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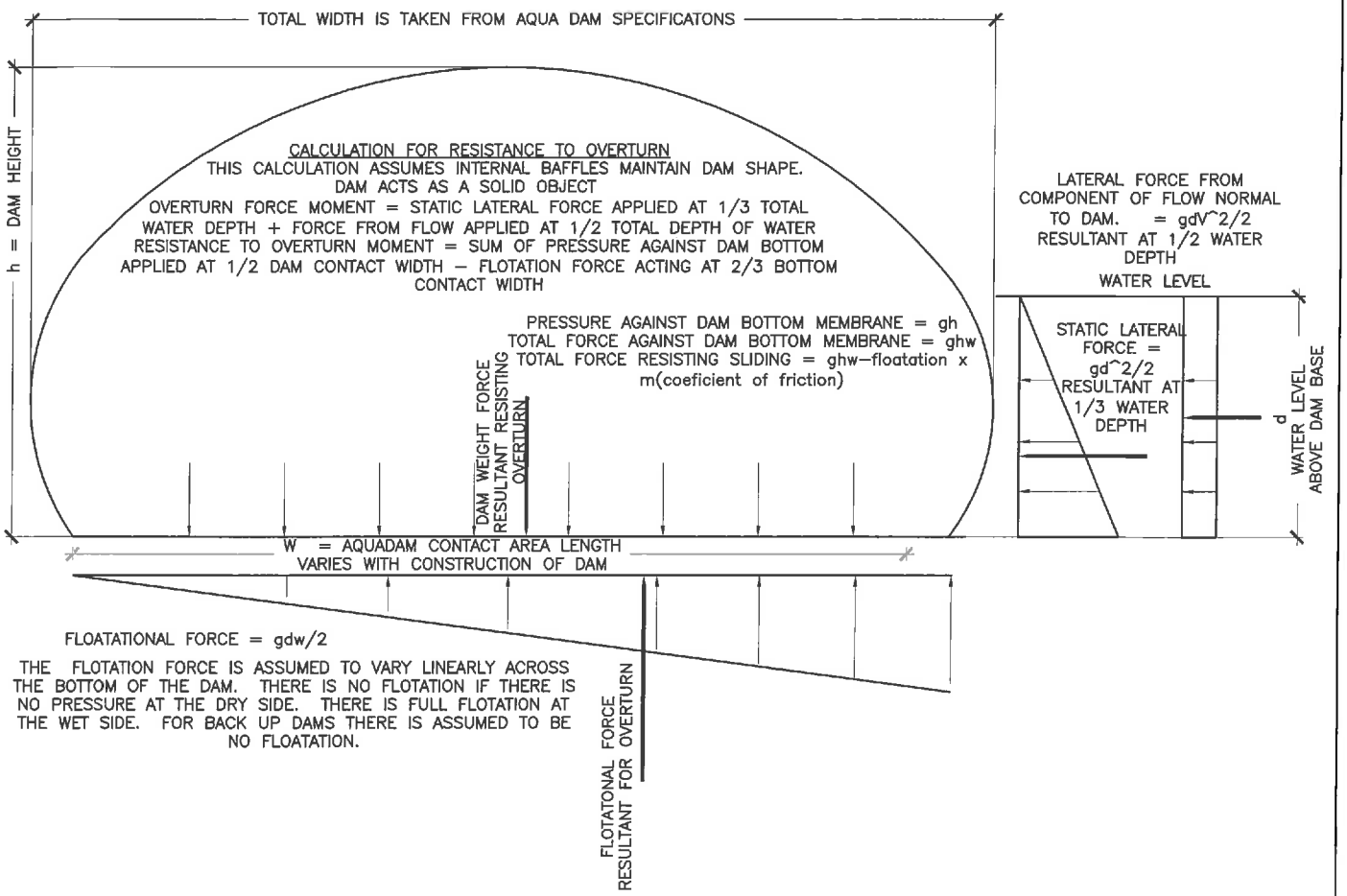
JOB Palm Desert Groundwater Replenishment Project
ELEMENT Aquadam stability Rev 1
SHEET NO. 1 OF 2
CALCULATED BY pmg DATE April 24 2018
CHECKED BY PMG JN WML1801

Palm Desert Ground Water Replenishment Project

Aquadam stability calculation



12' HEIGHT AQUADAM, 30.83' LAY FLAT, 25' FILLED WIDTH, 22' EST. GROUND CONTACT WIDTH
8' HEIGHT AQUADAM, 21.67' LAY FLAT, 17' FILLED WIDTH, 16' EST. GROUND CONTACT WIDTH

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April 24 2018
CIVIL
STATE OF CALIFORNIA

Aquadam Stability Calculation Whitchurch engineering job no. WML1801

Palm Desert Groundwater Replenishment Project Date April 24 2018

This calculation assumes the Aqua Dam flotational forces act across the dam contact width. The bottom of the basin is at elevation 163'. The retained water depth is 8'. We have been instructed that the water level will be reduced to, and to calculate the water depth at this level. The primary dam height will be 12'. A secondary dam height 8'. The top of the embankment at the fill point is elevation 182'. The soils report, from Brookman Edmonston Engineering, indicates the native soils, that were called out to be used as the fill at the bottom of the basin, are silty sands. The Aquadam is not expected to sink in this material. The coefficient of friction for geotextile fabric against silty sands, from a study by Bosto Geosynthetics, is .84. The coeficient for synthetics against wet concrete can be as low as .35. .30 is the coefficient of friction used in this calculation.

Single dam

Dam height, h	12 feet	3.7 Meters
height of retained water, d	8 feet	2.4 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	0.3	0.3
Contact width across bottom of dam, w	22 feet	6.7056 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	1,997 lbs/ft dam length	2,972 N/M dam length
Total lateral force	1,997 lbs/ft dam length	2,972 N/M dam length

Resistance to sliding

Total pressure acting on interior dam membrane contact width, = ghw	16,474 lbs/ft dam length	24,515 N/M dam length
Flotation force from static height = gdw/2	5,491 lbs/ft dam length	8,172 N/M dam length
Net gravitational force creating friction = ghw – gdw/2	10,982 lbs/ft dam length	16,344 N/M dam length
Frictional force resisting lateral movement = m (ghw-gdw/2)	3,295 lbs/ft dam length	4,903.09 N/M dam length
Factor of safety against lateral displacement = lat. force/frict. force	1.65	1.65

Resistance to overturn

Moment imparted by static depth = .3333*d*gd^2/2	5,324 ftlbs/ft dam length	2,415 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	80,530 ftlbs/ft dam length	36,531 NM/M dam length
Sum of overturn moments	85,854 ftlbs/ft dam length	38,946 NM/M dam length
Resisting vertical moment dam width water weight = .5w*ghw	181,210 ftlbs/ft dam length	82,195 NM/M dam length
Factor of safety against overturn = resisting moment/overturn moment	2.1	2.1

Lateral force resistance with second dam as back up

Second dam height, h	8 feet	2.4 Meters
Second dam contact width across bottom of dam, w	16 feet	4.9 Meters
Frictional force resisting lateral movement = ghwm	2396 lbs/ft dam length	3,566 N/M dam length
Combined frictional force resisting lateral force	5691 lbs/ft dam length	8,469 N/M dam length
Combined factor of safety against sliding	2.85	2.85