

## CIVE 716 EROSION AND SEDIMENTATION

Pierre Y. Julien

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### Assignment #1 Chapters 1, 2, and 3 due September 9, 2009

#### Problem # 1 (30%)

**1a.** Consider a 100 m high cylindrical container with a 30 cm diameter. The volumetric sediment concentration of sand is 30%. If the sand is maintained in uniform suspension through constant mixing, determine the following properties of the mixture in SI units: sediment concentration in mg/l and in ppm, the specific mass and specific weight of the mixture. [*Hint: also read Section 10.1*]

**1b.** Stop mixing and wait until all the sediment settles at a dry specific weight of 93lb per cubic feet, determine the following properties of the deposit in English units: height of the deposit, dry specific mass, void ratio, and porosity.

**1c.** The water temperature of a reservoir varies with depth from about 7°C near the bottom to 18°C near the surface. What concentration of very fine sediment in mg/l should be added to the warm water to equal the specific weight of cold water?

#### Problem # 2 (15%)

Starting from equations 3.1abc, derive equations 3.8a and 3.9a.

(*Hint: reduce 3.8 to 3.1 first*)

#### Problem # 3 (25%)

**3a.** With reference to Example 3.3 on p.35, determine the buoyancy force on a box that is 1 m long, 50 cm wide and 25 cm high: a) integrate the pressure distribution on all surfaces; and b) use the divergence theorem. (Hint: the object can be rotated in space to ease the calculations).

**3b.** A neutrally buoyant 100 lb fish is pulled vertically up. Determine the force in the cable when the submerged fish is first at rest, then pulled at an acceleration of  $g$ .

**3c.** Repeat problem 5b when the fish is out of the water. Present a summary table. Which condition requires the maximum force and why?

#### Problem #4 (30%)

A mud volcano in Indonesia shown on the figure. The incoming flow rate is about  $1 \text{ m}^3/\text{s}$  and the volumetric sediment concentration is 30%. If the detention area traps 90% of the incoming sediment, define an equation describing sediment continuity. Describe the change in bed elevation in the detention pond as a function of time. Define the dimensions of the detention pond required to contain the incoming sediment over the coming years. Outline a plan describing how to cope with this accumulation of sediment over the next 20 years.

