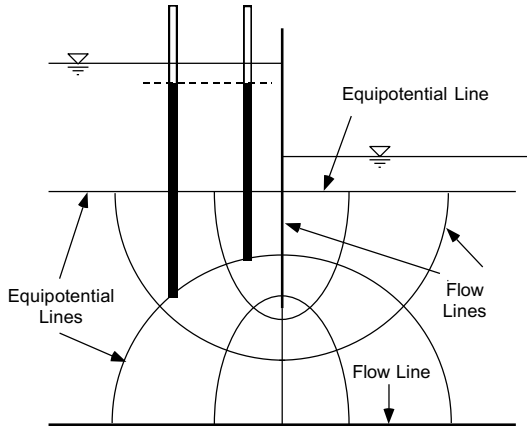
CE EN 544 – BRIGHAM YOUNG UNIVERSITY

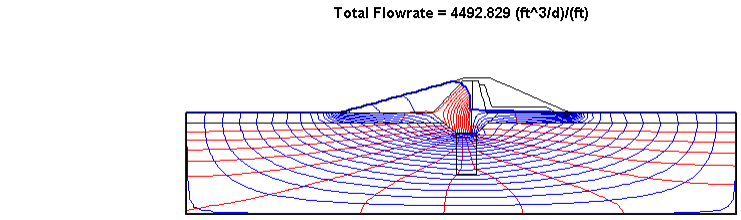
Course Introduction

Topics – Seepage Analysis

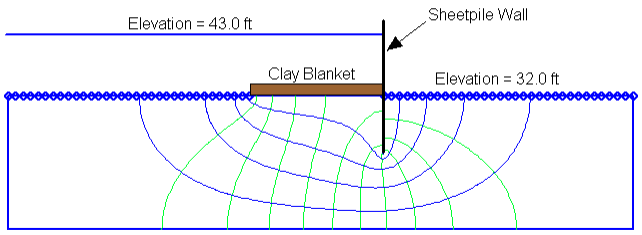
- Review (Darcy's Law, heads, etc.)
- Governing equations
- Graphical solutions
- Analytical solutions
- Well equations
- Construction dewatering
- Finite difference method
- Finite element method, SEEP2D

Flow Nets

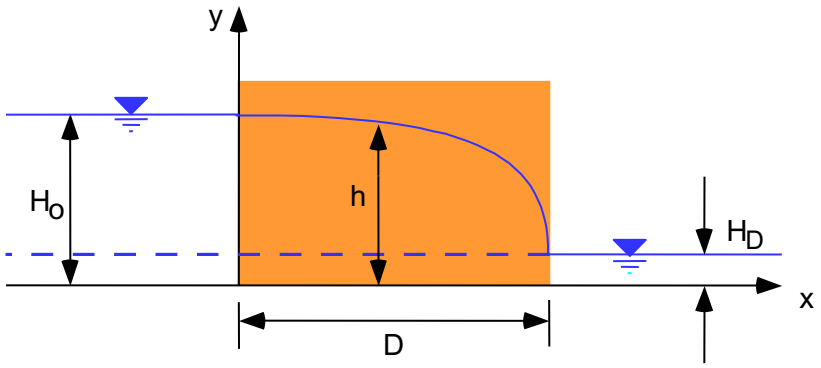




Sample Confined Seepage Problem

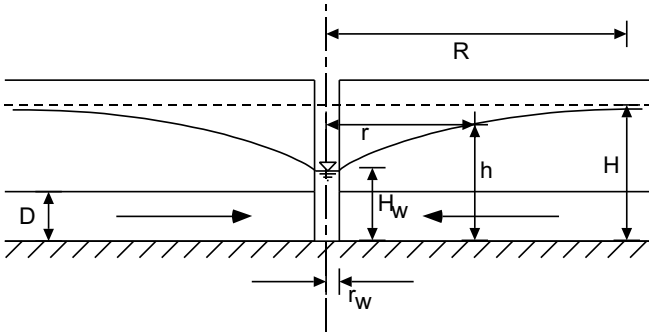


Analytical Solutions



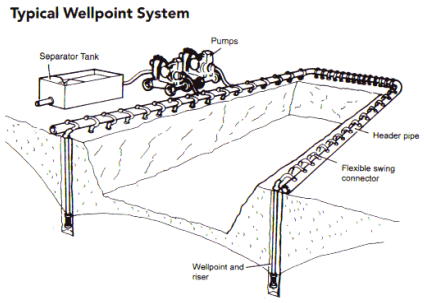
$$q = k\frac{\left(H_o^{\,2} - H_D^{\,2}\right)}{2D}$$

Well Equations



$$q = 2\pi kD\frac{H - H_w}{\ln\left(R / r_w\right)}$$

Construction Dewatering



Mine Dewatering

Finite Difference Method

Coffer Dam - Finite Difference Solution

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H = 72

H = 42

72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	68.7	67.8	53.1	52.6	51.3	49.3	46.5	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0	42.0
71.7	71.7	71.6	71.6	71.5	71.3	71.1	70.9	70.5	70.0	69.2	67.6	66.9	53.6	53.0	51.6	49.7	47.4	45.0	43.9	43.3	43.0	42.7	42.6	42.5	42.4	42.3	42.3	42.3
71.4	71.3	71.3	71.1	71.0	70.7	70.4	69.9	69.2	68.4	67.1	65.6	64.4	55.4	54.2	52.4	50.5	48.5	46.6	45.3	44.4	43.8	43.4	43.1	42.9	42.7	42.6	42.6	42.6
71.1	71.1	71.0	70.8	70.5	70.2	69.7	69.1	68.2	67.0	65.4	63.2	59.6	56.0	53.4	51.3	49.3	47.6	46.3	45.3	44.5	44.0	43.6	43.2	43.0	42.9	42.8	42.8	
70.9	70.8	70.7	70.5	70.2	69.8	69.2	68.4	67.4	66.1	64.4	62.2	59.4	56.5	54.1	51.9	50.0	48.3	47.0	45.9	45.0	44.4	43.9	43.5	43.3	43.1	43.0	43.0	
70.7	70.7	70.6	70.3	70.0	69.5	68.9	68.1	67.0	65.6	63.9	61.7	59.3	56.8	54.4	52.3	50.4	48.7	47.3	46.2	45.3	44.6	44.1	43.7	43.4	43.2	43.1	43.1	
70.7	70.7	70.5	70.3	69.9	69.5	68.8	67.9	66.8	65.4	63.7	61.6	59.2	56.8	54.5	52.4	50.5	48.8	47.5	46.3	45.4	44.7	44.2	43.7	43.5	43.3	43.1	43.1	

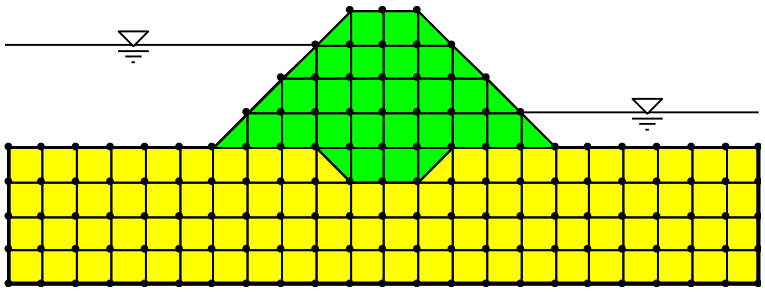
K 4.0 [m/d]

dy 7.0 [m]

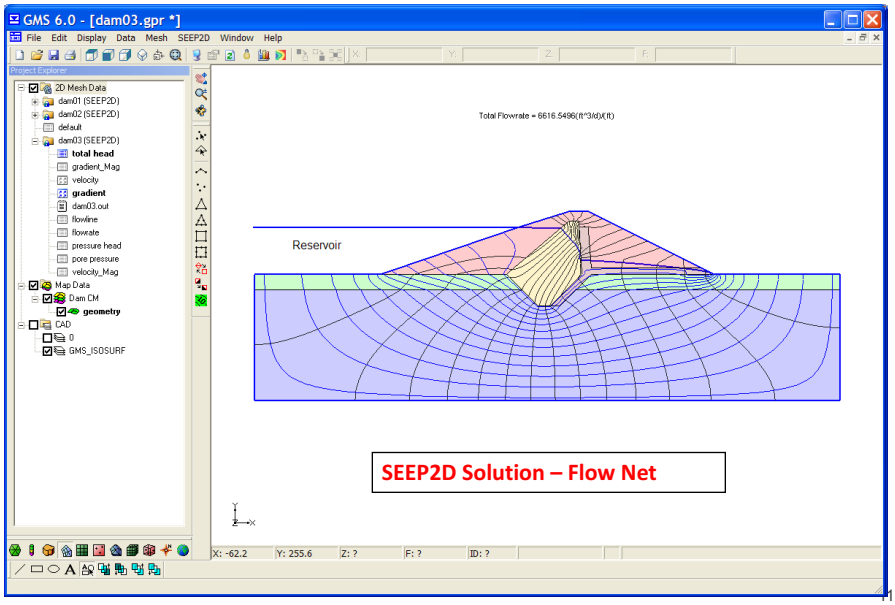
dh	-2.98	-1.90	-1.33	-0.98	-0.74	-0.58	-0.46	-0.38	-0.33	-0.30	-0.29
dh/dy	-0.43	-0.27	-0.19	-0.14	-0.11	-0.08	-0.07	-0.05	-0.05	-0.04	-0.04
Ai	3.50	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	3.50
Qi	-5.96	-7.62	-5.32	-3.91	-2.97	-2.31	-1.84	-1.52	-1.30	-1.18	-0.57

Qtotal: -34.51 [m^3/d/m]

Finite Element Method

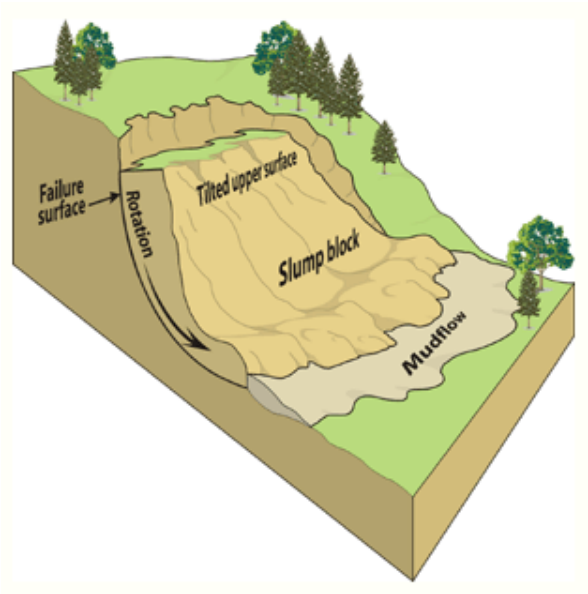


SEEP2D

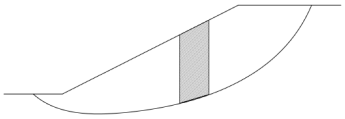


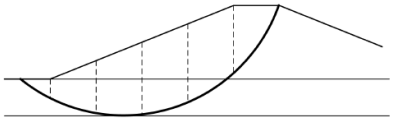
Topics – Slope Stability

- Types of failures
- Method of slices
- Infinite slope analysis
- UTEXAS slope stability program
- Seismic analysis
- Sudden drawdown, multi-stage analysis

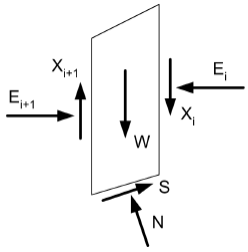

Failure surface
Rotation
Tilted upper surface
Slump block
Mudflow

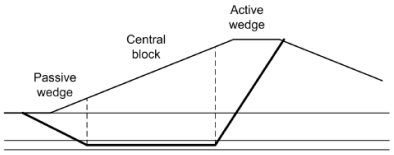
Method of Slices



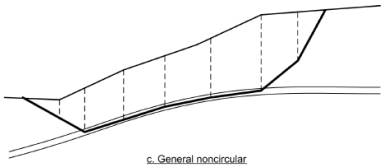


a. Circular





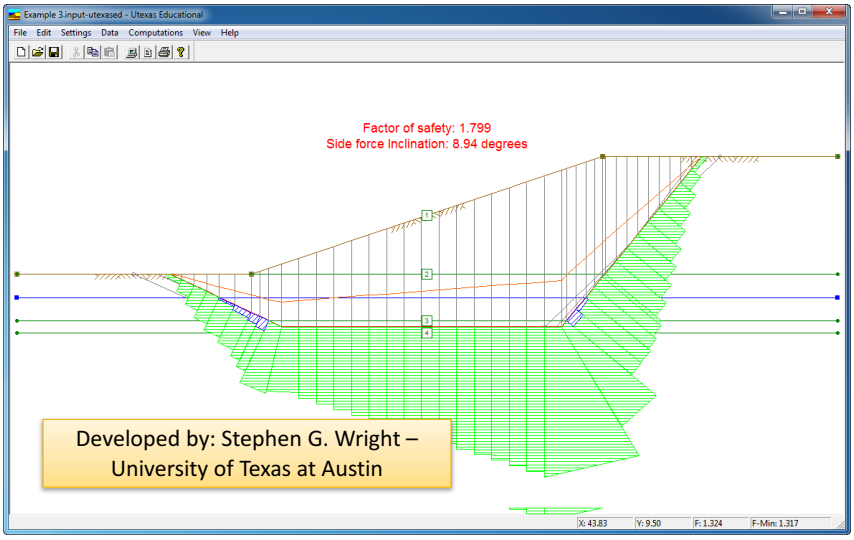
b. Wedge



c. General noncircular

$$F = \frac{\sum\left[c'\Delta\ell + \left(W\cos\alpha - u\Delta\ell\cos^2\alpha\right)\tan\phi'\right]}{\sum W\sin\alpha}$$

UTEXASED



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