TECHNICAL NOTE

JBA Project	2017s6312 - Caerleon Road, Dinas Powys
Client	Kier Living Ltd
Day, Date and Time	28 July 2017
Author	Daryl Taylor
Subject	Caerleon Road, Dinas Powys – Surface Water Drainage Review

1 Purpose

JBA Consulting was commissioned by Keir Living Ltd. to carry out a review of the proposed surface water drainage strategy at Caerleon Road, Dinas Powys, and where necessary recommend design changes in order to address concerns raised by the Local Planning Authority.

The concerns raised relate to flood risk to neighbouring properties on Caerleon Road, either by exceedence of the proposed SuDS system or as a result of additional flows into a culverted watercourse which flows beneath the north-western corner of the site.

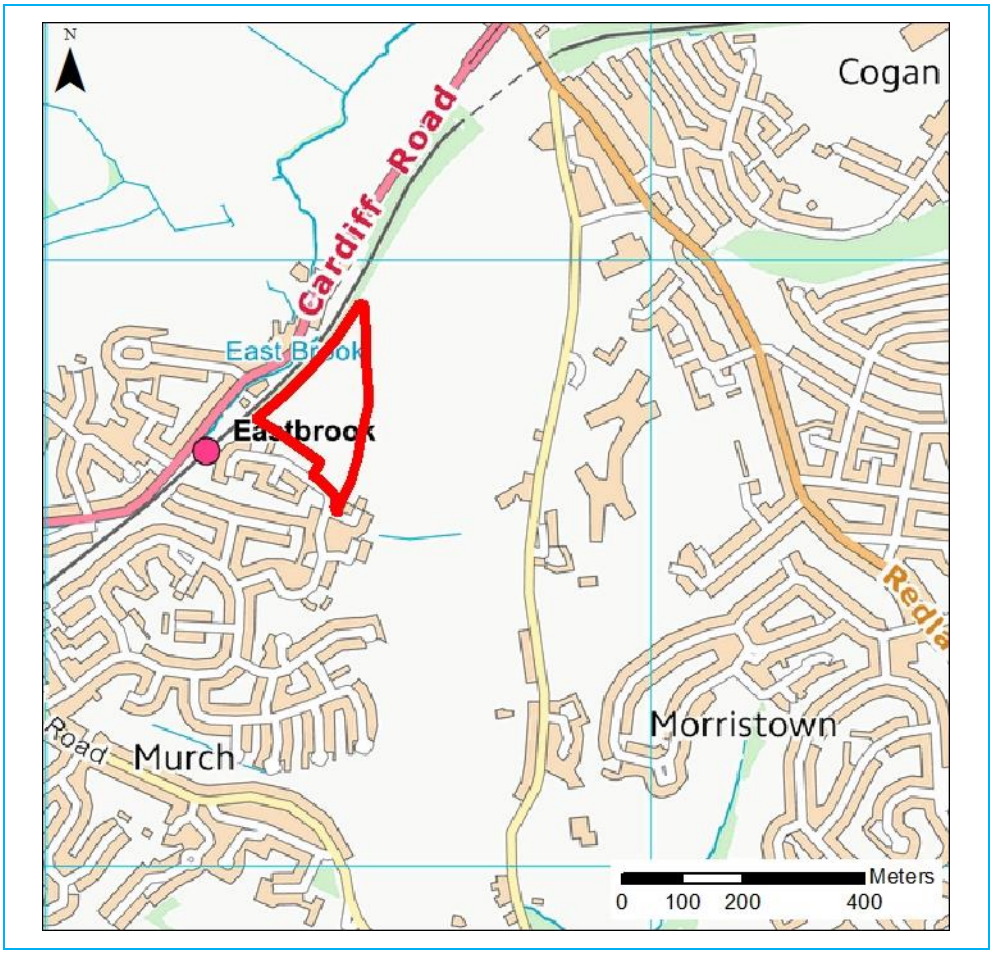
This report should be read in conjunction with the Caerleon Road Drainage Strategy Report (Waterman Transport & Development Ltd, July 2013) and Drainage Strategy Drawings 16022-100B & 101B (Mucklow & Harris, Revision Date 11-07-17).

2 Existing Site

2.1 Site Description

The existing site is a 2.55ha Greenfield site, which has previously been used as grazing land. The site is approximately triangular in shape, and is bounded along its north-western boundary by a railway line, along its south-western boundary by residential development off Caerleon Road, and along its eastern boundary by agricultural land.

Figure 1: Site Location



LiDAR data and topographic survey of the site show that the ground falls from east to west across the site, at a slope of between 1 in 40 and 1 in 60. The highest point on the site is at 21.3m AOD, in the south-east corner of the site, and the lowest point on the site is in the south-western corner adjacent to the railway line, where ground levels are approximately 18.0m AOD.

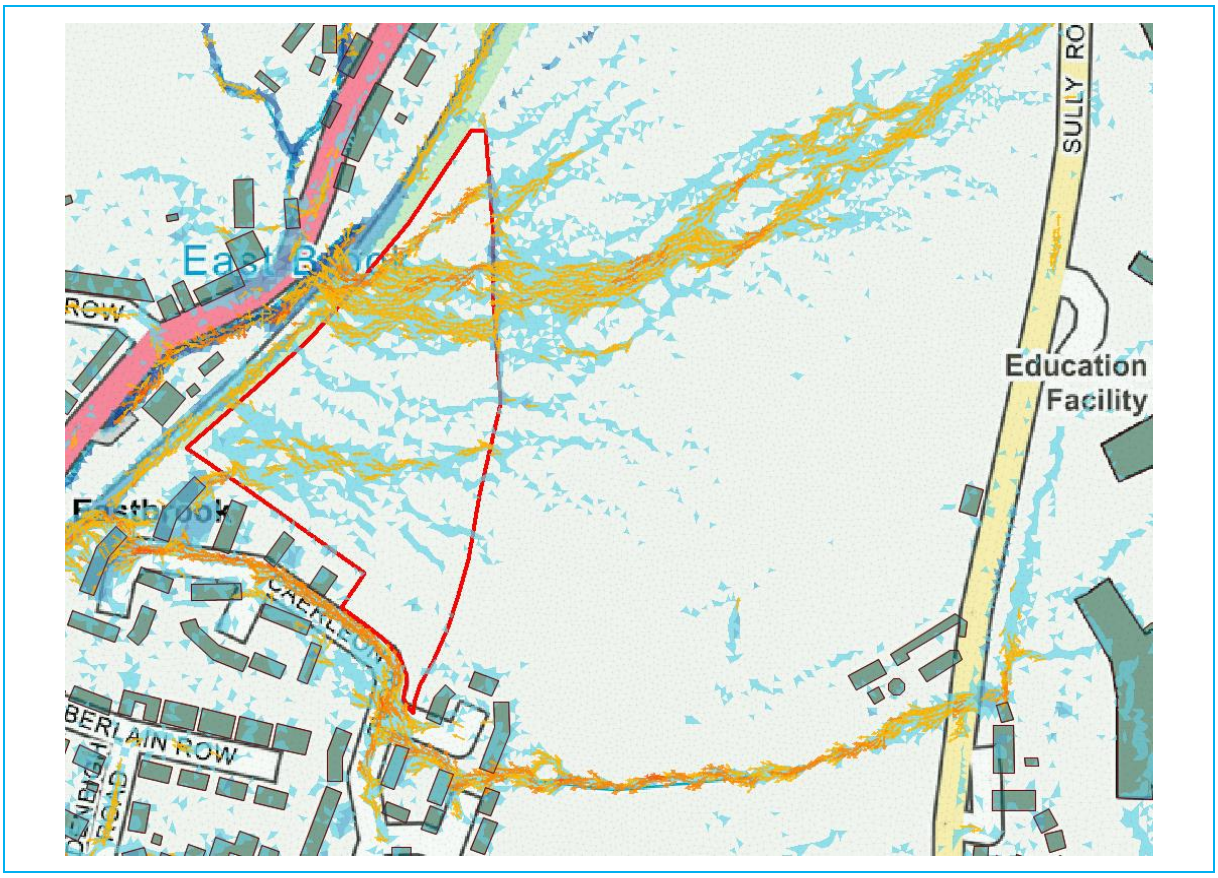
The underlying soils are typically clays, overlying a relatively shallow gravel layer, which in turn overlies mudstone bedrock. This indicates that the site currently drains through a combination of overland flow and some limited infiltration flow

2.2 Existing Drainage Routes

It is understood that the site is currently served by a land drainage system, which discharges in a north and west direction into the East Brook which flows along the northern side of the railway line.

A baseline surface water model has been developed as part of this study, to understand the existing overland flow routes present through the site and its surroundings (Figure 2). This is a simple model, which routes rainfall runoff across a ground model derived from NRW LiDAR data. Due to limited available details, the model does not account for the existing field drainage system but provides show key overland flow routes through the site. The model can therefore be considered to show the effect of field drainage exceedence.

Figure 2: Model Results - Existing Drainage Routes



Whilst the model does not show the flood risk in a particular design event, it clearly shows the existing runoff routes across the site. There are two well defined flow routes through the site, the most significant being across the northern portion of the site where flows from adjacent fields flow into the site from the west, and then leave the site onto the railway on the eastern boundary.

A second, less significant flow route is shown in the southern portion of the site, with flows primarily generated on site flowing in a north-west and south-west direction on to the railway or towards existing residential development respectively.

It can be seen that, during heavy rainfall which could exceed the capacity of the field drainage system, runoff would flow uncontrolled onto the adjacent railway and subsequently into the East Brook.

3 Development Proposal

3.1 Description

The proposed development is for up to 70 residential dwellings with associated infrastructure. The anticipated impervious area of the development will be approximately 1.22ha.

The site is to be drained through a combination of porous paving on driveways, oversized sewer pipes and an offline SuDS basin located in the south-western corner of the site (See drawing 16022-100-B). Outflows from the site will be limited by a Hydrobrake vortex flow control or similar to the QBAR rate of 8.9 l/s for all events up to the 1 in 100-year plus climate change storm event, and discharged to the East Brook via the existing sewer network and culverted watercourse beneath Caerleon Road.

3.2 Impact on Receiving Watercourses and Downstream Flood Risk

The existing site currently drains to the East Brook, via a field drainage system and overland flow. It is understood that there are no flow control structures provided within this drainage system, and that flows are therefore able to enter the East Brook at unattenuated Greenfield rates as follows:

Return Period	Peak Flow (l/s)
Qbar (1 in 2 year)	8.9
1 in 10 year	12.65
1 in 30 year	15.70
1 in 100 year	19.42
1 in 100 + 30% climate change	25.25

The proposal is for flows to be discharged to the East Brook via a public sewer, with discharge rates limited to the QBar rate (8.9 l/s) in all events. This will lead to a reduction in peak flows during all events greater than QBar, and consequently a reduction in downstream flood risk from the East Brook, however the flow in the existing sewer would increase when compared with the baseline scenario.

Welsh Water has not highlighted any capacity issues in this sewer, however an exceedence model has been constructed to test the impact of potential sewer flooding on Caerleon Road.

3.3 Exceedence modelling

In addition to flooding from the East Brook, there is the potential for the development to increase the risk of flooding from overland flooding in the event of an exceedence event (i.e. an event more significant than the design 1 in 100-year plus climate change event) or a blockage event.

The baseline modelling (Figure 2) shows that existing properties at the western end of Caerleon Road are currently at risk of flooding from overland flows generated on land to the east, local highways and in the event of a blockage of a small stream culvert to the east of Criccieth Court.

A hydraulic model of the proposed development has been built, to test the impact of the proposed development on local flood risk in the event of an exceedence event occurring. Two versions of the model were run, one which includes rainfall on the catchment and the other only representing exceedence of the drainage system. These two models allow the operation of the system during an exceedence event to be tested, and the impact of an exceedence event on local flood risk to be tested. Flow hydrographs with a peak flow of 10l/s have been applied to every manhole in the proposed system and on the downstream sewer to represent manholes surcharging, with this flow selected as it is a little

higher than the proposed discharge rate and therefore is the maximum increase in surcharge flow that could be expected from the sewer system. Additionally, a flow hydrograph with peak flow of 1m/s applied to the proposed basin to represent filling and overtopping of the storage feature.

Figure 3 shows the routing of overland flows through the proposed development, and it can be seen that shallow overland flows are routed along highways either into the SuDS basin or onto the railway, along similar routes as in the current baseline situation, with little flow leaving to the south in the direction of the existing residential development. This model indicates that, in the event of a blockage in the drainage system, flows would be expected to be routed away from both existing and proposed development.

Figure 3: Exceedence Model Results (Direct Rainfall not included)

In the southern portion of the site, overland flows are shown to be routed away from both existing and proposed development retained within the public highway and directed towards the SuDS Basin. The existing flow route off-site near to the SuDS basin is retained, however the flow in a southerly direction is reduced when compared with the baseline. In the model, water levels have been monitored at the existing buildings at risk of flooding and shown to decrease in the post-development model, even with the additional flows from the surcharging manholes on adjacent highways. This demonstrates that the proposed development will reduce flood risk to properties on Caerleon Road.

Figure 4 shows the effect of surcharging flows during a storm event. In the northern portion of the site flows from adjacent land are shown to cross the development site including in the location of proposed dwellings. Where overland flows are shown to intercept the location of a proposed dwelling, building thresholds will be raised at least 300mm above surrounding ground levels to reduce the risk of flooding. Additionally, levels along the eastern boundary will be raised along the western edge of the existing drainage ditch, in order to improve its ability to intercept overland flows and direct them to the East Brook at the northern corner of the site, which will reduce the risk of flooding to both the site and the railway line.

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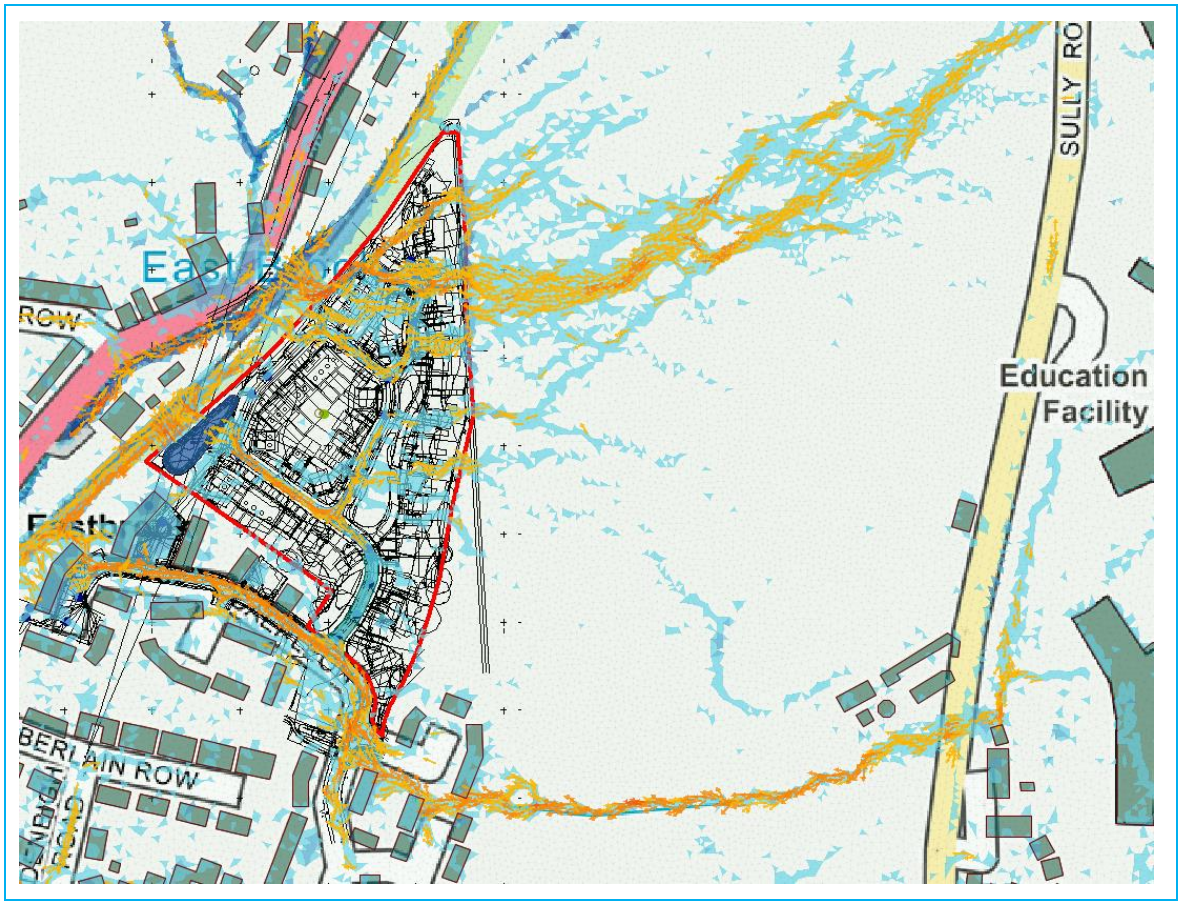
Figure 4: Exceedence Model Results (Including Direct Rainfall)



4 Summary

The purpose of this study was to review the proposed surface water drainage strategy for the residential development at Caerleon Road, Dinas Powys, to confirm that the proposal would not increase flood risk to local development either through exceedence flows or increasing discharge rates into the culverted watercourse and East Brook.

Hydraulic modelling has shown that exceedence flows generated on site will typically be retained within site on highways, and directed either into the proposed SuDS basin or onto the railway as per the existing situation. The predicted flood levels at existing properties on Caerleon Road was shown to reduce, even with manholes on Caerleon Road surcharging, indicating that the proposal will reduce flood risk to properties from overland flows.

The existing site is served by a field drainage system, which discharges unattenuated at Greenfield rates to the East Brook. In the proposed scenario, flows are limited to the Greenfield QBAR flow for all events up to the design 1 in 100 year plus climate change storm, and therefore the discharge rate from the site will reduce in all storms more extreme than this QBAR storm. The proposal will therefore reduce flood risk from the East Brook by reducing flows into the Brook.

Mitigation measures to reduce the risk of on-site flooding from shallow overland flows from neighbouring fields to the east have been proposed. The finished floor level of all proposed dwellings intercepted by the overland flow routes will be raised at least 300mm above local ground levels, and ground levels along the western edge of the existing drainage ditch along the eastern boundary will be increased to intercept overland flows before entering the site, directing these instead to the East Brook upstream of the railway to reduce flood risk to the site and the railway line.