SUBMITED TO

ENGR ADEED

SUBMITED BY

M. AFAQ KHAN

STUDENT ID

7700

SECTION

B

SUBJECT:

HYDRAULIC STRUCTURS

Q01 (A)

Culvert	Causeway
→ Culvert is define as. Tunnel structure constructed under roadway or railways to provide cross drainage or to take electrical. or other cable from one side to other.	→ A Causeway is: of course a raised road it as built an Embankment.
→ It is Totally Enclosed by Soil or ground. pipe culvert, box culvert and arch Culvert are. the common Type used under roadways and railways.	→ It is Supported. mostly by Earth or Stone.
→ It is normally uses for natural flow of water for controlling it.	→ And it is not. a bridge because it Support a roadway b/w piers.
	→ It can be constructed of Earth, masonry, wood or concrete. for track road. or railway.

Q1 (b): Cross Drainage Works:

→ Cross drainage works is a structure constructed, when there is a crossing of cannal and natural drain, to prevent the drain water from mixing into cannal water.

→ By mixing two or three streams into one and only one cross drainage work to be constructed.

NECESSITY OF CROSS DRAINAGE WORK.

→ The water-shed cannal donot cross the natural drainages but in actual orientation of the cannal network. this condition may not be avaliable and the obstacles. like natural drainages. may be present across the cannal. So, the cross drainage works. must be provided for running the irrigation systems.

→ When the water cross, the water of the cannal and the drainage get intermixed, for the smooth running of the water (cannal). to design discharge the cross drainage works.

→ The Cross Drainage work Required to dispose of the drainage water. So that the cannal supply water remains undisturbed.

TYPES OF CROSS DRAINAGE WORK

The Types of Cross Drainage work. are as under;

TYPE-1 IRREGATION CANAL PASSES OVER DRAINAGE

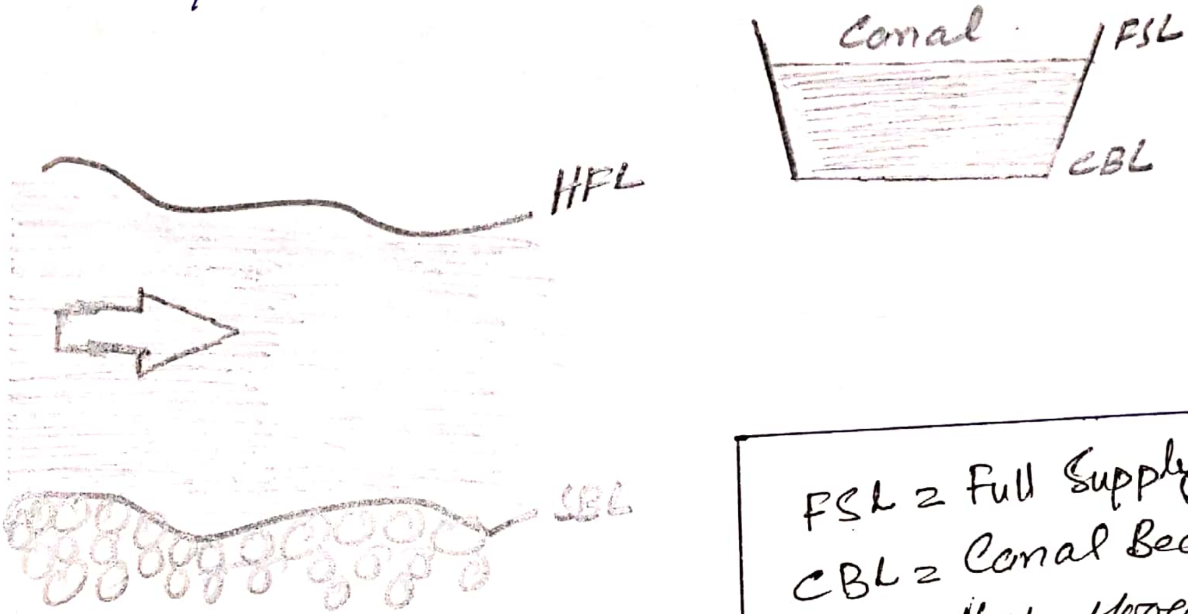
AQUEDUCT :

DEF : The hydrulic structure in which the Irrigation cannal is. Taken over the drainage is called aqueducts.

→ This structure is. Suitable for, when the bed level.

is greater or above the highest flood level. of drainage.

In this case, the drainage. water passes clearly below the Cannal.

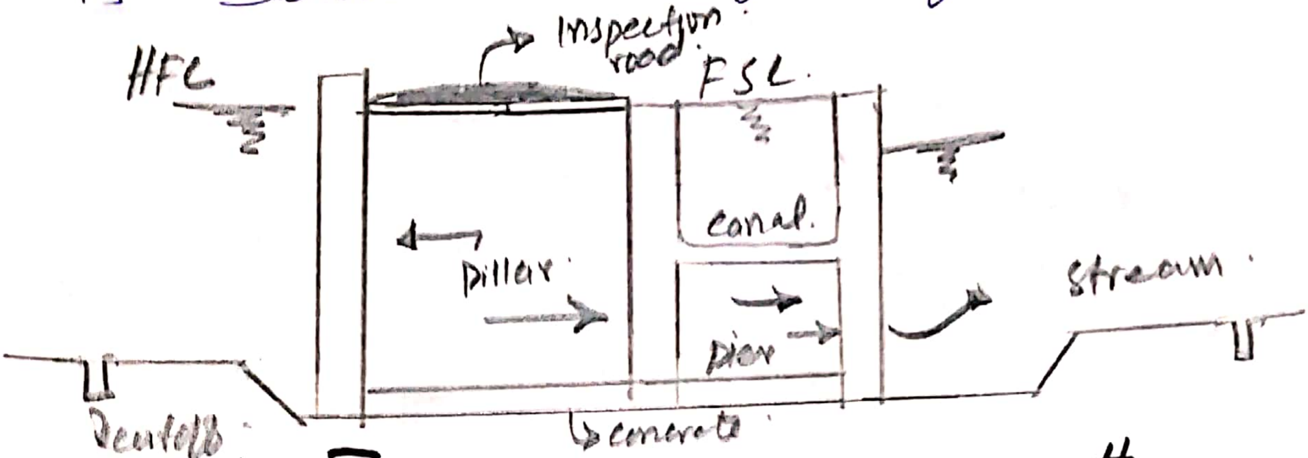


FSL = Full Supply Level.
CBL = Canal Bed level.
HFL = High flood level.
SBL = Stream Bed level

2 Siphon AQUEDUCT:

DEF: In a hydralic structure where the canal is Taken over the drainage. but the drainage canot passes clearly below the Cannal. It flow. under siphone action. So it is. called aqueduct.

Siphon Aqueduct is Sutible. When the bed level of cannal is below the higest flood level.



TYPE II DRAINAGE PASSES OVER the Irrigation cannal.

Supper Passage:

DEF: The Structure in which the drainage is taken over the irrigation cannal is know as Supper pasage.

→ It is Sutible when the bed level of drainage is above the full supply level of the cannal.

→ The water of the cannal passes clearly below the drainage.

Siphon Super Passage:

DEF:

The hydraulic Structure in which the drainage is taken over the irrigation canal, but the cannal water passes below the canal. (Drainage). Under siphonic Action. is called Siphon Super passage.

→ It is suitable when the bed level of drainage is below the full supply level of the cannal.

TYPE III "DRAINAGE AND CANAL INTERSECT Each other at the Same level"

Level Crossing:

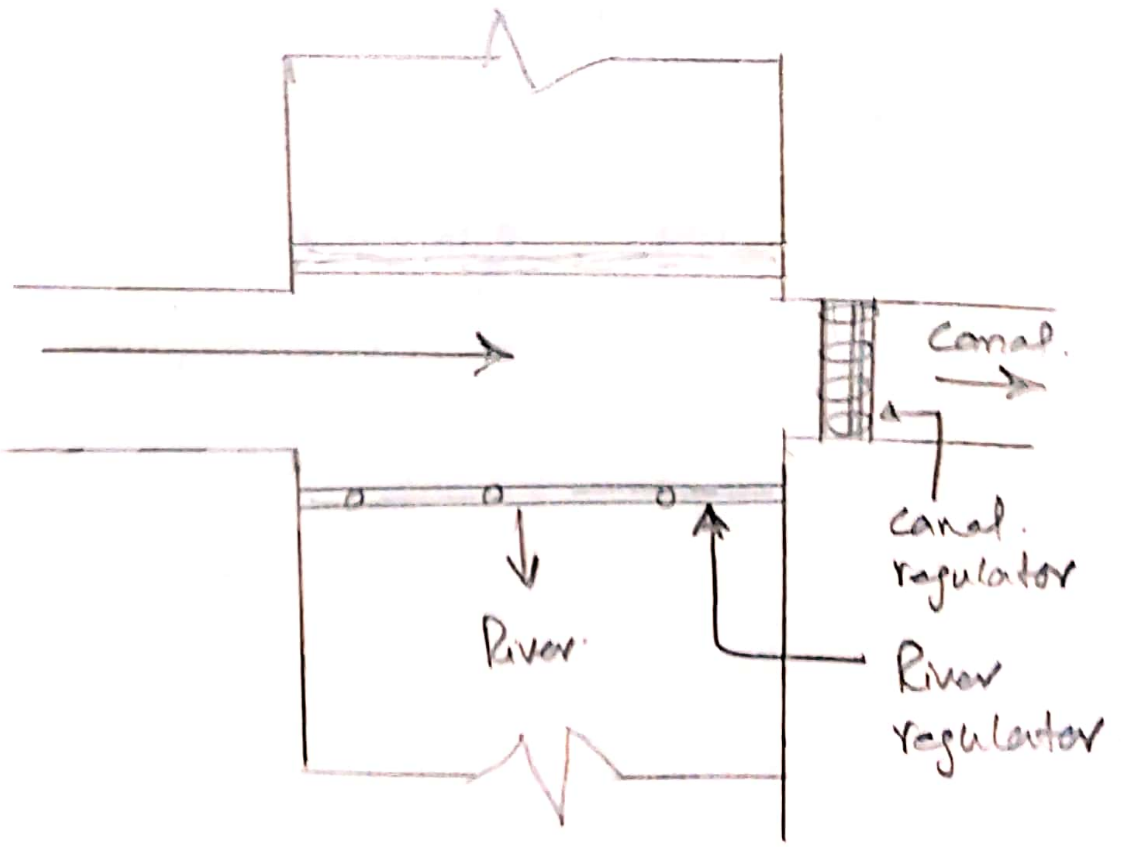
When the bed level of the cannal and the stream are approx. the same and quality of water in cannal and stream is not much different, the cross drainage work.

Constructed are known as level crossing.

→ water of cannal and stream allowed to mix with the help of regulator both in cannal and stream.

→ water is disposed through canal and stream is required quantity.

→ level crossing consist of
- crest wall.
- stream regulator.
- cannal regulator.



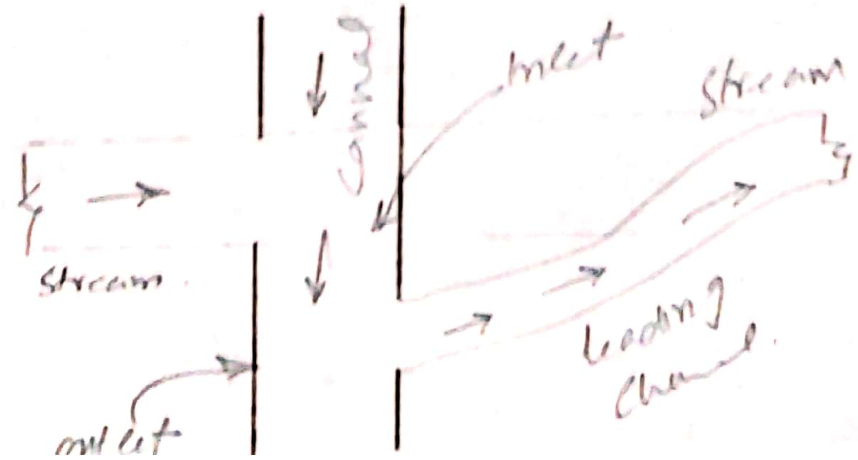
INLET & OUTLET :

When irrigation cannal meets a Small stream or drain at Same level, drain is allowed to Enter the cannal. an Inlet,

At Some distances from this inlet point, apart of water is allowed to drain as outlet.

Eventually meets the orignal. stream. Stone pitching is required. at the inlet and outlet.

The bed and blanks s/w. inlet and outlet are also protected by stone pitching This type of CDW is known as Inlet and outlet.



Q No 2 (a)

DIFFERENCE BETWEEN WEIRS & BARRAGE

BARRAGE	WEIR
1) Low Set Crest	(i) Heigh Set Crest.
2) ponding is done by means of gates.	(ii) ponding is done against the raised crest or partly against crest and partly by shutter.
3) Gated Over Entire length.	3) Shutter are part length.
4) Gates are at greater height.	4) Shutter are of smaller height, 2m.
5) perfect Control on river flow.	5) No Control of river in low floods.
6) High flood can be passed with minimum afflux.	6) Excessive afflux is high flood.
7) less Silting Upstream due to low Set Crest.	7) Raised Crest Causes Silting upstream
8) longer Construction period.	8) Shorter Construction period.
9) Silt removal is done through Under Sluices.	9) No Means for Silt disposal
10) Costly Structure.	10) Relatively Cheaper Structure

QNO2 (B)

REYNOLD Number:

DEF:

Reynold number Can be define as " The Ratio of an Inertial forces to viscous forces."

→ Reynold number is also use to predict if a flow condition will be laminar or turbulent or Transition.

FORMULA:

$$Re = \frac{\text{Interial force}}{\text{viscous forces}}$$

Laminar Flow:

→ The flow in which the Reynold number is less than 2000

→ $Re < 2000$.

TURBULENT Flow:

The flow in which the Reynold number is greater than 4000

$Re > 4000$

Transition Flow:

→ The flow at which the Reynold number is greater than 2000 and less than 4000.

→ $Re > 2000$ and < 4000.

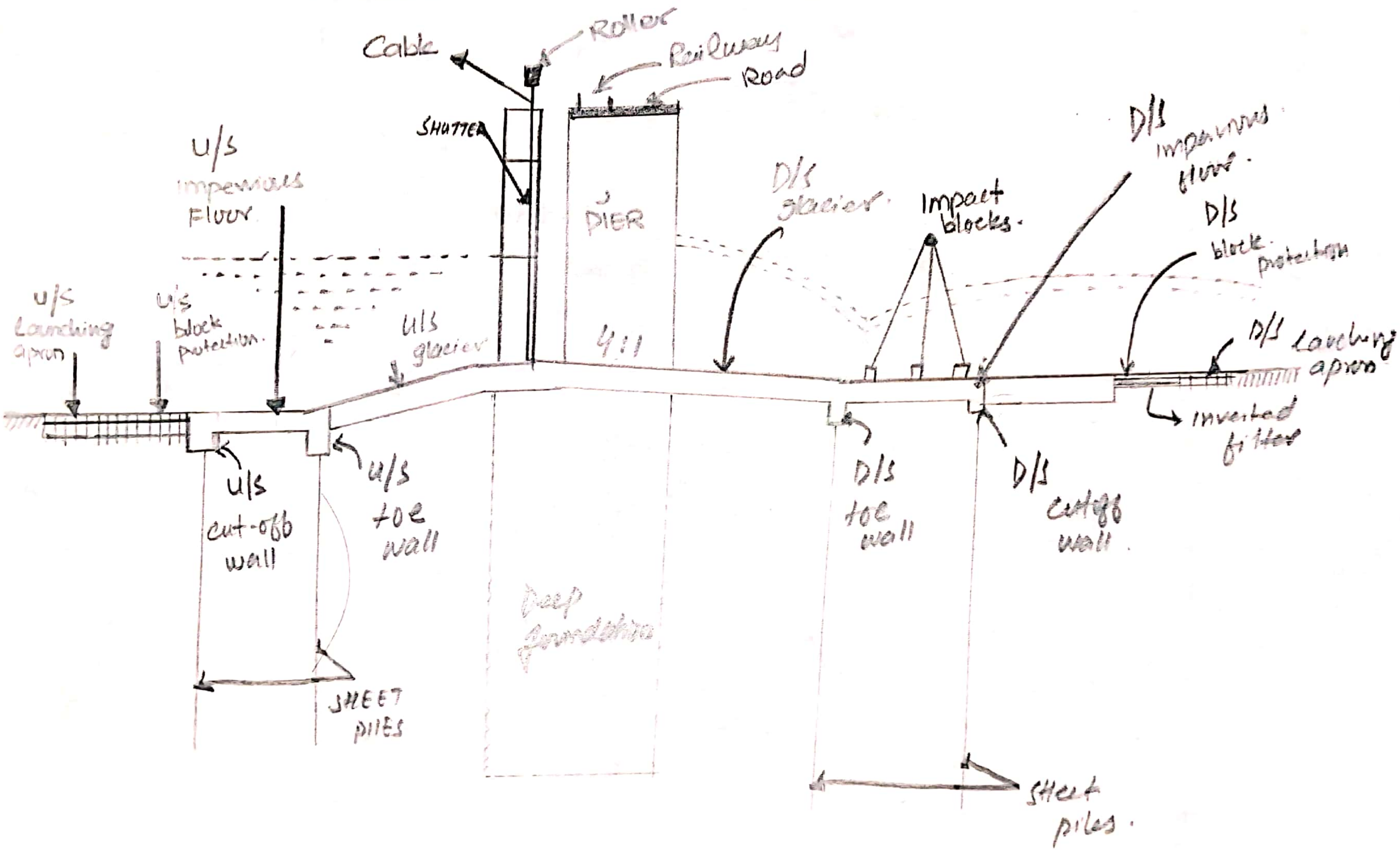
Lower Critical Velocity:

The flow which changes from Laminar to Transition state.

higher Critical Velocity:

The flow which changes from transition to Turbulent flow. called higher critical velocity.

Q # 3 Part (A)



Components of BARRAGE:

Q NO 3 PART (B)

Serval formulae based on Experimental Result have been proposed to predict the maximum or Equalibrium Scour depth (Y_s below the ground bed level), around bridge piers, In gernal, these the assume releationship

$$Y_s / b' = \phi \left(y_0 / b', F_r, d/b' \right)$$

=> where b' is the pier width, Y_0 is the upstream flow depth, d is the sediment size and F_r is the flow flood number.

=> Laursen's (1962) Experimental results Underestimate the Scour depths, compared to many Indian Experiments which suggest the formula.

$$Y_s / b' = 4.2 \left(y_0 / b' \right)^{0.78} F_r^{0.52}.$$

The Scour depth should be taken as Twice the regime Scour depth.

inner and cover layer of thickness.

→ In case of live bed (a stream with bedload Transport) the formula

$$y_s / y_0 = (B/b')^{5/7} - 1 .$$

Predicts. The Maximum Equilibrium Scour depth:

In relatively deep flow a first order Estimate of local Scour may obtained by.

$$y_s = 2.3 k_a b' .$$

→ where k_a = angularity coffient which is a function of the peir alignment. i-e angle of attack of approch flow.

→ The best Estimate will be achieved with the appropriate coefficant for flow depth, alignment etc.

→ The live bed may contribute to an appreciable reduced local Scour depth. if the sediment bed is distinctly [layer and cover layer of thickness] less than the local scour depth the overall scouring phenomena is Quite different.

→ The stepped scour depth in the lowering layer, H is given by

$$H = \eta (Y_2 - Y_1).$$

→ Y_1 and Y_2 are the uniform flow depth over a flat bed of grain roughness corresponding to the upstream surface particles (d_1) and the underlying surface final particals (d_2) respectively.

Coefficent of non riffle forming sediments $\eta = 2.6$ for design purpose.

→ The total scour depth may lead to a gross under estimate if the lower layer is of very fine material.

Q # 4:

Given Data:

Thickness = 0.92 m ≅ 3 ft.

Culvert dimension = 15' × 15'

L.L = 1.5 kip/ft² = 1500 lb/ft²

D.L = 300 lb/ft²

Unit weight of Soil = 100 lb/ft³

Angle repose = 30°

for 1:2:4 Rcc Concrete = 156 lb/ft

F_y = 60 ksi

Required:

Design a Culvert.

Sol:

STEP NO # 1

Self wt of slab = Thickness × Unit weight of Rcc.

= 3 × 156

= 468 lb/ft².

Total load

L.L + D.L + Self wt.

= 1500 + 300 + 468

= 2268 lb/ft^2.

STEP # 02.

Co-efficant of Earth

$$= \frac{1 - \sin \theta}{1 + \sin \theta}$$

$$= \frac{1 - \sin(30)}{1 + \sin(30)}$$

= 0.33.

Lateral pressure:

Vertical pressure at Top.

(L.L + D.L) ka.

(1500 + 300) × 0.33

= 594 lb/ft^2.

Pressure of soil:

ka * h × Unit wt of soil.

$0.33 \times (15+3) \times 100$

$0.33 \times 18 \times 100$

$= 594\ lb/ft^2$.

pressure at Top = $594\ lb/ft^2$.

Pressure at bottom:

Top + pressure of Soil.

$594 + 594$.

$= 1188\ lb/ft^2$.