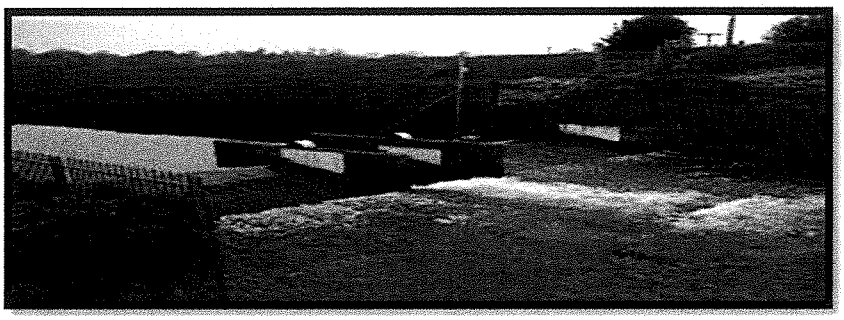
DESIGN OF IRRIGATION STRUCTURE (2)

رابعة مدني



LOCKS
Continue of drawing
&
Design of side culvert

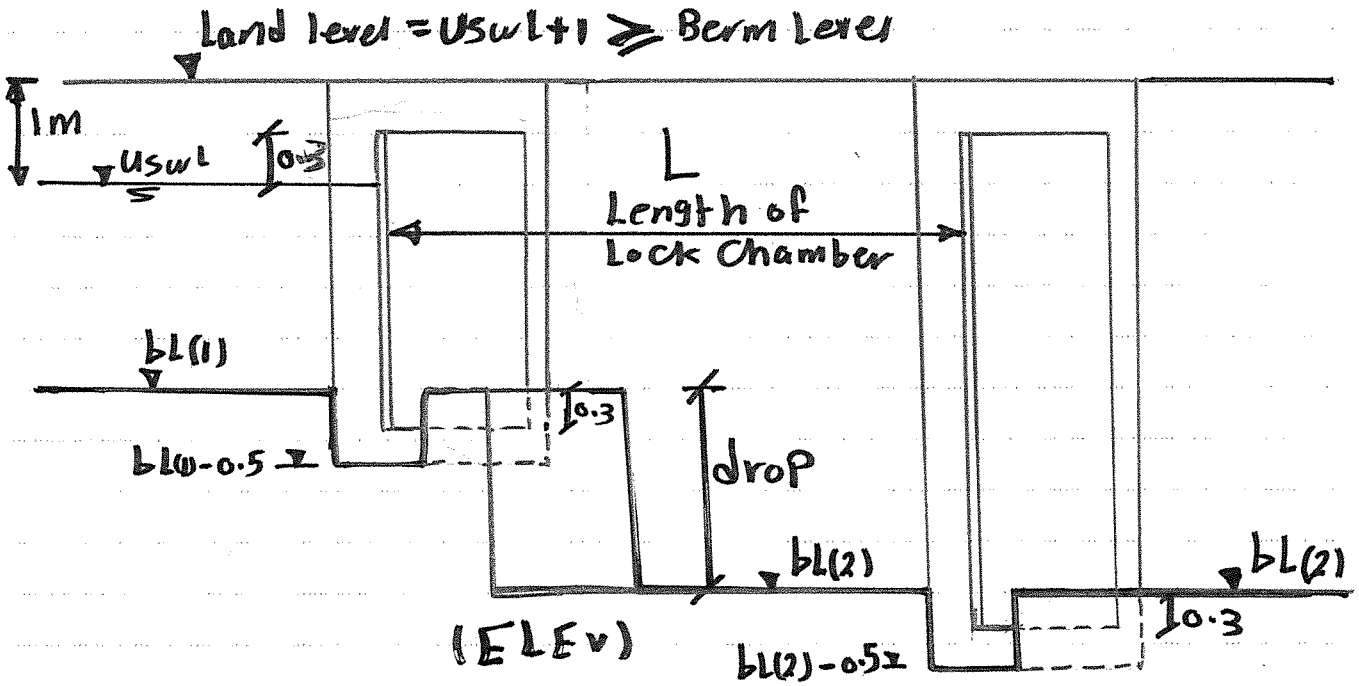
12

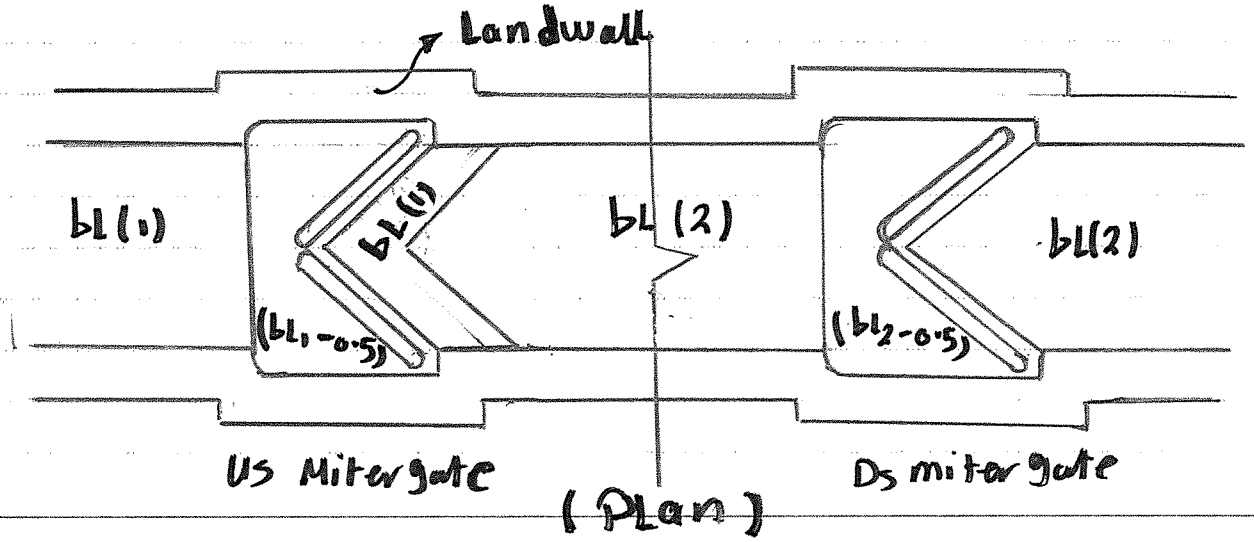
(Continue of Drawing)

* يوجد عدة انواع للأبوسة منها (Shaftlock - dropLock)

(Two way Lock (Chain Lock

* سنقوم الان بدراسة شكل الـ (dropLock) ويستخدم هذا النوع في حالة وجود فرق في مناسيب القاع لايزيد عن 6 متر.

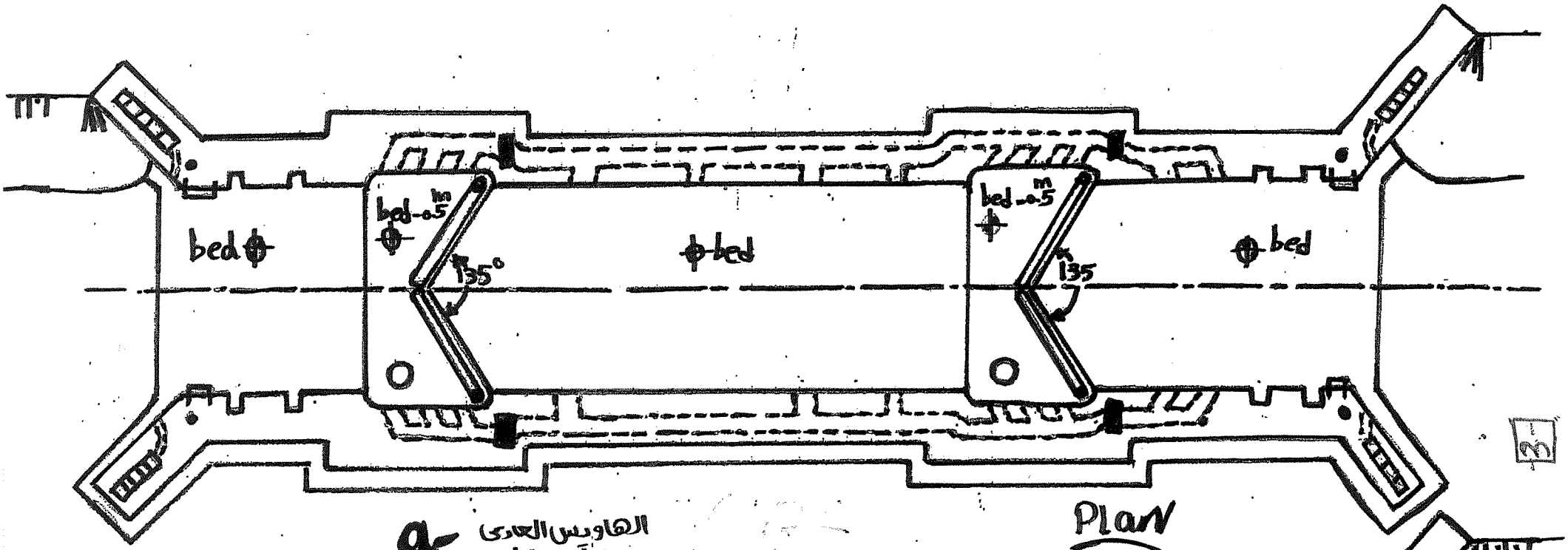




- يحدث انخفاض (drop) فى منسوب الفرشة بين البوابتين يساوى الفرق بين المنسوبين bl(1) و bl(2) .
- وسنقوم الان بالتعرف على الفرق بين الهاويس العادى والـ drop lock) فى رسم الـ ELEV والـ Plan

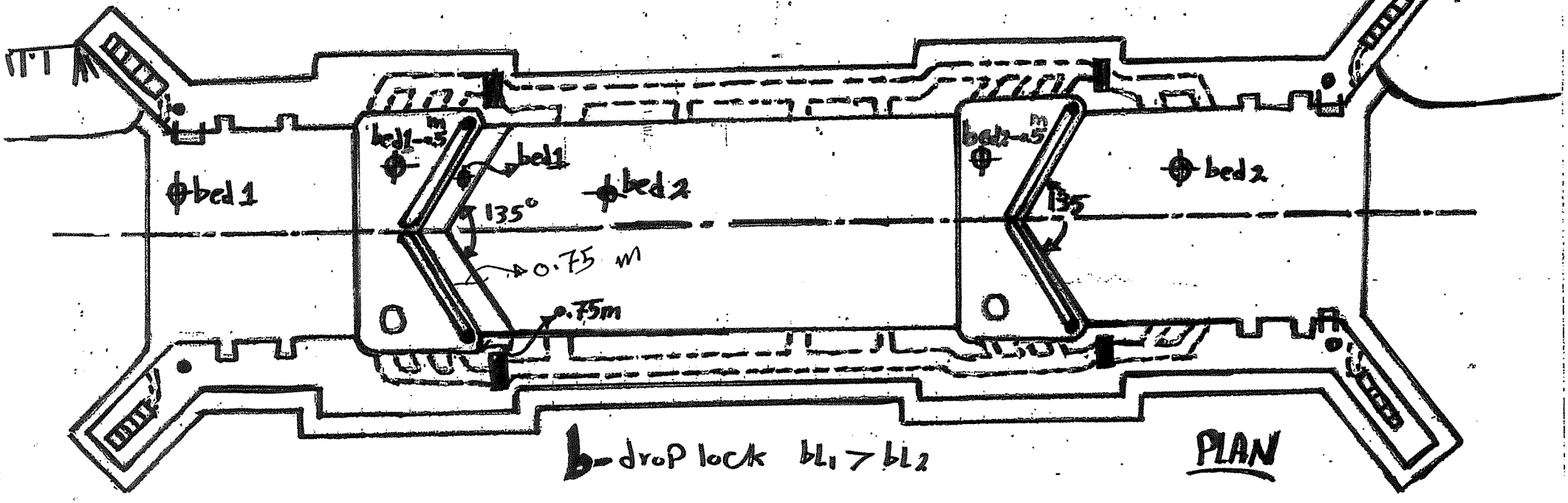
الهاويس العادى ← $bl(1) = bl(2)$

drop Lock ← $bl(1) > bl(2)$



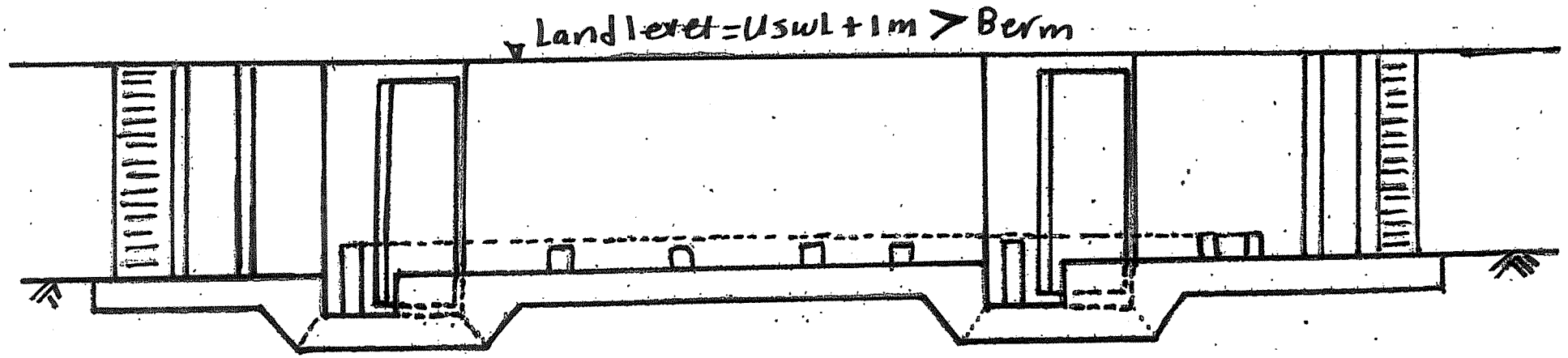
a- الهاويس العادى
$bl_1 = bl_2$

PLAN



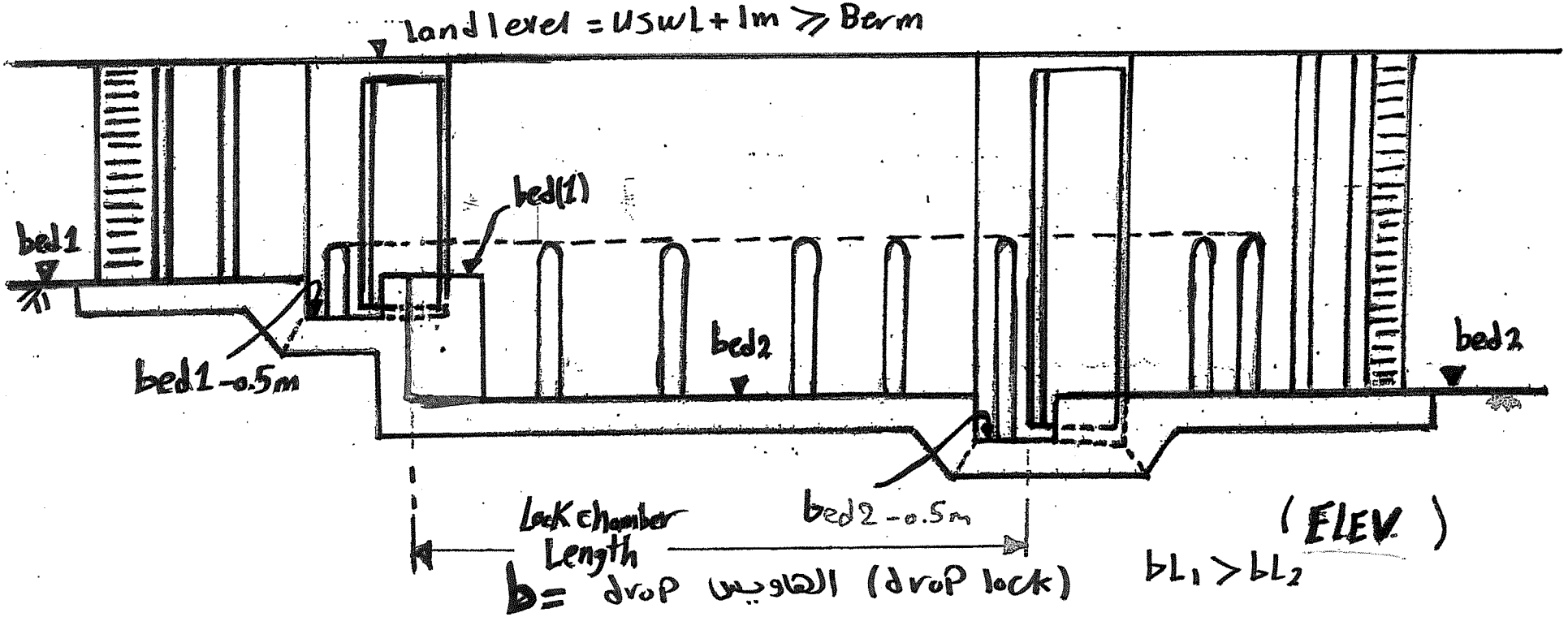
b- drop lock $bl_1 > bl_2$

PLAN



a- الهاويس العادى (ELEV)
$bL_1 = bL_2$

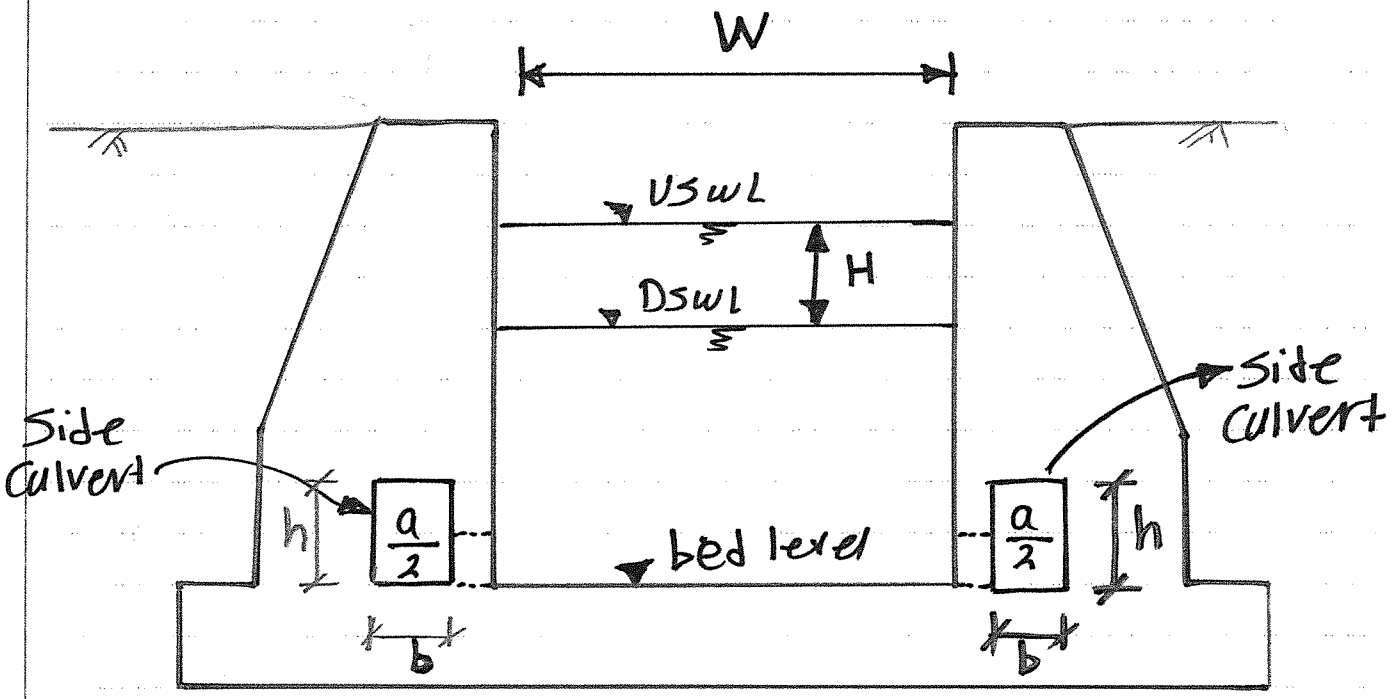
اعرف الفرق



b= drop الهاويس (drop lock) (ELEV.)
$bL_1 > bL_2$

Design of Side Culvert

لديجاد ابعاد فتحات الملئ و التفريغ



$$(a)\ area = \frac{2 * W * L * \sqrt{H}}{Cd\ \sqrt{2g}\ T}$$

a → area = m^2 المساحة المائية المطلوبة للملئ والتفريغ

L → (m) طول غرفة الهاويس Length of Lock chamber

W → (m) عرض غرفة الهاويس Width of Lock Chamber

H → USWL − DSWL = (m)

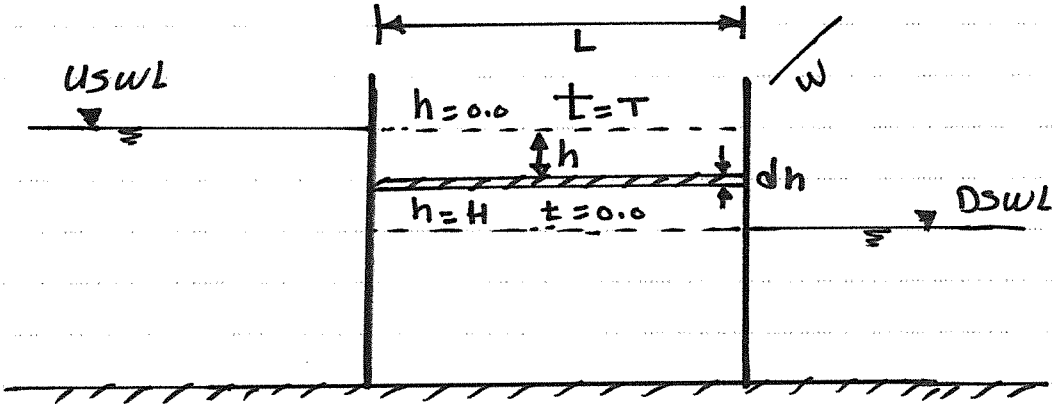
Cd → Coefficient of Discharge = 0.625

T → زمن الملئ والتفريغ = sec (10 → 15 min)

حفظ اثبات

*Derive an expression for calculation The filling and empting oPening ?

استنتاج معادلة فتحات الملئ والتفريغ.



يتم اخذ شريحة عرضها (dh) ويتم عمل لها تكامل

$$d\forall = -L * W * dh$$

$$Q = \frac{dv}{dt} \rightarrow d\forall = Q\,dt$$

$$Q\,dt = -L * W * dh \rightarrow ①$$ معادلة ①

$$Q = Cd\ a\ \sqrt{2gh} \rightarrow ②$$ معادلة ②

من ① ، ②

$$Cd\ a\ \sqrt{2gh}\ dt = -L*W*dh$$

$$dt = \frac{-L * W * dh}{Cd\ a\sqrt{2g}\ \sqrt{h}}$$

الاشارة سالب ان كل ما الزمن يزيد h بتقل

$$\int_0^T dt = \frac{-L * W}{Cd\ a\sqrt{2g}} \int_H^0 h^{-1/2}$$

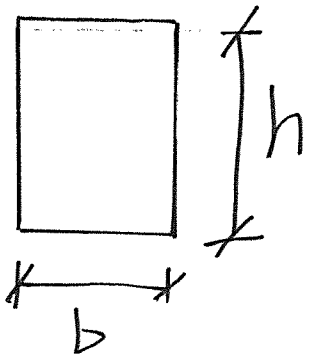
$$T = \frac{2\,L\,W\sqrt{H}}{Cd\ a\sqrt{2g}} \rightarrow a = \frac{2\,L\,W\sqrt{H}}{Cd\ T\sqrt{2g}}$$

لو الفتحة مستطيلة :-

$$\therefore \frac{a}{2} = b * h$$

$$\therefore b \nless 1m$$

$$h \nless 1.8m$$



assume $h = 1.8\ m$

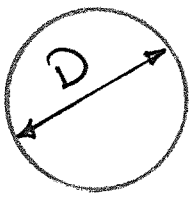
$$b = \frac{(a/2)}{h} = \text{؟؟} \geq 1m$$

يتم تقريب b لاقرب (10cm)

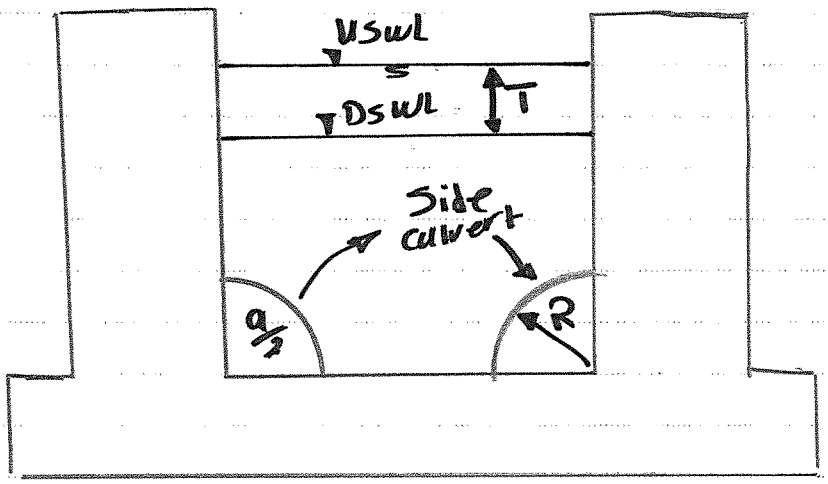
لو الفتحة دائرية :-

$$\frac{a}{2} = \frac{\pi D^2}{4}$$

$$D = \text{؟؟} \geq 1.8m$$



لو الفتحة ربع دائرة :-



$$\frac{a}{2} = \frac{\pi r^2}{4}$$

$$r = r_v \, m$$

example

$\therefore$ Uswl = (8.00)

Dswl = (5.00)

L = 120 m

w = 16 m

T = 10 min

Cd = 0.62

الحل

$$(a)\ area = \frac{2 * L * w\sqrt{H}}{Cd * T * \sqrt{2g}}$$

$\therefore H = Uswl - Dswl = 8 - 5 = 3\ m$

$\therefore T = 10 * 60 = 600\ sec$

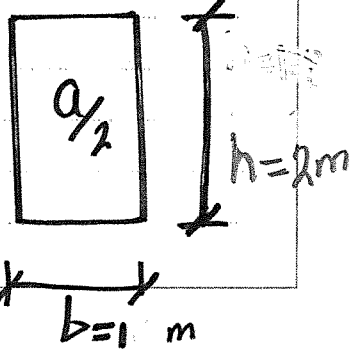
$$(a) = \frac{2 * 120 * 16 * \sqrt{3}}{0.62 * 600 * \sqrt{2 * 9.81}} = 4\ m^2$$

$$\therefore \frac{a}{2} = \frac{4}{2} = 2\ m^2$$

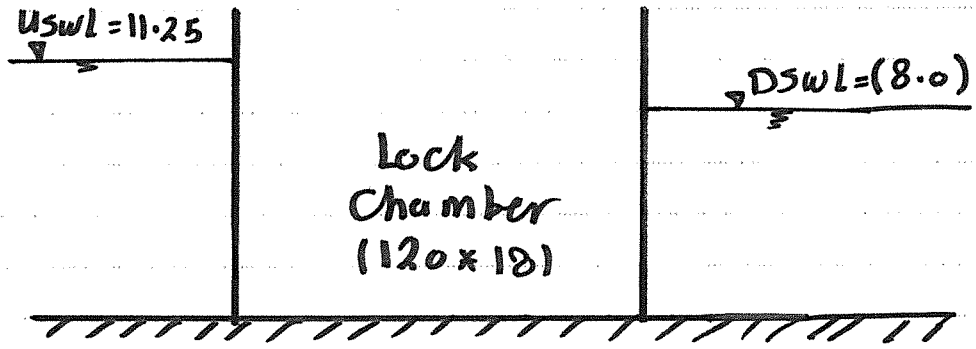
$$\frac{a}{2} = b * h$$

assume $b = 1.0\ m$ فرض b وايجاد h

$2 = 1 * h$ $\quad h = 2 > 1.8$



Example



* Lock Chamber (120 * 18) $L = 120m$, $W = 18m$
* Time of filling and empting = 12 min

Req

Design of filling and empting for each of The following Cases :-

1- 2 Side Culvert (Rectangular) مستطيل

2- 2 Side Culvert (1/4 Circular) ربع دائرة

3- one Culvert embeded in floor if tf = 4.5m rectangular

4- 2 Side Culvert (Pipes)

الحلو

$$H = USWL - DSWL = 11.25 - 8 = 3.25\ m$$

$$T = 12\ min * 60 = 720\ sec$$

$$a = \frac{2 * L * W\sqrt{H}}{Cd * T * \sqrt{2g}}$$

$$a = \frac{2 * 120 * 18 * \sqrt{3.25}}{0.62 * 720 * \sqrt{2 * 9.81}} = 3.92\ m^2$$

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① 2 Side Culvert Reetangular :-

$$\frac{a}{2} = b * h$$

$$\frac{3.92}{2} = b * h$$

ملحوظات بالمحاضرة
ممكن فرض h وايجاد b
" " b وايجاد h

assume $h = 1.8\ m$

$$\frac{3.92}{2} = b * 1.8$$

$$b = 1.08\ m \simeq 1.1\ m > 1m$$ OK

$$\therefore h = 1.8m \quad b = 1.1\ m$$

② 2 side culvert (1/4 Circular) :-

$$\frac{a}{2} = \frac{1}{4}\pi r^2$$

$$\frac{3.92}{2} = \frac{1}{4}\pi r^2$$

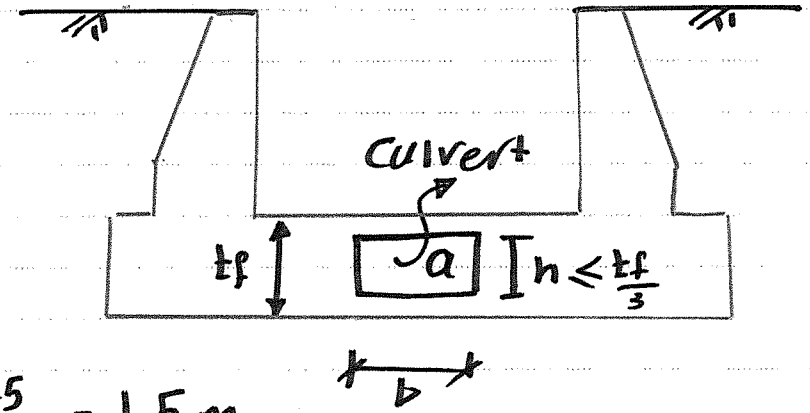
$$r = 1.57\ m \simeq 1.6\ m$$

$$\therefore \boxed{r = 1.6\ m}$$

③ one culvert embeded in floor if $t_{floor} = 4.5\ m$:-

ممكن الـ culvert يتعمل فى الفرشة

$a = 3.92\ m^2$



$a = b * h$

assume

$$h = \frac{t_f}{3} = \frac{4.5}{3} = 1.5\ m$$

$$3.92 = b * 1.5$$

$$b = 2.61\ m \simeq 2.7\ m$$

$$\therefore \boxed{b = 2.7\ m \quad h = 1.5\ m}$$

④ 2 side culvert Pipes

$$\frac{a}{2} = \frac{\pi D^2}{4}$$

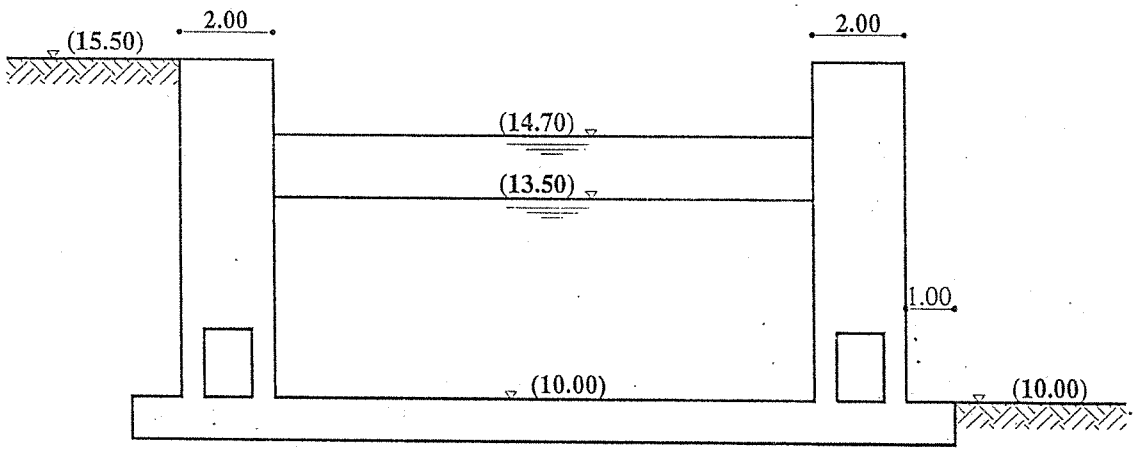
$$\frac{3.92}{2} = \frac{\pi \times D^2}{4}$$

$$D = 1.57 \simeq 1.8\ m$$

Example

A reinforced concrete compound regulator and lock is to be constructed across a Rayah. The cross section of the Rayah is given in the following table. The Regulator consists of three vents each 5.0m span and piers of 1.0m thick. The Lock chamber dimensions 118*18m.The cross section of the lock chamber is given in fig (1). Time of filling and empting the lock chamber is 10 minutes.

Bed width, m	Berm width, m	Road width, m	Side slopes	Bed level	Water level		Berm level	Road level	Land level
					H.W.L	L.W.L			
40.0	8.0	12.0	2 : 1	(10.00)	(14.70)	(13.50)	(15.50)	(17.00)	(16.20)



fig(1)

It is required to

1- Design the side culvert.

2- Draw neat sketches showing all elements, levels and dimensions for the following items:

a. Full plan.

b. Longitudinal section through the lock chamber.

الحل

* Lock chamber (118 * 18 m)

$L = 118\ m \qquad W = 18\ m$

* Time of filling and empting = 10 min

∴ ▽ USWL = (14.7)

▽ DSWL = (13.5)

* Design of the side culvert ?

$$a = \frac{2 * L * W * \sqrt{H}}{Cd * T * \sqrt{2g}}$$

$H = USWL - DSWL = 14.7 - 13.5 = 1.2\ m$

$T = 10 * 60 = 600\ sec$

$$a = \frac{2 * 118 * 18 * \sqrt{1.2}}{0.62 * 600 * \sqrt{2 * 9.81}} = 2.82\ m^2$$

$\frac{a}{2} = b * h$ في الرسم شكل الـ Culvet مستطيل

$\frac{2.82}{2} = b * h$

assume $h = 1.8\ m$

$\frac{2.82}{2} = 1.8 * b \rightarrow b = 0.78 \Rightarrow 1.0\ m$