

Designer's Response

Project	Bonhams Field, Yapton
Project Number	23018

Comments Received From Arun District Council

Date Comments Received 5 January, 12 January, 16 February 2021, 16 March 2021

Date of Response 29 March 2021 (Resubmission of Discharge of Conditions Application).



Comment / Query		Designer's response
1	<u>Arun District Council comment 5 January 2021</u> You have indicated that sub-bases will be stepped in several locations and that baffles will be used. The construction detail says these baffles are to have a minimum height of 250mm. You have not allowed for these baffles in calculations. I have completed some hand calculations based upon baffles at 250mm in Area B and it appears that flooding would occur at the bottom. Please could you review all required baffle heights-	The sub-catchment baffles have been removed and a flat formation will be introduced as per the main catchments. Updated calculations are provided to reflect the new formation level where required.



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	<u>Arun District Council comment 12 January 2021</u> Okay, you didnt need to remove them just re consider heights, but the solution you have provided technically works.	Noted
2	<u>Arun District Council comment 5 January 2021</u> Some areas appear to achieve insufficient storage depths in reality. I.e. taking invert levels and construction depths the required formation level exceeds that stated on plan. Please review.	We have reviewed this and updated some catchments where the lowering of formation levels is required to achieve the minimum 450mm thickness throughout to provide sufficient thickness for an assumed CBR value of between 2-5%. Other than Catchment F and H which require 477mm and 505mm thickness of voided subbase, surface water storage for all other catchments require between 180mm to 413mm of void subbase for the attenuation of surface water. A flat formation is to be used throughout all catchments and the construction detail on Drawing 1501B has been updated
	<u>Arun District Council comment 12 January 2021</u> Now okay.	OK.
3	<u>Arun District Council comment 5 January 2021</u> An urbanisation allowance has not been applied. Please apply an appropriate allowance.	An 'urban creep' allowance of 10% have been added to all roof areas within the revised calculations attached. Catchment A comprises permeable paving only.

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3	<u>Arun District Council comment 12 January 2021</u> Okay, when full revised details pack is submitted please include and updated catchment areas diagram.	OK. We have included the 10% urban creep for roof areas in brackets on the catchment plan attached, which is reflected in the calculations
3	<u>Arun District Council comment 16 February 2021</u> Okay.	
4	<u>Arun District Council comment 5 January 2021</u> A factor of safety of 2 has been used throughout. This is low. We would like to see a factor of safety of 4 applied to catchment areas greater than 1000m². We see this as a substantial compromise upon the table contained within our checklist.	As per Section 25.6 of CIRIA C753 guidance engineering judgement has been used to determine that the Factor of Safety of 2 is sufficient when full BRE 365 testing has been completed during the winter months. The table referenced within the Arun District Council checklist uses modified values from Table 25.2 contained within SuDS Manual C753 which includes a note stating 'Note: not relevant for BRE Method' as per the attached screenshot. This is therefore not considered to be applicable as we are not designing using Bettess (1996) and therefore the design is fully in accordance with CIRIA C753. A Factor of Safety of 2 is more than sufficient in this case given the reasons stated.
4	<u>Arun District Council comment 12 January 2021</u> You are not using the BRE method for design, as you are only using the base. Therefore please comply with previous requirement.	Following our discussions we have updated all calculations to include a Factor of Safety of 4 and updated subbase depth accordingly. This has increased subbase depth by a maximum of 70mm, which is in Catchment H. As discussed the half drain time for the 1 in 100 plus 40% storm event is increased to almost 33 hours which was agreed as acceptable during our recent meeting. The drawings have been updated to reflect this change.

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	<u>Arun District Council comment 16 February 2021</u>	
4	This is not an entirely accurate representation of our discussions. Features must half drain within 24 hours for the 1 in 10 year plus 40% cc event, as detailed this is the absolute minimum requirement and can be applied instead of the 100 year plus cc event when agreed by the local engineer. Please supply half drain times for the 1 in 10 year plus cc event for all features where half drain time exceeds 24 hours for the 1 in 100 year plus cc event.	As requested, we have provided the half drain times for the 1:10 year event, with a 40% allowance for climate change, to ensure that half storage is still available within the voided subbase after 24 hours if the half drain time for the 1:100-year event using the requested Factor of Safety of 4 and a 40% allowance for climate change cannot be achieved. A summary table, confirming compliance, has been provided in the revised Discharge of Conditions Technical Note capturing the half drain times for each catchment.
4	Catchment F has a FOS of 2 applied in calculations.	We have revised the calculations to meet the set criteria with all catchments now using the requested Factor of Safety of 4, this has increased the thickness of the voided subbase required in Catchments F and H by 120mm and 140mm respectively within these catchments.

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	<u>Arun District Council comment 16 March 2021</u>	
4	You have not provided calculations showing the half drain time for the 10 year plus cc event for catchments F and H. The only half drain times provided in calculations are for the critical 100 year plus 40%cc event. The table in your report states that the half drain time for the 10 year plus cc event for catchment H is 960mins. This appears to be the node event, rather than the half drain time.	The half drain times have been based upon the peak storage requirement for the 1:10 year storm event with a 40% allowance for climate change as the infiltration blankets storage systems for both Catchments F and H only reach half capacity during the critical storm for this event, therefore the node event has been referenced. Catchment F and H have been designed to provide twice the storage required for the critical 1:10 year storm event with a 40% allowance for climate change. When the critical storage requirements for this storm event occurs the system only reaches half full (or half drained) meaning a replica storm within a 24-hour period could still be accommodated, therefore the request has been met. Without lowering the cover level of the storage node Causeway Flow does not accurately record the half drain time for the 1:10 plus 40% climate change allowance storm event. We have therefore provided screenshots showing the Causeway Flow outputs for the critical 1:10 plus 40% climate change allowance storm which demonstrates the system only reaches 50% capacity for this storm event, which are located at the rear of this design response.

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5	<u>Arun District Council comment 5 January 2021</u> I note that in areas G and H you are proposing to locally deepen the sub-base around diffusers. Inlets should be set above the 1 in 10 year plus 40% cc event water level, they certainly should not be set below the base. Please reconsider the design here and check all areas have inlets set above the 1 in 10 year plus 40% climate change water level.	Further to the revisions above we have removed the locally thickening with the diffuser tanks have now been placed just above the formation level in these catchments, which is the highest point the diffuser tank can be set to ensure that minimum pipe falls and cover levels can be achieved.
5	<u>Arun District Council comment 12 January 2021</u> There are many areas where incoming connections are set below the 1 in 10 year, let alone 1 in 10 year plus 40% water level. This is not acceptable, please review. There is even one diffuser tank proposed below formation level. I note your comments about minimum falls, however your current proposals do not meet requirements. You may need to take some of the downpipes to more local features in some locations.	All diffusers are now either at or above formation level as discussed. This has been accepted elsewhere by Arun District Council including on Planning Application A/79/20/DOC approved in July 2020
	<u>Arun District Council comment 16 February 2021</u>	
5	Policy requirement for major applications is to have all incoming connections set above the 1 in 10 year plus climate change event water level. The policy requirement comes from both the suds manual and BRE365.	As previously stated, the diffuser box detail proposed was submitted to and approved previously by Arun District Council Local Planning Authority under Planning Application A/79/20/DOC which was approved in July 2020.

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5	Regarding the reference to BRE365 and The SuDS Manual, BRE365 was produced in 1991, specifically for the design of traditional concrete ring and trench soakaway systems in which the design criteria is the 1:10 year event. Due to the depth of the traditional soakaway systems, the incoming connection would be traditionally set at the top of the soakaway, typically no less than 1m below ground level. CIRIA C753 Report The SuDS Manual only shows examples of incoming connection above the 1:10 year storage for traditional soakaway systems. This is not directly comparable to the use of a shallow permeable paved drainage system and there are no requirements within The SuDS Manual for the 1:10 year event to be stored below the incoming connection. For permeable paving systems the SuDS Manual provides a detail in Figure 20.24 showing distribution boxes set at 50mm above the base of the permeable system with no reference to being above the 1:10 year event being made.

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5 The suds manual references that incoming flow to infiltrating structures should be free and unimpeded.	We cannot find the reference in the SuDS Manual to which Arun District Council has referred in their response. The following are the closest comments we have found, but they do not confirm the need for an inlet to a voided stone infiltration system to be set above the 1 in 10 year rainfall event. The SuDS manual notes <i>'Are there any constraints to water entry into existing pavement sub-base sections (on or adjacent to the site)?'</i> and that all inlets should be designed to <i>'deliver the required maximum flowrate freely from the upstream collection system'</i> In section 28.4 of SuDS Manual there is a section on inlets which notes <i>'Inlets raised above adjacent permanent water levels area generally recommended. Submerged inlets have the following potential risks:</i> • <i>Surcharging or backwater effect on the upstream surface water conveyance system'</i> The SuDS manual further provides an example of a diffuser unit discharging into subbase storage in Figure 20.24 of CIRIA Report C753 the SuDS Manual. This details a diffuser box which enters 50mm above the subbase formation level and is the detail included within the latest construction details drawing referenced in the latest Technical Note attached.
5 BRE365 makes you calculate the storage volume required between the base of the soakaway and the incoming invert for the 10 year event (based on the fact this is the design event in this section of the guidance), specifically "Storage must equal or be greater than inflow minus outflow, defined above, and is the required effective volume available between the base of the soakaway and the invert of the drain discharging to the soakaway."	As previously stated BRE365 is specifically for the design of traditional concrete ring and trench soakaway systems in which the design criteria is the 1:10 year event and is not directly comparable to the use of a shallow permeable paved drainage system. We have designed in accordance with Chapter 20 of CIRIA Report C753 The SuDS Manual.

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5 We acknowledge that on sites it will not always be possible to have the invert level above the 1 in 100 year plus climate change event storage but do require flow to be free and unimpeded for more frequent events. Please demonstrate that your design meets policy requirements.	As previously noted we have found no reference to free and 'unimpeded' flow within CIRIA Report C753 The SuDS Manual with reference to discharges into a voided subbase. The purpose of the diffuser box is to disperse and distribute surface water into the voided subbases stone without impeding flow. The way in which flow enters a voided subbase via a diffuser box is the same irrespective of whether the voided stone is lined or unlined. Applying guidance for traditional infiltration structures is not appropriate for shallow base draining permeable paving design. The design is in accordance with CIRIA Report C753 The SuDS Manual.

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5 I note that pipe falls of 150 diameter pipes are at 1:167, this is below the gradient required to achieve 1m/s self-cleansing velocity. Please ensure all pipes achieve minimum falls.	The surface water system will remain private and is not being offered for adoption. The design is in compliance with minimum velocity for Part H of building regulations, BS EN 752 and BS EN 16933-2 which specifies a self-cleansing velocity of 0.7m/s for drains and sewers of less than 300mm diameter. The system has been designed using a minimum velocity of 0.75 m/s which accords with the relevant regulations and standards. BS EN 16933-2 also states that in situations where self-cleansing conditions cannot be achieved provisions should be made for adequate maintenance activities. A robust maintenance plan has been put in place across the site which further supports the approach taken. Increasing the steepness of the gradients beyond those shown would cause a further increase in the depth of the diffuser boxes which have already been moved 5m from buildings and will compromise the ability to provide minimum cover on the pipes. This specific point was previously raised in relation to the Discharge of Conditions Planning Application for A/166/20/DOC. The design approach regarding self-cleansing velocities was accepted as part of Planning Condition 21 of Planning Application A/166/20/DOC which was approved by Arun District Council on 2 February 2021.

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	<u>Arun District Council comments 16 March 2021</u>	
5	Policy requirement for major applications is to have all incoming connections to infiltration devices set above the 1 in 10 year plus climate change event water level. You are not meeting this requirement. You must meet the policy requirement.	We request that the above industry guidance is considered against the policy, robust evidence provided within our response of 3 March 2021 and details previously approved as part of Planning Application Planning Application A/79/20/DOC which was approved in July 2020. CIRIA C753 Report The SuDS Manual clearly demonstrates a detail in Figure 20.24 for permeable paving systems the SuDS Manual provides showing distribution boxes set at 50mm above the base of the permeable system with no reference to being above the 1:10 year event being made. The Arun District Council policy referenced conflicts with this industry recognised guidance. We have designed in accordance with Chapter 20 of CIRIA Report C753 The SuDS Manual, which is the most suitable industry guidance in this instance.

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5	All pipes should achieve 1m/s self cleansing velocity.	We request our previous response from the 3 March 2021 is reviewed. This is a Sewers for Adoption requirement. The system is to remain private and not be offered for adoption. We have designed the system in compliance with minimum velocity for Part H of building regulations, BS EN 752 and BS EN 16933-2, which specifies a self-cleansing velocity of 0.7m/s for drains and sewers of less than 300mm diameter. Why is it being requested that our design is set to criterion other than the British Standards? This specific point was also previously raised in relation to the Discharge of Conditions Planning Application for A/166/20/DOC. Our design approach regarding self-cleansing velocities was accepted as part of Planning Condition 21 of Planning Application A/166/20/DOC which was approved by Arun District Council on 2 February 2021.
6	<u>Arun District Council comment 5 January 2021</u> Do you have the peak seasonal groundwater level at BH4 to mAOD? It appears that the base level of area G is very close to seasonal peak level here.	The ground level at BH4 was sited at approximately 6.1m AOD as identified on the Existing Site Layout Plan on Drawing 2 of the Appendices of the Discharge of Conditions Technical Note sent to you on Monday 4 January 2021. This indicates a peak water level of approximately 5.15m AOD, formation levels in this area are at 5.8m AOD as existing ground levels increase to 6.5m AOD immediately to the north of the of where BH4 was sited
	<u>Arun District Council comment 12 January 2021</u> Okay.	OK.

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7	<u>Arun District Council comment 5 January 2021</u> Please provide an exceedance flows drawing.	This is provided on Drawing 05 of the Discharge of Conditions Technical Note sent to you on Monday 4 January 2021. It should be noted that this scenario would only occur if there were a storm event larger than the 1:100 with a 40% climate change allowance, which has been used as the design event in this case and is regularly referred to as the 'exceedance event'
	<u>Arun District Council comment 12 January 2021</u> Apologies this does not load well for me due to the file size of the technical note. It only seems to show arrows off site. Please also indicate how exceedance flow will safely flow through the site.	We have updated the exceedance flow plan as requested, the latest plan is attached.
	<u>Arun District Council comment 16 February 2021</u> Okay.	
8	<u>Arun District Council comment 5 January 2021</u> Is terram to be provided to separate the sub-base from the clean stone on the permeable paving?	Yes, this has been provided on the latest revision of Drawing 1501B Construction Details which is attached.

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	<u>Arun District Council comment 12 January 2021</u> Okay. The baffle is stated to always be 450mm deep, yet you have two catchments where water level will exceed this. Should the baffle height be adjusted in these two catchments?	We have updated the construction detail and included a note that the baffle height will vary based on the minimum depth of the subbase shown on the General Arrangement drawing.
	<u>Arun District Council comment 16 February 2021</u> Okay.	
9	<u>Arun District Council comment 5 January 2021</u> How is the formation to be protected during construction?	This is referenced within Section 3.3 of the Discharge of Conditions Technical Note sent to you Monday 4 January 2021.
	<u>Arun District Council comment 12 January 2021</u> Please include a during construction detail on the detail drawings along with a note explaining at what stage the final construction is required. Are you confident that during construction you will not increase flood risk? Please also elaborate on when it is required for the final construction to be built.	We have updated this detail which provides a permeable surface during the construction phase, which will not only ensure that flood risk does not increase during construction but will also provide additional capacity beneath surface level compared to the existing made ground. The sacrificial layer will be removed from each area prior to the installation of the final geotextile, 3-6mm clean stone and block paving surface finish being applied.
	<u>Arun District Council comment 16 February 2021</u> Okay.	

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10	<u>Arun District Council comment 5 January 2021</u> Please detail how the maintenance will be funded, e.g. charge levied upon residents.	Yes, this has been revised within the updated Drainage Maintenance Manual which will follow on from this email.-
	<u>Arun District Council comment 12 January 2021</u> Okay.	OK.
11	<u>Arun District Council comment 5 January 2021</u> Please include requirements for monitoring of weed growth and removal from permeable paving.	Added to attached Drainage Maintenance Manual.
	Okay.	OK.
12	<u>Arun District Council comment 5 January 2021</u> Are service trenches required for the foul drainage?	No service trenches are required for the foul drainage.-
	<u>Arun District Council comment 12 January 2021</u> okay.	OK.

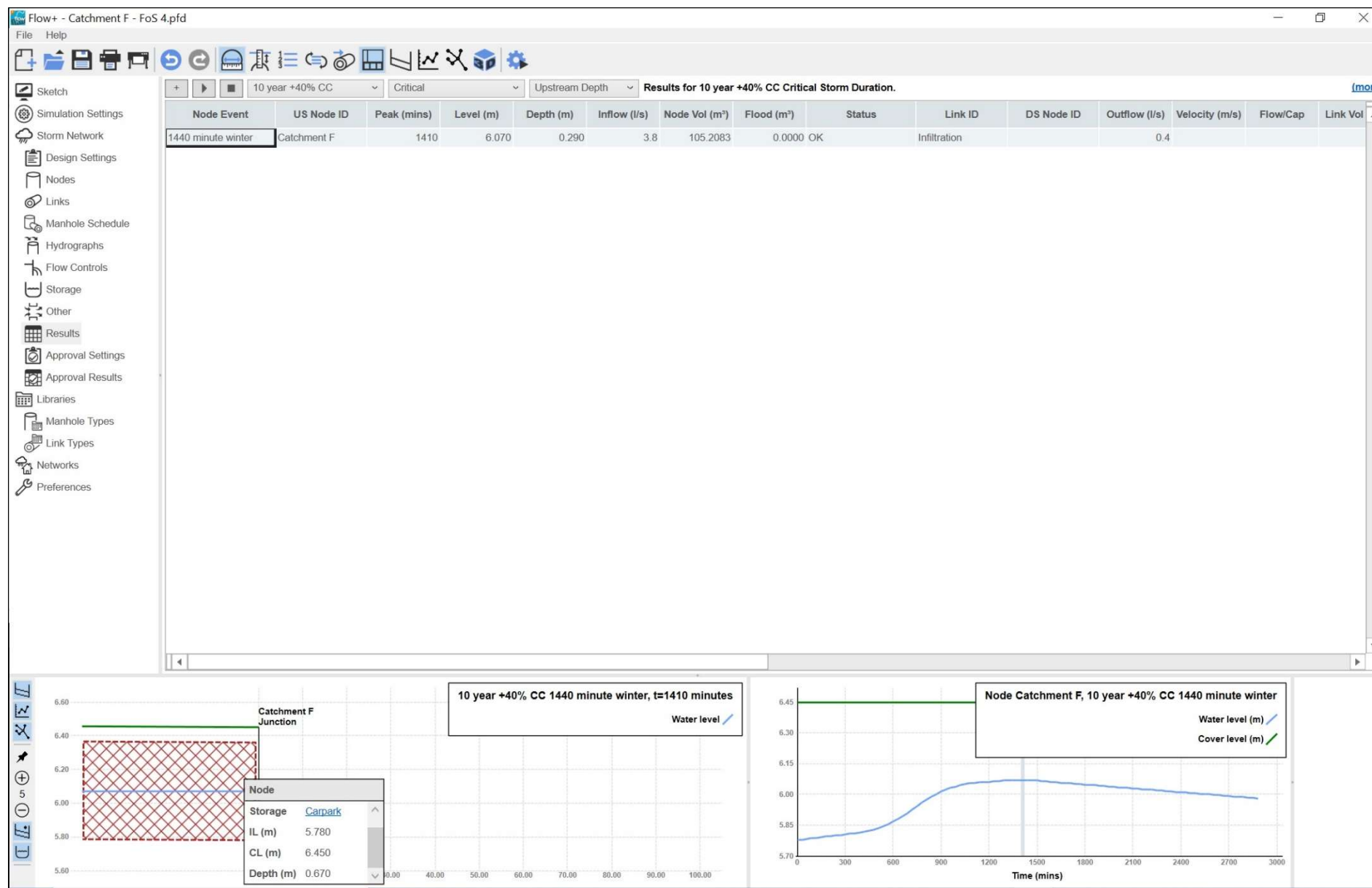


Image 1 - Catchment F – Causeway Flow Results for 1:10 plus 40% Allowance for Climate Change

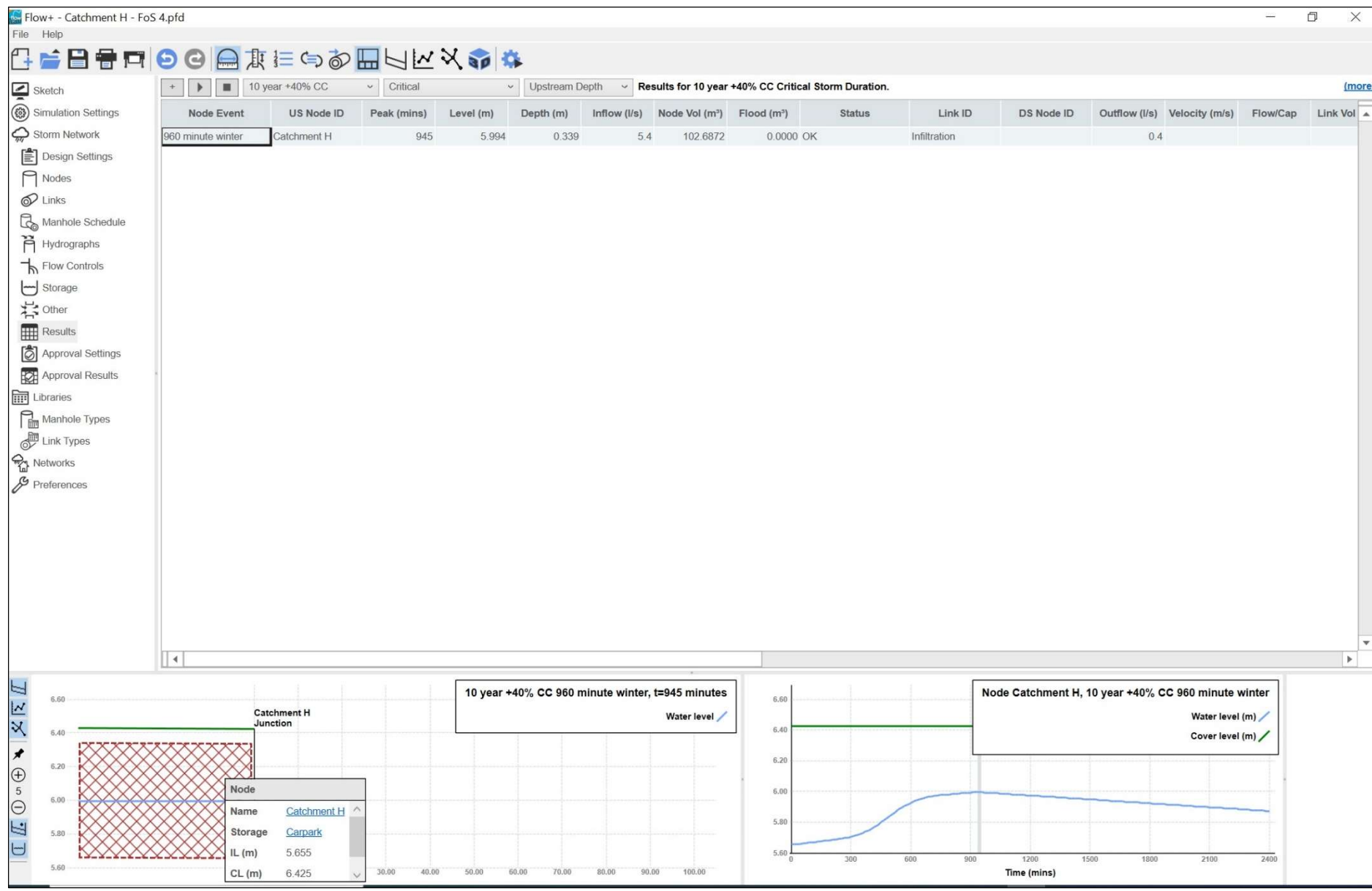


Image 2 - Catchment H – Causeway Flow Results for 1:10 plus 40% Allowance for Climate Change