distance between
F.D & w.L in CD

Soil
surface

depth of
F.D = 1.8 - 2.2
use it 2m

20cm

C.D

length of F.D
200 - 300 m

use it 220m

Slope of F.D = 100 cm/km

W.C

$$W.L_{CD} = G.L - \text{depth of field} - S_{F.D} \times L_{F.D} - \text{distance from} - S \times L$$
$$\text{drain below } G.L \qquad\qquad\qquad\qquad F.D \text{ to w.L in} \qquad CD$$
$$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad C.D$$

$$\boxed{W.L_{CD} = G.L - 2 - \frac{220}{1000} \times \frac{100 cm/km}{100} - 0.2 - S_{CD} \times L_{CD}}$$

Ex Find the water level at the C.D, if $S_{min} = 40 cm/km$, $S_{max} = 150 cm/km$, Length of CD = 2 km

sol.
$$S = \left(\frac{17.65 - 17.25}{2}\right) \times 100 = 20 \ cm/km$$

$20 cm/km < S_{min}$

$\therefore$ use $S = S_{min} = 40 \ cm/km$

1- w.L @ Km 0.0 to the drain from point (1)

$$= 17.75 - 2 - \frac{220}{1000} \times 1 \frac{m}{Km} - 0.2 - 0.4 \times 2 \quad = \boxed{14.53\,m}$$

G.L   F.D منسوب   S×L F.D   قعر F.D   S×L C.D
   قعاع G.L   F.D   منسوب قعر F.D عند   C.D
       C.D

2- W.L @ Km 0.0 to the drain from point (2)

$$= 17.61 - 2 - 0.22 \times 1 - 0.2 - 0.4 \left(\frac{1.75}{2} + 0.25 \right)$$
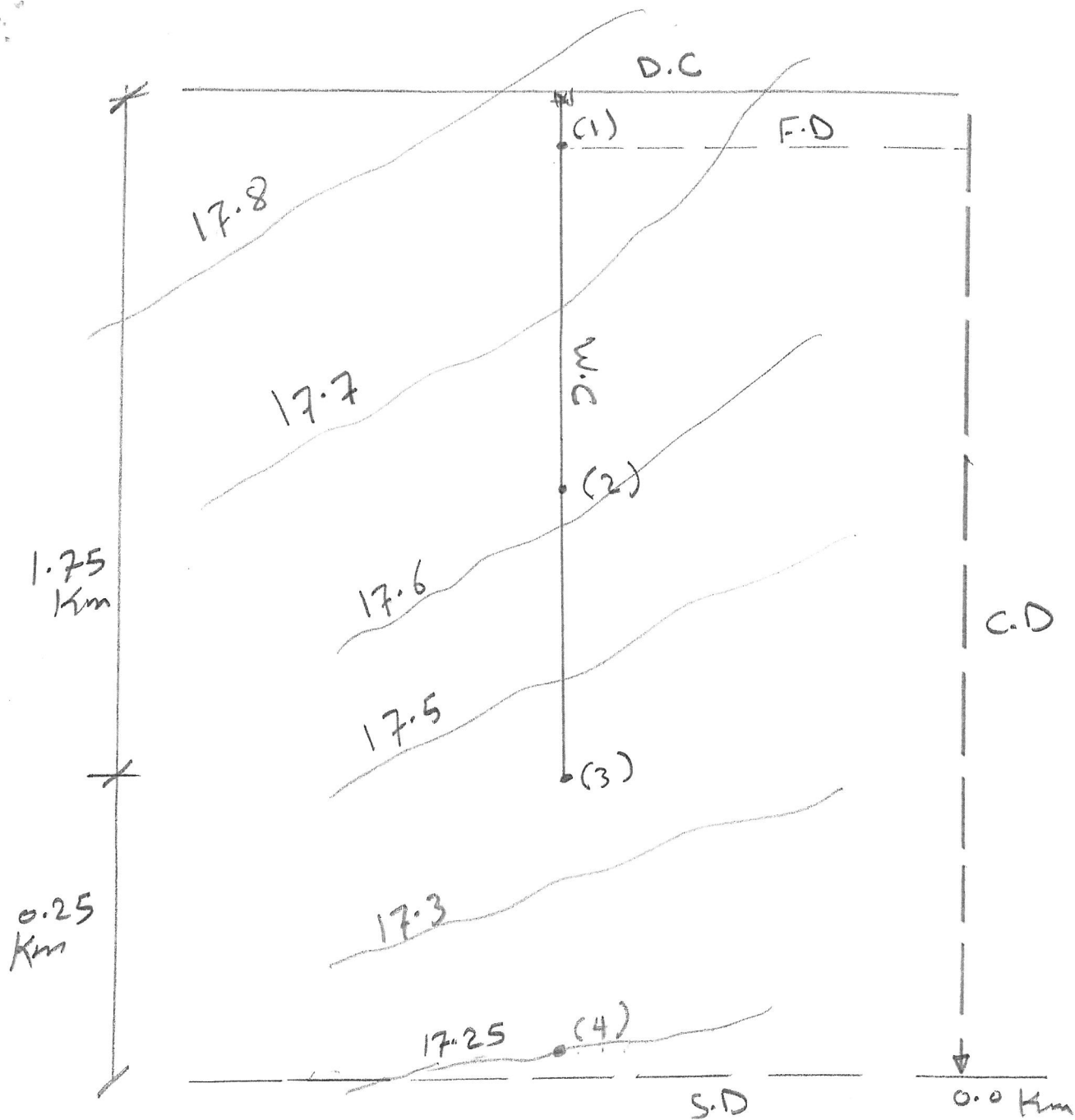$$= \boxed{14.75\,m}$$

3- w.L @ Km 0.0 to the drain from point (3)

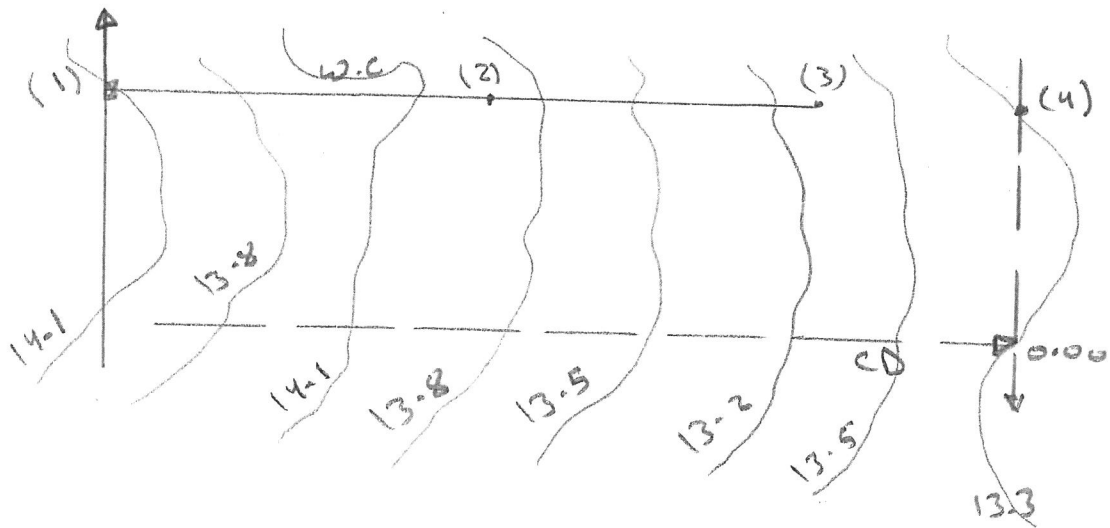$$= 17.35 - 2 - 0.22 \times 1 - 0.2 - 0.4 \times 0.25$$
$$= \boxed{14.83\,m}$$

4- w.L @ Km 0.0 to the drain from point (4)

$$= 17.25 - 2 - 0.22 \times 1 - 0.2 = \boxed{14.83\,m}$$

$$\therefore W.L @ Km\ 0.0\ of\ C.D = 14.53\,m$$

D.C

(1)

17.8

F·D

17.7

W.C

(2)

1.75
Km

17.6

17.5

C.D

(3)

0.25
Km

17.3

17.25   (4)

S.D

0.0 Km

Ex Find the required water level at Km 0.00 of CD. The length of WC is 900 m & length of CD is 1200 m. $S_{max_{CD}} = 60 \text{ cm/km}$, $S_{min_{CD}} = 25 \text{ cm/km}$

sol.

$$S = \frac{14 - 13.3}{1.2} \times 100 = 58.3 \text{ cm/km} \approx 60 \text{ cm/km}$$

w.L @ Km 0.0 to CD from point (1)

$$= 14.1 - 2 - 0.22 \times 1 - 0.2 - 0.6 \times \frac{1200}{1000} = 10.96 m$$

w.L @ Km 0.00 to CD from point (2)

$$= 13.9 - 2 - 0.22 \times 1 - 0.2 - 0.6\left(1.2 - \frac{0.9}{2}\right) = 11.03 m$$

w.L @ Km 0.0 to CD from point (3)

$$= 13.3 - 2 - 0.22 \times 1 - 0.2 - 0.6\left(1.2 - 0.9\right) = 10.7 m$$

w.L @ Km 0.0 to CD from point (4)

$$= 13.3 - 2 - 0.22 \times 1 - 0.2 = 10.88 m$$

∴ w.L @ Km 0.0 of CD = 10.7 m

Ex The length of MD is 4.25 km, water level at the begining of LD8 = 42.35 m & LD5 = 42 m. The slope along MD & LD is 100cm/... water level difference between LD & MD is 40cm. Find the water level along MD and at the end of each L.D & sketch the longitudinal water level profile of M.D.

Station (Km)	0.5	1.25	2.1	2.8	3.5	4.25
L.D	2	1	4	3	6	5, 8
length (m)	5000	4500	6000	4000	4500	3000, 5000
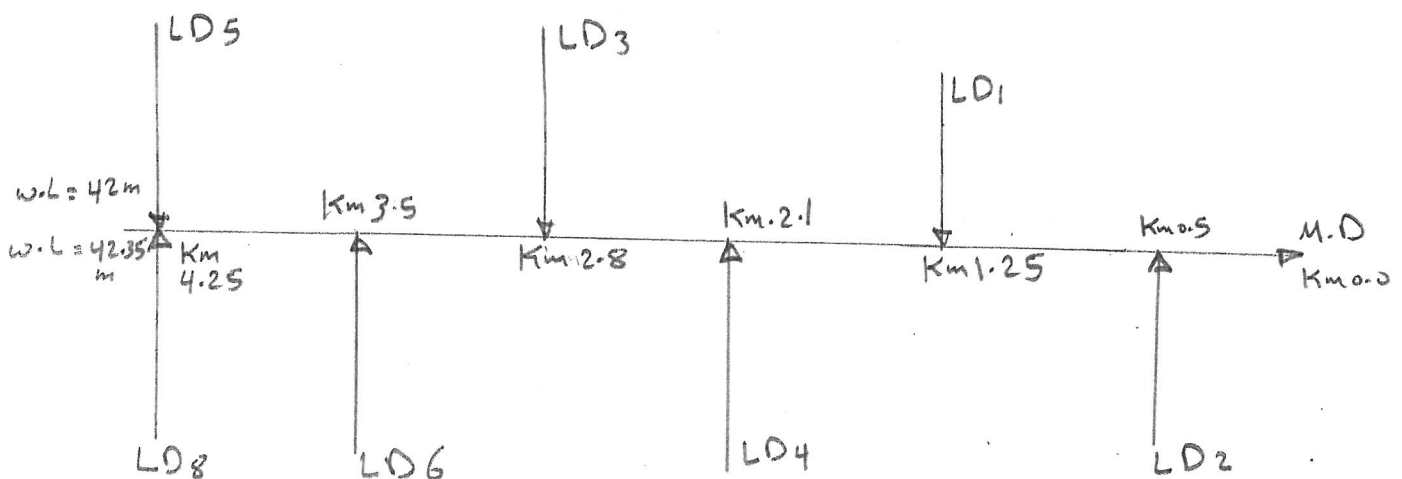
$w.L @ Km\,0.0\ MD = 42 - \underline{0.4} - \dfrac{100\,cm/km}{100} \times 4.25 = 37.35\,m$

(head difference) in w.L

$w.L @ Km\,0.5\ MD = 37.35 + 1 \times 0.5 = 37.85\,m$

$w.L @ Km\,1.25\ MD = 37.35 + 1 \times 1.25 = 38.6\,m$

$w.L @ Km\,2.1\ MD = 37.35 + 1 \times 2.1 = 39.45\,m$

$w.L @ Km\,2.8\ MD = 37.35 + 1 \times 2.8 = 40.15\,m$

$w.L @ Km\,3.5\ MD = 37.35 + 1 \times 3.5 = 40.85\,m$

$w.L @ Km\,4.25\ MD = 37.35 + 1 \times 4.25 = 41.6\,m$

$$\boxed{\begin{aligned}
\text{W.L} @ \text{Km}_{0.0} \text{LD} &= \text{W.L}_{\text{M.D Km}_{of\ L.D}} + \text{head difference in (W.L)} \\
\text{OR} \qquad &= \text{W.L}_{\text{M.D}_{\text{Km}_{0.0}}} + \underset{\text{M.D}}{S} \times \underset{\text{M.D}}{L} + \text{h.diff.}
\end{aligned}}$$

$$\begin{aligned}
\text{W.L} @ \text{Km}_{0.0} \text{LD}_2 &= \text{W.L}_{\text{Km}_{0.5}\text{M.D}} + \text{h diff} \\
&= 37.85 + 0.4 = 38.25\,m
\end{aligned}$$

$$\text{W.L} @ \text{end } \text{LD}_2 = 38.25 + \underset{S \times L}{\boxed{1 \times 5}} = 38.75\,m$$

$$\text{W.L} @ \text{Km}_{0.0} \text{LD}_1 = 38.6 + 0.4 = 39\,m$$
$$\text{W.L} @ \text{end } \text{LD}_1 = 39 + 1 \times 4.5 = 43.5\,m$$

$$\text{W.L} @ \text{Km}_{0.0} \text{LD}_4 = 39.45 + 0.4 = 39.85\,m$$
$$\text{W.L} @ \text{end } \text{LD}_4 = 39.85 + 1 \times 6 = 45.85\,m$$

$$\text{W.L} @ \text{Km}_{0.0} \text{LD}_3 = 40.15 + 0.4 = 40.55\,m$$
$$\text{W.L} @ \text{end } \text{LD}_3 = 40.55 + 1 \times 4 = 40.95\,m$$

$$\text{W.L} @ \text{Km}_{0.0} \text{LD}_6 = 40.85 + 0.4 = 41.25\,m$$
$$\text{W.L} @ \text{end } \text{LD}_6 = 41.25 + 1 \times 4.5 = 45.75\,m$$

$$\text{W.L} @ \text{end } \text{LD}_5 = 42 + 1 \times 3 = 45\,m$$
$$\text{W.L} @ \text{end } \text{LD}_8 = 42.35 + 1 \times 5 = 47.35\,m$$

Design data (Q , A , S)

3	
37·35	
37·85	LD2 — 38·25m
38·6	LD1 — 39 m
39·45	LD4 — 39·85 m
40·15	LD3 — 40·55m
40·85	LD6 — 41·25
41·6	LD5 42m / LD8 42·35m
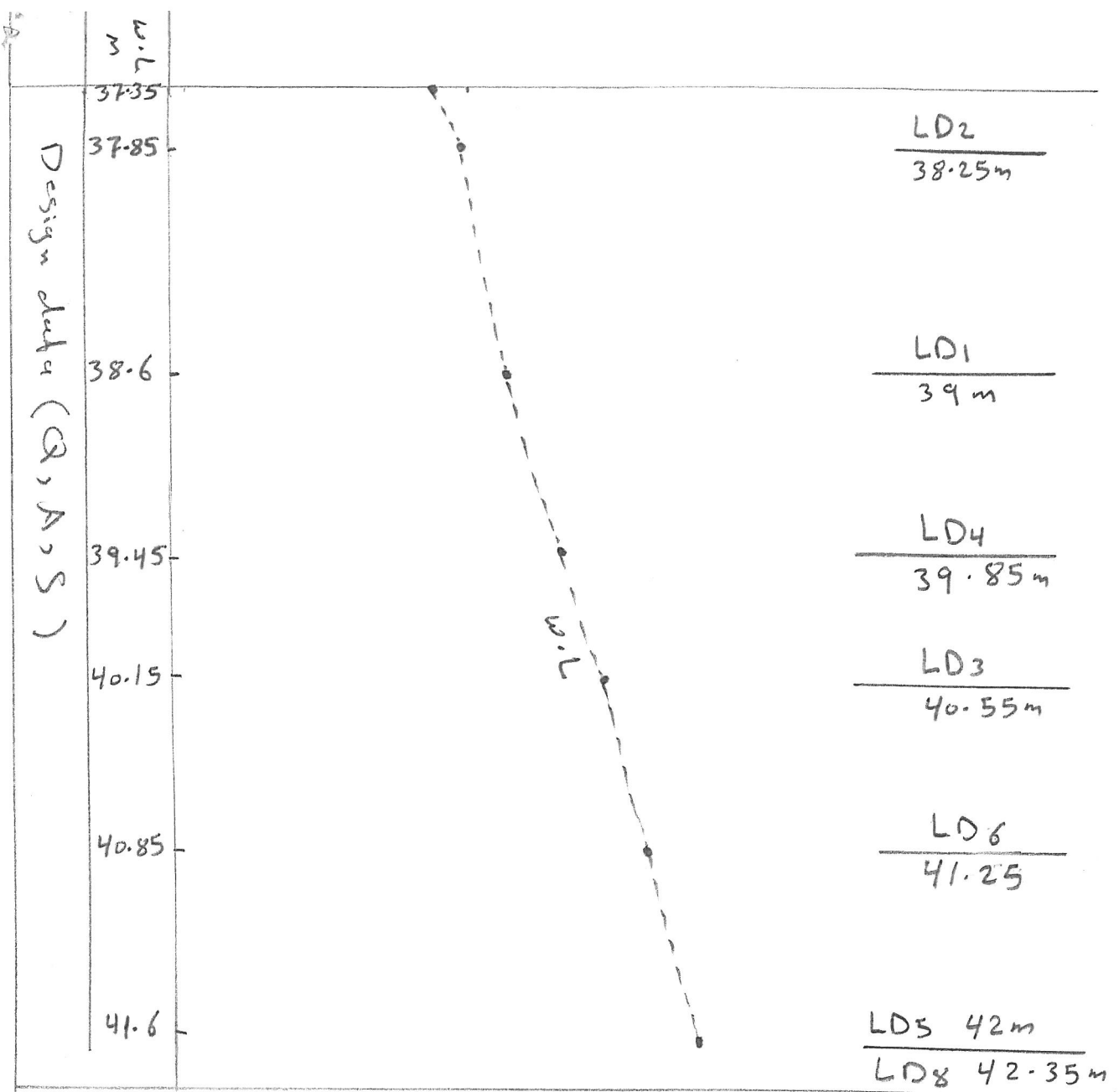
Ex The length of odd lateral drain is 3 km, while the length of even lateral drain is 4 km, the slopes of main drain and lateral drain are 40 cm/km & 25 cm/km respectively. The minimum difference in water level between the main drain & lateral drain is 30 cm. The water level at km 0.0 of main drain is 29 m. Find the water level at the ends of LD_2 & LD_3, draw the longitudinal water level profile for the main drain.
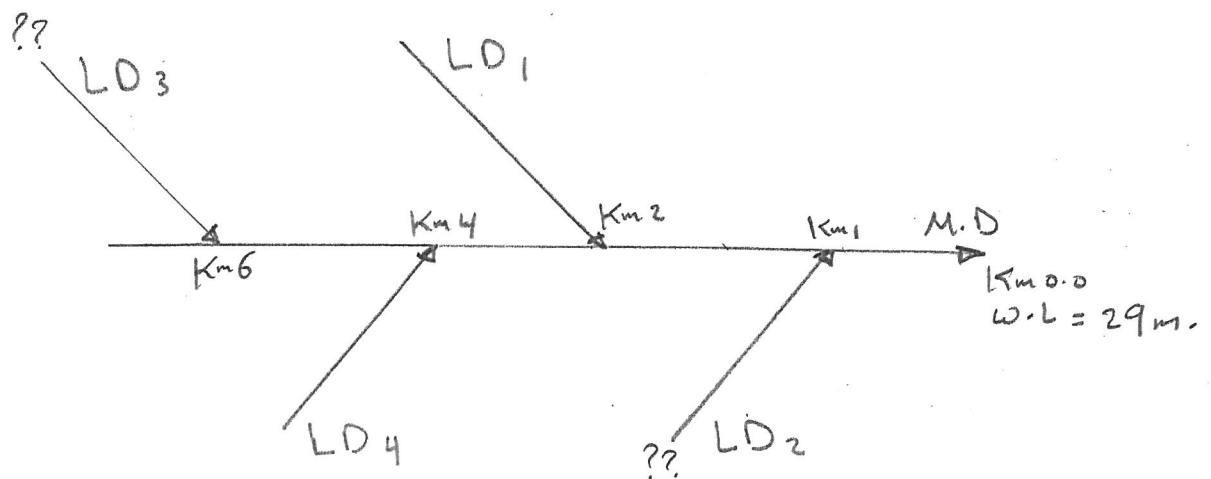
w.L @ km 0.0 MD = 29 m

w.L @ km 1 MD = 29 + 0.4 × 1 = 29.4 m

w.L @ km 0.0 of LD_2 = 29.4 + ⓮.3 = 29.7 m → head diff. (h diff)

w.L @ end of LD_2 = 29.7 + 0.25 × 4 = 30.7 m

w.L @ km 6 MD = 29 + 0.4 × 6 = 31.4 m

OR = 29.4 + 0.4 × (6−1) = 31.4 m

w.L @ km 0.0 LD_3 = 31.4 + 0.3 = 31.7 m

w.L @ end LD_3 = 31.7 + 0.25 × 3 = 32.45 m