosphorus and lead respectively in run-off from forested, through rural to urban catchments.

How are the suspended solids likely to differ between the rural and urban situations?

[5 marks]

What contaminants in urban stormwater are likely to be difficult to remove by conventional drinking water treatment procedures?

What is their most common source?

[2 marks]

(b) How major a threat to Australia's waterways and reservoirs is posed by blue green algae?

What issues are there for recreational exposure?

[5 marks]

(c) How are algal toxins best removed in drinking water treatment?

[1 mark]

## Section 2

### Question 4

- a) Describe water pollutants considering their sources, types, forms, characteristics and examples. [12 marks]
- b) Draw the diagram and explain natural water purification cycle. [8 marks]

### Question 5

- a) Discuss processes of water treatment for drinking water supply. [8 marks]
- b) Explain the purpose of each process. [12 marks]

### Question 6

- a) Define “plug flow” and “complete mixed flow” systems. [4 marks]
- b) Calculate the detention times considering the rate coefficient of K being 80 per day and it is aimed to achieve 80 % reduction of suspended matter of 180 mg/L in:
- b 1) a plug flow reactor. [8 marks]
- b 2) a complete mixed flow reactor. [8 marks]