APPENDIX - IV : DESIGN EXAMPLE OF PERCOLATION TANK

DESIGN EXAMPLE OF PERCOLATION TANK

Data

Catchment Area = 1.4 sq.km (0.549 sq.miles)
Nature of Catchment = Good
Average annual rainfall = 786 mm
65 percent dependable rainfall = 717 mm

Capacity Table for Tank

R.L. (m)	Capacity (MCM)
97.00	0.0070
97.50	0.0090
98.00	0.0105
98.50	0.0116
99.00	0.0120
99.50	0.0131
100.00	0.0139
100.50	0.0142

Yield from Catchment

From Strange's Table
Yield/sq. km for 717 mm rainfall = 0.187 MCM
Yield from the catchment = $0.187 \times 1.4 = 0.262$ MCM

Assumptions

(i) Number of fillings per year = 2
(ii) Utilisation of yield per filling = 5 percent

Design of Tank

Capacity of percolation tank = $0.05 \times 0.262 = 0.0131$ MCM
Total utilisation of yield per year = $2 \times 0.0131 = 0.0262$ MCM
Full Tank Level for capacity of 0.0131 MCM = 99.50 m
Crest level of spillway = 99.50 m
Providing 0.5 m head over the spillway crest
Maximum water level in tank = 100.00 m
Providing free board of 0.5 m above M.W.L.
Top of bund = 100.50 m

Design Flood

Where a formula applicable to a given situation is available viz. Dicken's or Ryve's formula. Assuming that following Dicken's formula is available. This gives flood discharge of 25 years frequency

$Q = 1000\ A^{3/4}$

Where,

Q = Flood discharge in cusecs
A = Catchment area in sq.miles

$Q = 1000 \times (0.549)^{3/4}$
$= 1000 \times 0.638$
$= 638.00$ cusecs
$= 18.09$ cumecs

Length of Spillway

Head over spillway crest = 0.5 m

For weir discharge per m length, $q = 1.84\ (h)^{3/2}$

Length of spillway $= \dfrac{Q}{1.84\,(h)^{3/2}}$

$= \dfrac{18.09}{1.84 \times (0.5)^{3/2}}$

$= 27.82$

Say 28 m

Design of Surplus Course

Area of flow = (28+0.5) 0.50 = 14.25 sq.m
Bed slope = 1 in 750

$P = 28 + (2 \times 1.118 \times 0.50) = 29.118$ m

Say 29.12 m

$R = \dfrac{14.25}{29.12}$

$= 0.4894$ m

$R^{2/3} = (0.4894)^{2/3}$
$= 0.621$

Velocity $= \dfrac{1}{n} \times R^{2/3}\, S^{1/2}$

$= \dfrac{1}{0.025} \times 0.621 \times \dfrac{1}{(750)^{1/2}}$

$$= \frac{1}{0.025} \times 0.621 \times \frac{1}{27.38}$$

$$= 0.907 \text{ m/sec}$$

Discharge = 14.25×0.907
= 12.92 cumecs as against 12.66 cumecs
Hence safe

Depth of foundation

Design flood discharge, Q = 18.09 cumecs

Normal Scour depth, $R = 1.35 \left(\frac{q^2}{f}\right)^{1/3}$

$q = \frac{18.09}{28} = 0.646$

Assuming, f = 1

$R = 1.35 \left(\frac{0.646^2}{1}\right)^{1/3}$

= 1.00 m

Scour depth = 1.5 R
= 1.5×1.00
= 1.5 m

Maximum scour level = 100.00 – 1.50
= 98.50

Height of body wall = 0.90 m
Thickness of foundation concrete = 0.15 m

Foundation level = 99.50 – 0.90 – 0.15
= 98.45 O.K.

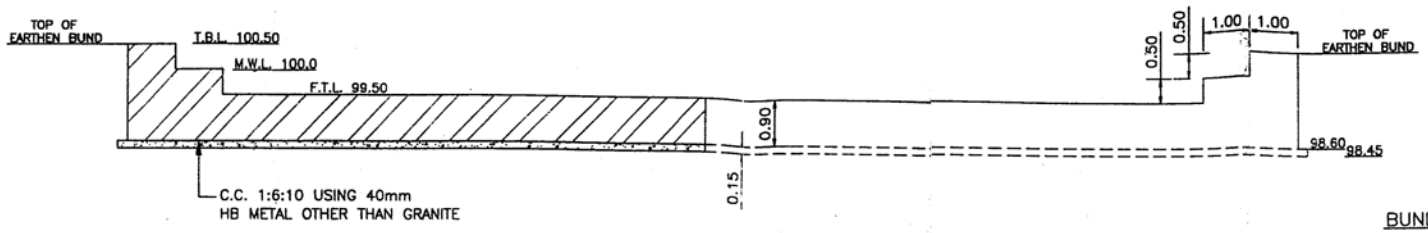
Earthen Bund

Top width = 1.85 m
Side slopes : Taking into consideration the nature of soil and local practice, side slopes of 2:1 are proposed on both sides of the bund.

The sample drawings for Percolation Tank are shown in Figure A-4.1.

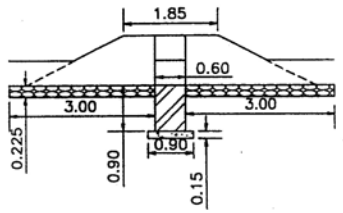
Figure A-4.1

PLAN SHOWING SURPLUS WEIR OF PERCOLATION TANK

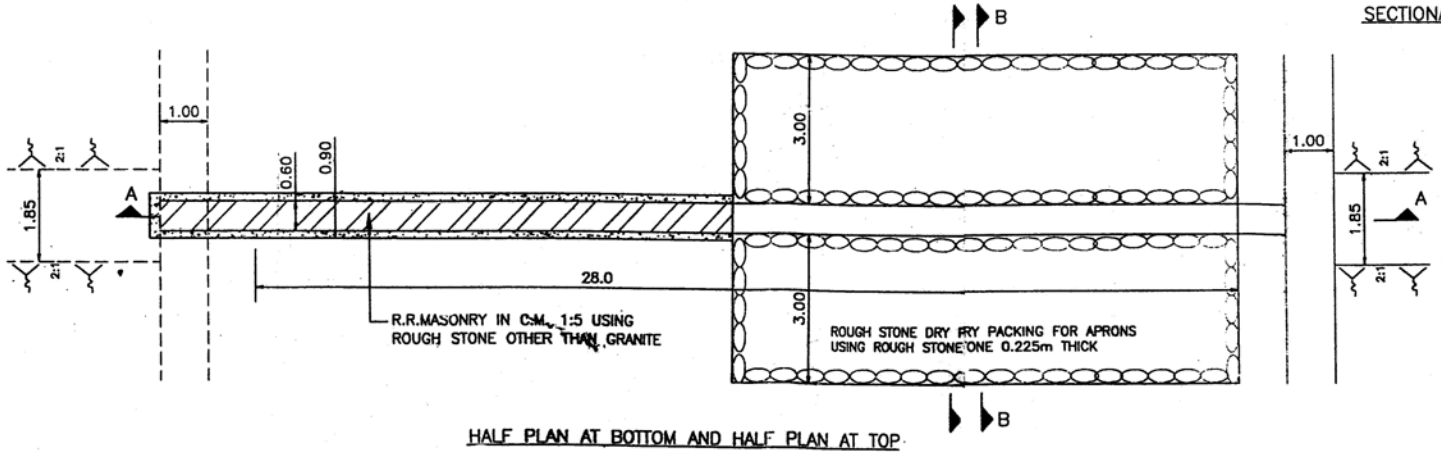


LONGITUDINAL SECTIONAL ELEVATIOTION A–A

BUND DETAILS



SECTIONAL ELEVATION B–B



HALF PLAN AT BOTTOM AND HALF PLAN AT TOP

NOTE–ALL DIMENSIONS ARE IN METRES.