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For each problem, show the details of your calculations (equations, units etc.).

Problem 1

The data show below were obtained during an unconfined compression test conducted on a stabilized petroleum sludge. Plot the stress-strain relationship and determine the unconfined compressive strength.

Load, kg	Axial deflection, cm
0	0
508	0.028
893	0.056
1364	0.086
1896	0.114
2488	0.142
3098	0.17
3632	0.2
3991	0.229
4191	0.257
4332	0.287
3597	0.315
Original sample length = 15 cm Original sample diameter = 7.1 cm	

Problem 2

A lagoon 100 m by 50 m by 3 m deep is found to contain a PCB- and metal-contaminated sludge at a 10% solids content by volume. Sludge dewatering can be used to increase the volumetric solids content to 40% at a cost of $34 per cubic meter of sludge processed. Stabilization of the sludge costs $110 per metric ton of sludge treated. Leachate can be treated at a cost of $20 per cubic meter. By calculating the volume of sludge and leachate generated by dewatering, compare the cost of two alternatives:

stabilization of the entire sludge or dewatering and leachate treatment with stabilization of the dewatered sludge. Comment on the overall environmental effectiveness of the two approaches.

Problem 3

Calculate the hydraulic conductivity of a test sample described as follows: sample length of 7.1 cm, sample diameter of 7.1 cm, σ_{top} of 350 kPa, σ_{bottom} of 400 kPa, σ_{cell} of 500 kPa, and total flow of 3 cm^3 after 6 hours.

Problem 4

For a site 100 m x 50 m x 3 m deep, calculate the cost for in situ vitrification assuming $375/metric ton of soil treated. Assume the site consists of sandy soils having a total density of 1.9 g/cm^3 at a porosity of 0.4. Also, calculate the expected surface settlement.

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