Question 1

A hydroelectric reservoir will extend over an old buried channel flanked on both sides by competent impervious till. A dam must be constructed at the location shown on Figure 1 to impound the reservoir on the down stream end of the old channel to an elevation of 115m. The old channel deposits of sand and gravel, approximately 6m in thickness, tapers out at about 2000m upstream of the dam and at about 1000m downstream of the dam due to changes in the bedrock elevation.

If the length of the base of the dam is 100m:

a) Determine the amount of leakage that will occur from the reservoir and the under seepage pressures.

b) Estimate the factor of safety against the till layer on the down stream side of the dam heaving. If the factor of safety is not adequate make recommendations to improve the factor of safety.
Question 2

a) Determine the amount of seepage occurring under the dam foundation assuming the thickness of pervious foundation is 4, 8, 12, 16 and 20 feet and the hydraulic conductivity is from $1 \times 10^{-4}$, $1 \times 10^{-5}$, $1 \times 10^{-6}$, $1 \times 10^{-7}$, and $1 \times 10^{-8}$ ft/min.

b) If the hydraulic conductivity of the earth dam is $1 \times 10^{-4}$ ft/min determine how much seepage will occur through the dam?
Question 3

a) Determine the phreatic surface and the quantity of seepage through a homogeneous earth dyke with a hydraulic conductivity of $1 \times 10^{-6}$ cm/s using Dupuit’s and Pavolosky’s numerical methods. Compare these results to the phreatic surface determined using the program placed on the course website. Which method would you recommend?

b) If a horizontal drain is installed $\frac{H}{3}$ from the downstream toe determine the location of the phreatic surface and quantity of flow thru the dam.
Question 4

Below is an actual dam that failed after filling of the reservoir. Can you determine the most probable reasons why the failure occurred? Justify your answer and indicate what steps should have been done to prevent failure from occurring. The clay was compacted in 150mm thick lifts.