Aquadam Stability Calculation | Whitchurch engineering job no. | KWE1901

Blue Lake Dam Seismic Retrofit Project, Alpine County, California | Date | April 9 2019

This calculation assumes the Aqua Dam flotational forces act across the dam contact width. The retained water depth for calculation is 7'. The primary dam height will be 8'. A secondary dam height 4'. PGE drawing number 3099454, sheet 2 of 8, states the base soils are non cohesive with a friction angle of 45 degrees. The Aquadam is not expected to settle in this material. The coefficient of friction for geotextile fabric against sands, from a study by Bosto Geosynthetics, is .84. The coefficient of friction for a friction angle of 45 degrees is 1.0. The photgraphs indicate a layer of sediment covering the base sand. A coeffient of friction of .36 has been chosen for this calculation.

Single dam

Dam height, h	8	feet	2.4	Meters
height of retained water, d	7	feet	2.1	Meters
Temp of water in dam and being retained assumed similar	68	deg F	20	deg C
Density of water, g	62.4	lbs/cuft	999.6	Kg/cuMeter
flow rate normal to dam, v	0	feet/second	0.0	Meters/Second
Coeficient of friction, m	0.36		0.36	
Contact width across bottom of dam, w	16	feet	4.8768	Meters
Lateral force from flow = dgv^2/(2*Gc)	0	lbs/ft dam length	0.0	N/M dam length
Lateral force from static height = gd^2/2	1,529	lbs/ft dam length	2,275	N/M dam length
Total lateral force	1,529	lbs/ft dam length	2,275	N/M dam length

Resistance to sliding

Total pressure acting on interior dam membrane contact width, = ghw	7,987	lbs/ft dam length	11,886	N/M dam length
Flotation force from static height = gdw/2	3,494	lbs/ft dam length	5,200	N/M dam length
Net gravitational force creating friction = ghw – gdw/2	4,493	lbs/ft dam length	6,686	N/M dam length
Frictional force resisting lateral movement = m (ghw-gdw/2)	1,617	lbs/ft dam length	2,406.97	N/M dam length
Factor of safety against lateral displacement = lat. force/frict. force	1.06		1.06	

Resistance to overturn

Moment imparted by static depth = .3333*d*gd^2/2	3,567	ftlbs/ft dam length	1,618	NM/M dam length
Moment imparted by flow = .5*d*dgv^2/2	0	ftlbs/ft dam length	0	NM/M dam length
Moment imparted by flotation = .6666*w*gdw/2	37,270	ftlbs/ft dam length	16,907	NM/M dam length
Sum of overturn moments	40,837	ftlbs/ft dam length	18,525	NM/M dam length
Resisting vertical moment dam width water weight = .5w*ghw	63,898	ftlbs/ft dam length	28,984	NM/M dam length
Factor of safety against overturn = resisting moment/overturn moment	1.6		1.6	

Lateral force resistance with second dam as back up

Second dam height, h	4	feet	1.2	Meters
Second dam contact width across bottom of dam, w	8	feet	2.4	Meters
Frictional force resisting lateral movement = ghwm	719	lbs/ft dam length	1,070	N/M dam length
Combined frictional force resisting lateral force	2336	lbs/ft dam length	3,477	N/M dam length
Combined factor of safety against sliding	1.53		1.53