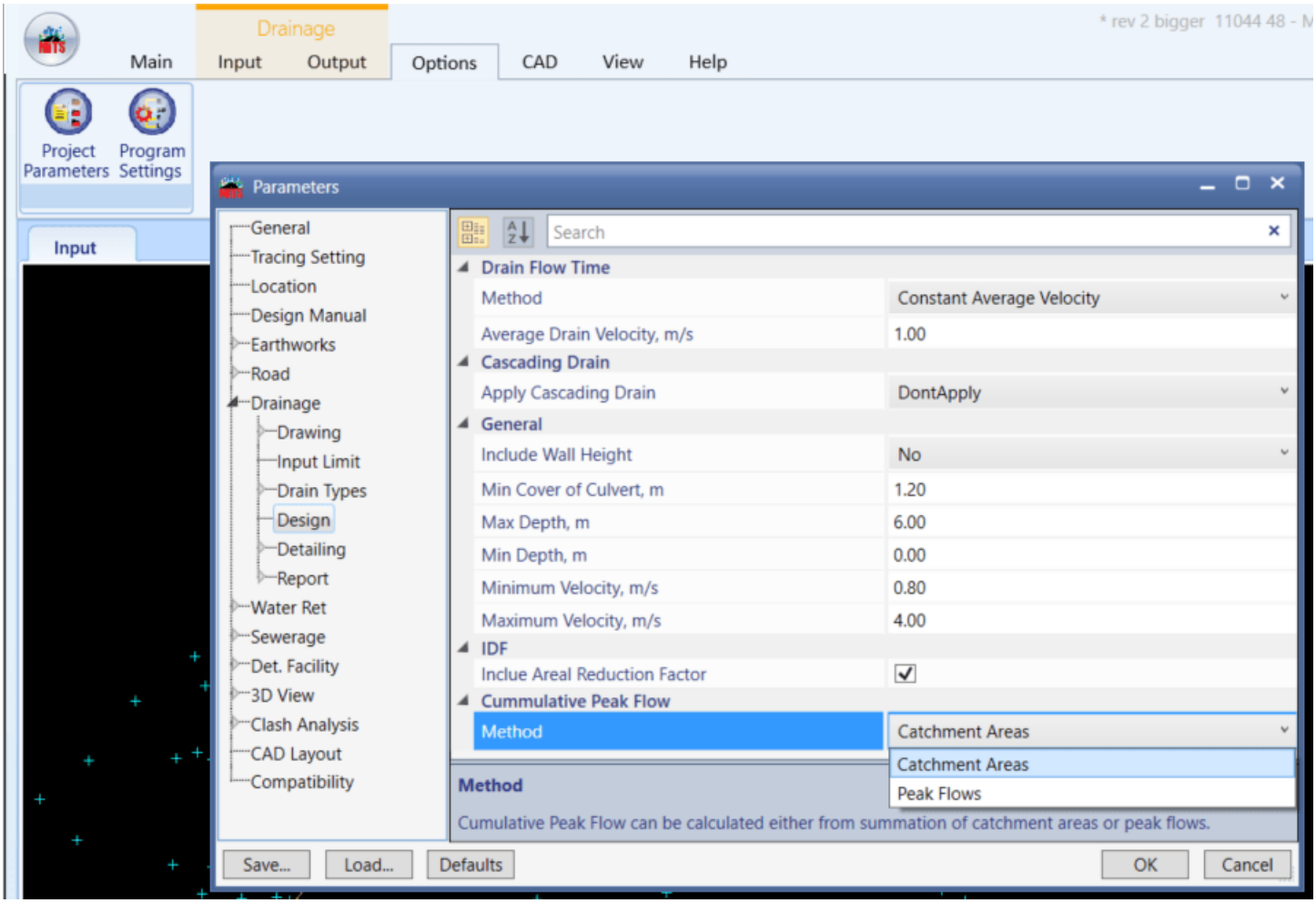
Why Does The Drain Dimension Is Smaller Than The Previous Drain ?

Drain · https://mes100.com/docs/why-does-the-drain-dimension-is-smaller-than-the-previous-drain/

Project = **Project 1**

You might encounter a situation where some of the drains are smaller than the previous drain dimension, which is not supposed to happen because of course the water flow is not supposed to suddenly disappear in the drain and causes the dimension to be smaller.

If you encounter this, you may need to change the discharge calculation method to Peak Flows Method. To change the methods, click on “Options > Project Parameters > Drainage > Design > Cumulative Peak Flow > Method



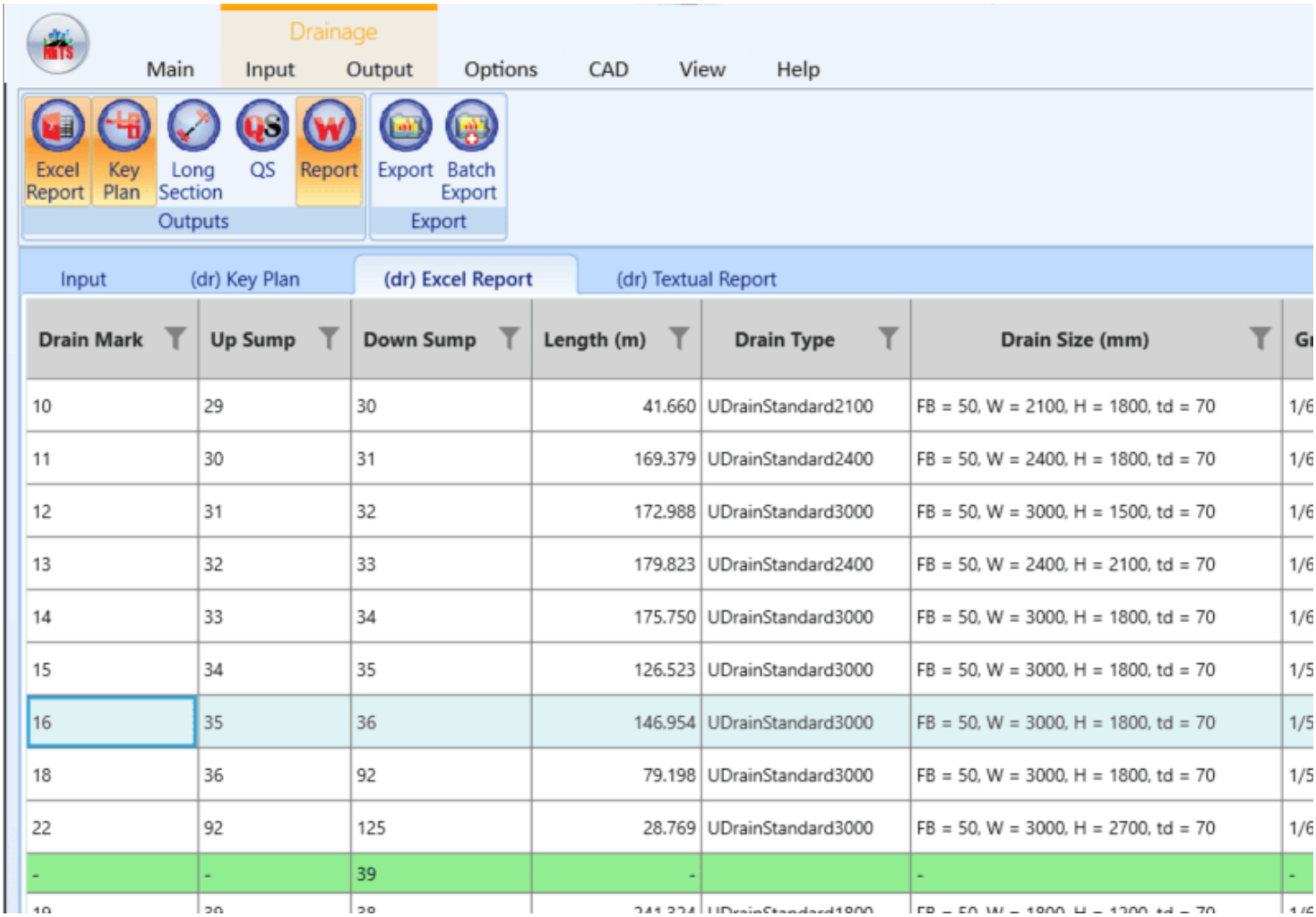
There are two options of calculating the discharge in MiTS, which are Catchment Flows and Peak Flows method. These two methods are important during the analysis in drainage as it will control the output, especially the dimension.

Peak Flows Method

The calculation of the Peak Flow Method depends on the cumulative calculation of peak flow. It is crucial to determine the dimension of the drains, as the total effective catchment areas and the total peak flows are considered in the consecutive drain designs.

Below are the examples of calculation, which you may compare between these two methods.

Results:

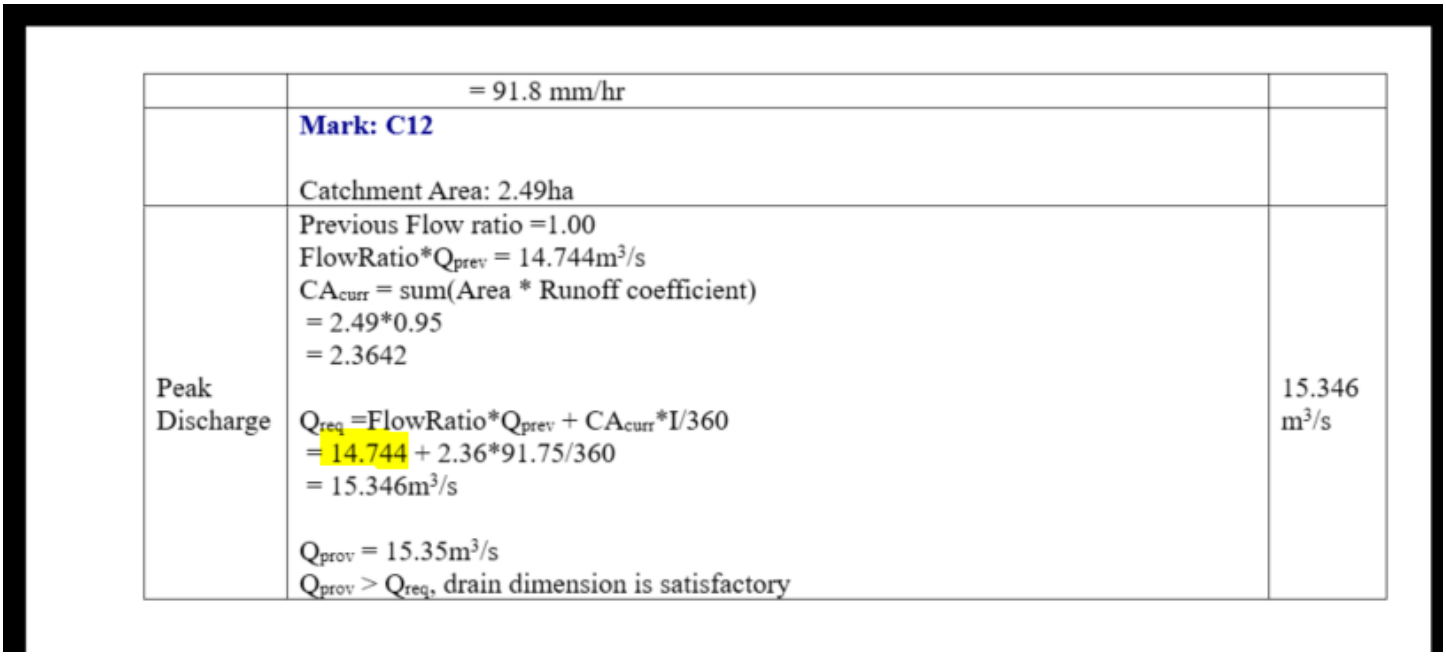


Drain Mark	Up Sump	Down Sump	Length (m)	Drain Type	Drain Size (mm)	G
10	29	30	41.660	UDrainStandard2100	FB = 50, W = 2100, H = 1800, td = 70	1/6
11	30	31	169.379	UDrainStandard2400	FB = 50, W = 2400, H = 1800, td = 70	1/6
12	31	32	172.988	UDrainStandard3000	FB = 50, W = 3000, H = 1500, td = 70	1/6
13	32	33	179.823	UDrainStandard2400	FB = 50, W = 2400, H = 2100, td = 70	1/6
14	33	34	175.750	UDrainStandard3000	FB = 50, W = 3000, H = 1800, td = 70	1/6
15	34	35	126.523	UDrainStandard3000	FB = 50, W = 3000, H = 1800, td = 70	1/5
16	35	36	146.954	UDrainStandard3000	FB = 50, W = 3000, H = 1800, td = 70	1/5
18	36	92	79.198	UDrainStandard3000	FB = 50, W = 3000, H = 1800, td = 70	1/5
22	92	125	28.769	UDrainStandard3000	FB = 50, W = 3000, H = 2700, td = 70	1/6
-	-	39	-		-	-

Drain 15 and Drain 16 are taken as examples and the dimensions generated are the same. By using this method, there is no chance of getting a smaller drain in the consecutive connected drains, as the peak discharge of the previous drains are evaluated as well.

Textual Report:

Refer to Drain 16 detailed calculation in the textual report. Notice that in the Peak Discharge, the previous peak discharge (Drain 15) is also calculated in order to determine the drain peak discharge.



	= 91.8 mm/hr	
	Mark: C12 Catchment Area: 2.49ha	
Peak Discharge	Previous Flow ratio =1.00 FlowRatio*Q_{prev} = 14.744m^3/s CA_{curr} = sum(Area * Runoff coefficient) = 2.49*0.95 = 2.3642 Q_{req} =FlowRatio*Q_{prev} + CA_{curr}*I/360 = 14.744 + 2.36*91.75/360 = 15.346m^3/s Q_{prov} = 15.35m^3/s Q_{prov} > Q_{req}, drain dimension is satisfactory	15.346 m^3/s

Drain 16 peak discharge

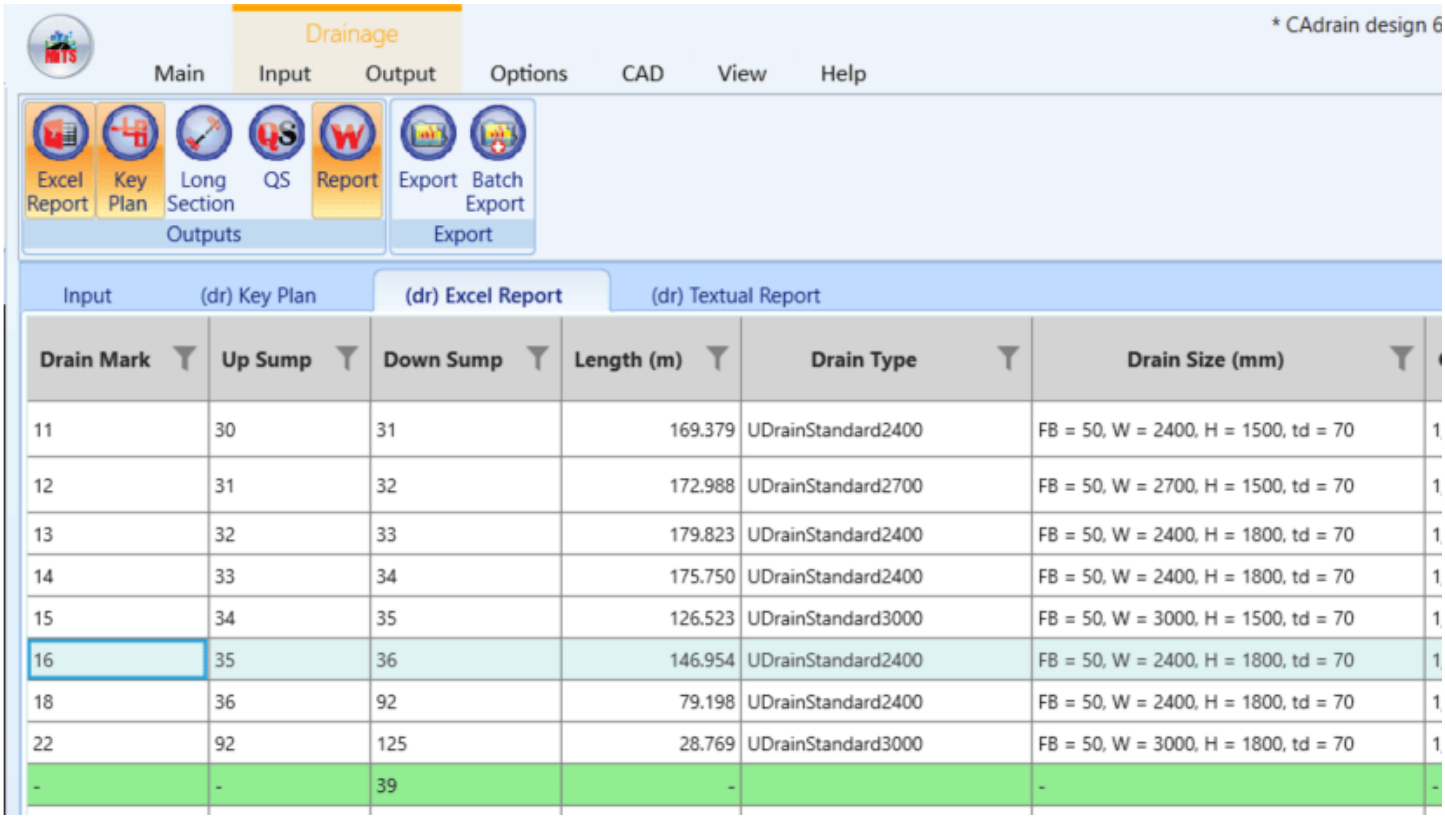
The highlighted 14.744 is the peak discharge of the previous drain which is Drain 15. The discharge is summed up with the current drain (Drain 16). Therefore, the dimension of the drain is proposed based on this peak discharge.

Catchment Areas Method

Catchment Area method is calculated based on individual calculation of its own effective peak discharge, without considering the previous drains. The discharge is calculated by summing up the C*A contribution from all of the previous connecting drains first, and then only multiplying it with its own Intensity, and since this Intensity can differ from previous drain, this may result in a smaller peak discharge compared to previous drains, and hence smaller drain size.

Below are the examples of calculation by using the catchment areas method.

Result:



Drain Mark	Up Sump	Down Sump	Length (m)	Drain Type	Drain Size (mm)	
11	30	31	169.379	UDrainStandard2400	FB = 50, W = 2400, H = 1500, td = 70	1
12	31	32	172.988	UDrainStandard2700	FB = 50, W = 2700, H = 1500, td = 70	1
13	32	33	179.823	UDrainStandard2400	FB = 50, W = 2400, H = 1800, td = 70	1
14	33	34	175.750	UDrainStandard2400	FB = 50, W = 2400, H = 1800, td = 70	1
15	34	35	126.523	UDrainStandard3000	FB = 50, W = 3000, H = 1500, td = 70	1
16	35	36	146.954	UDrainStandard2400	FB = 50, W = 2400, H = 1800, td = 70	1
18	36	92	79.198	UDrainStandard2400	FB = 50, W = 2400, H = 1800, td = 70	1
22	92	125	28.769	UDrainStandard3000	FB = 50, W = 3000, H = 1800, td = 70	1
-	-	39	-		-	-

As an example above, Drain 16 is smaller than the previous drain which is Drain 15. Refer to the Textual Report for more detailed calculation.

Textual Report:

As detailed calculations are shown, the drain 16 is smaller than the drain 15. Although they are connected, since the catchment area method has been used, therefore the calculation of the dimension is iterated based on individual discharge.

Plan (dr) Excel Report (dr) Textual Report

Drain Mark [15]

From Node	34
To Node	35
Drain Type	UDrain
Drain Dimension	FB = 50, W = 3000, H = 1500,td =70
Drain Length	126.523m
Cross-sectional area of flow (A)	4.345m^2
Wetted Perimeter	5.818m
Hydraulic Radius	0.747m

Reference	Calculation	Output
Manning coefficient, n	For composite manning coefficient, it can be calculated from its parts by $\Sigma P_i n_i/(\Sigma P_i)$ Where P_i is the Perimeter for the i-side Where n_i is the Manning coefficient for the i-side Thus, composite manning coefficient =0.0131	n =0.0131
Gradient	Friction Slope of Drainage = 1/600 Frictional slope of Drainage is satisfactory	1 / 600
Velocity (V)	$=1/n*R^{2/3}S^{1/2}$ $=1/0.0131*0.7468^{2/3}*1/600.0^{1/2}$ =2.561m/s The drain velocity is OK	2.561m /s

Drain 15 cross sectional area 4.345 m2

Plan (dr) Excel Report (dr) Textual Report

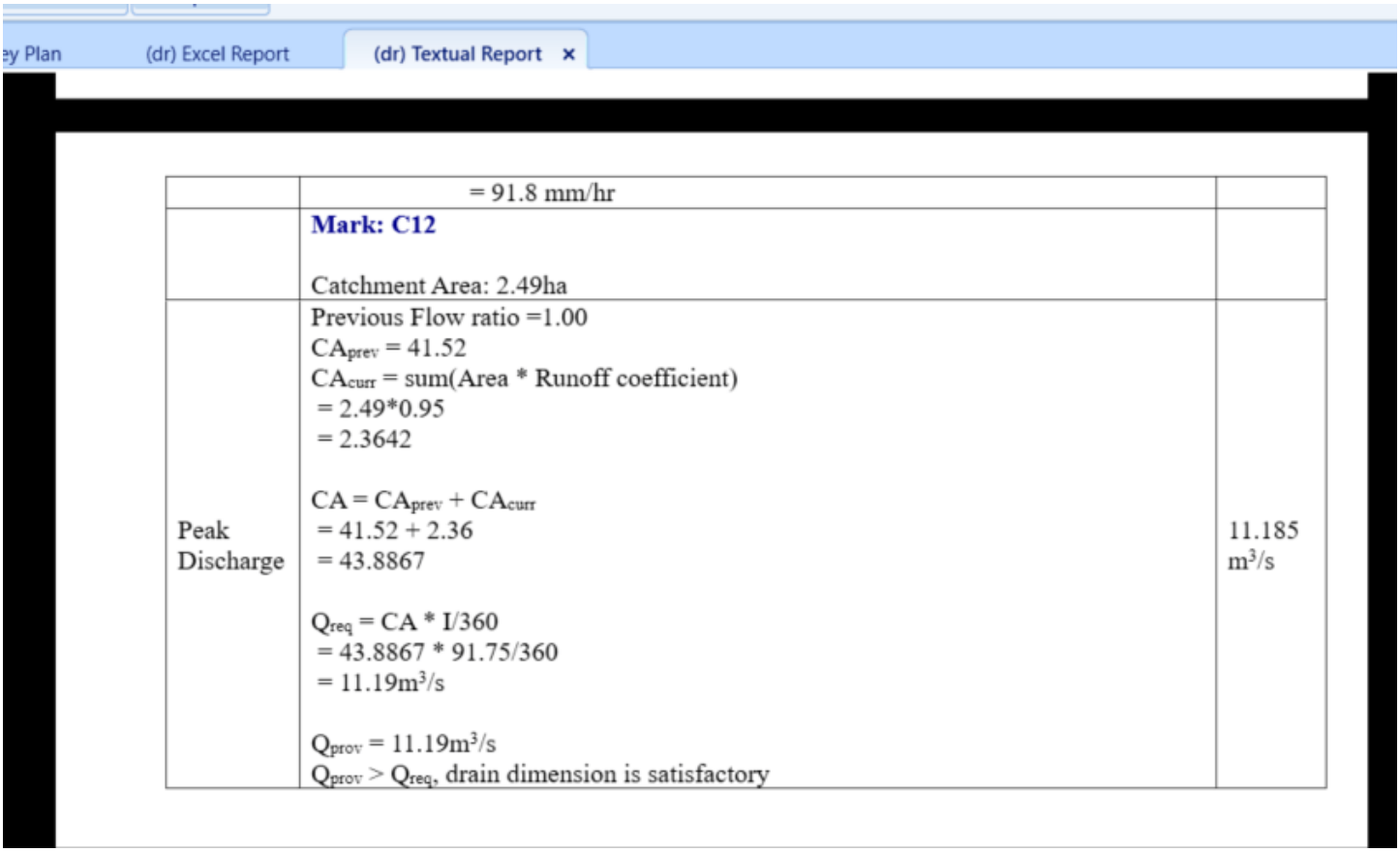
Drain Mark [16]

From Node	35
To Node	36
Drain Type	UDrain
Drain Dimension	FB = 50, W = 2400, H = 1800,td =70
Drain Length	146.954m
Cross-sectional area of flow (A)	4.195m^2
Wetted Perimeter	5.818m
Hydraulic Radius	0.721m

Reference	Calculation	Output
Manning coefficient, n	For composite manning coefficient, it can be calculated from its parts by $\Sigma P_i n_i/(\Sigma P_i)$ Where P_i is the Perimeter for the i-side Where n_i is the Manning coefficient for the i-side Thus, composite manning coefficient =0.0131	n =0.0131
Gradient	Friction Slope of Drainage = 1/528 Frictional slope of Drainage is satisfactory	1 / 528
Velocity (V)	$=1/n*R^{2/3}S^{1/2}$ $=1/0.0131*0.7211^{2/3}*1/528.2^{1/2}$ =2.666m/s The drain velocity is OK	2.666m /s

Drain 16 cross sectional area 4.195 m2

Below is an example of the peak discharge calculation of Drain 16. The peak discharge only considers the cumulative calculation of the effective catchment with the previous drain and peak discharge of the prior drain is disregarded.



	= 91.8 mm/hr	
	Mark: C12 Catchment Area: 2.49ha	
Peak Discharge	Previous Flow ratio =1.00 CA_{prev} = 41.52 CA_{curr} = sum(Area * Runoff coefficient) = 2.49*0.95 = 2.3642 $CA = CA_{prev} + CA_{curr}$ = 41.52 + 2.36 = 43.8867 $Q_{req} = CA * I/360$ = 43.8867 * 91.75/360 = 11.19m^3/s Q_{prov} = 11.19m^3/s $Q_{prov} > Q_{req}$, drain dimension is satisfactory	11.185 m^3/s

Hence, you may find that some of the drain may be smaller than than the previous drains. And if you want to change it the way software calculates it, change the method as explained in the above section (Peak Flows Method)

Related



Ngu Soon Hui

I'm the Benevolent Dictator for Life for MiTS Software cum Editor of this website. Read more here.

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