john newton & partners
jnpgroup
Consulting Engineers

Report on

Drainage Strategy, Lower Lark Hill, Cleckheaton

Chesham
Brighouse
Midlands
Sheffield
Teesside

For

Meadowcroft Developments

Prepared by Chris Yates

Approved by Neil D Taylor
BSc(Hons) CEng MICE MIStructE
Associate

Date 23rd March 2017

Ref. B21114-DS REV A

john newton & partners
jnpgroup
Consulting Engineers

DOCUMENT CONTROL SHEET

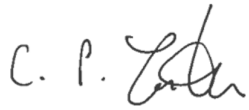
Project Name: Meadowcroft, Cleckheaton

Project Number: B21114

Client: Meadowcroft Developments

Report Title: Drainage Strategy

Reference: B21114-DS Rev A



Signed by……
Christopher Yates
Senior Technician

Countersigned by……
Neil D Taylor
BSc(Hons) CEng MICE MIStructE
Associate

FOR AND ON BEHALF OF JNP GROUP

Date: 06th July 2016

NB: The copyright at all times remains with JNP Group

Document Issue Record

Rev	Date	Description	Prepared	Reviewed	Approved
A	**23rd March 2017**	**Plot levels amended**	**CPY**	**NDT**	**NDT**

Contents Page

List of Figures / Drawings

List of Appendices

1 DRAINAGE STRATEGY

1.1 Introduction

1.1.1 An area of land situated off Lower Lark Hill in Cleckheaton is the subject site of a planning application for a two storey dwelling property with detached garage. A watercourse flows west to east through the site that is culverted approximately 40m to the west of the site and continues to be culverted as it passes beneath the site and beyond, where it emerges to the west of Brick Street approximately 450 metres to the east. The approximate line of the culvert has been recorded and can be seen in Appendix G.

1.1.2 Surface Water Flood Maps (SWFM) on the Environment Agency (EA) website, show the site area as a collection point for surface water. It is important to note however, that the SWFM's do not take into account structures such as bridges and culverts. The maps therefore do not factor in that there is a culvert beneath the site and so the information shown is the scenario for a blockage situation at the culvert entrance.

1.1.3 The Flood Management and Drainage Department (FMDD) at Kirklees Council have consulted the SWFM and raised concerns that the site is set at a low level locally and is seen as a collection point for surface water in the area.

1.1.4 This report has been produced to provide information that enables the concerns put forward by the FMDD about surface water flooding in the area, to be reviewed and reconsidered. A copy of the consultee correspondence relating to flooding on the site has been provided in Appendix F.

2 THE EXISTING SITUATION

2.1 Existing Site – Surface Water

2.1.1 The site forms a depression with raised areas to the north, east, and south. The site levels vary from 112.415m at its lowest point near the centre, to 114.718m on the adjacent track. The site levels have been entered into Autodesk Civil 3D software and an existing model of the site has been formed.

2.1.2 The SWFM for the site, produced by the EA and the Lead Local Flood Authority, Kirklees Metropolitan Borough Council (KMBC), indicate that the site is below water and that the water level is adjacent to neighbouring houses. There are no depths indicated on the maps.

2.1.3 Lidar information (digital terrain model information) used in the production of the EA's SWFM's is now freely available. This information has been used to produce a ground model for the site and surrounding area. Using this model to interpret the data shown on the SWFM, we can estimate the top water level as being 114.30m as an approximate value. When analysing this top water level against the existing ground levels it has been calculated that approximately **1600m^3** of water can be stored within the site and neighbouring land.

2.1.4 Taking a reading off the Environment Agency SWFM on their web site, the site as indicated is within a high risk zone which has 1 in 30 year chance of flooding. To gain a greater knowledge of the SWFM we can refer to the document *"What is the updated Flood Map for Surface Water?"* by the Environment Agency in 2013. The document states that storm durations of 1, 3 & 6 hours were analysed for each rainfall probability in producing the SWFM's. The worst-case situations for all three storm durations were then mapped onto the SWFM. For steeply sloping sites the 1 hour duration would be the more severe and so for the development site and catchment this is the duration we are assuming forms the basis of the SWFM.

2.1.5 For the 1 in 100 year event, water is indicated as overtopping the neighbouring road and taking the route through the housing estate on Sycamore Drive. The development site will not adversely affect this situation.

2.1.6 We are not aware of any reports of localised flooding of the site and it is assumed that the culvert has sufficient capacity at present.

2.1.7 The site has been inspected on a number of occasions and there has been no evidence of surface water ponding. It is assumed that the surface water is percolating into the ground on the landscaped areas and the hard landscaped areas may discharge to the culvert.

2.2 Existing Site – Foul Water

2.2.1 There is a recorded adopted foul sewer on site which flows from west to east with a depth to be confirmed.

2.2.2 There is a foul manhole on the site, recorded on YW's asset map. The next manhole downstream is within the neighbouring Lark Hill Lane.

3 PROPOSED SITE RUN OFF

3.1 Surface Water

3.1.1 It has been established that the existing situation regarding the surface water flooding for the site has been analysed by the EA and has indicated that the site is at risk of flooding due to surface water collecting from the local catchment area.

3.1.2 As mentioned previously, the SWFM's do not take into account culverts. As there is a culvert passing beneath the development site this presents certain opportunities to show that the site is not as vulnerable to surface water flooding as the SWFM appears to show. Below are some possible mitigation measures that can be introduced to the site to ensure the likelihood of flooding is kept as low as practically possible.

3.2 1 in 30 Year Event

3.2.1 It has to be taken into account that there is a culvert passing through the site and that this culvert will carry the flow of water from the catchment area downstream. An approximation on the capacity the culvert can discharge has been calculated as **574l/s** and can be seen in Appendix E. Applying this rate over the 1 hour period taken from paragraph 2.1.4 gives a total discharge from the site of **2066m³**. This calculation suggests that the culvert on site has the capacity to discharge the water generated from the 1 in 30 year event which is shown as being stored on site on the SWFM.

A A Lidar model has been created for the anticipated catchment area (see attached drawing B21114-02), and the area has been entered into a greenfield runoff calculation within Microdrainage. The greenfield runoff calculation represents the total amount of water generated as runoff for the catchment. The **1582m³** figure obtained in this calculation matches the volume worked out for the 1 in 30 year event from the Environment Agency Surface Water maps (1600m³). This suggests that the catchment that is predicted to generate the 1 in 30 year volume is an accurate estimate.

A The document 'Supplementary Note on Flood Hazard Ratings and the Thresholds for Development Planning and Control Purpose' gives advice to planning authorities on the depth of water and the hazard it represents to people. The drawing B21114-01 RevA shows the depths of water around the proposed plot for a 1 in 30 year total blockage situation. The anticipated maximum depth of water above ground for the 1 in 30 year total blockage scenario is 800mm. From the above document this depth is rated as a danger for most.

3.3 1 in 100 Year Event

3.3.1 Culvert Operational

A For the 1 in 100 year greenfield runoff rainfall event, the greenfield runoff volume is given as **2078m³**. This volume of water would be for the 1 hour duration and so we can calculate that for a 1 hour duration, if the culvert discharges at 574l/s, the total amount of water discharged from the site would be approximately 2000m³. This volume is comparable with the volume generated from the greenfield runoff calculation and so it can be assumed that the culvert is capable of discharging the catchment 1 in 100 year greenfield runoff event.

3.3.2 Culvert Blocked

A Using the figure above for the volume generated during the 1 in 100 year greenfield runoff event, we can plot an estimated water level and compare it to the existing ground model. When using a water level of 114.5m, the difference in volume between the two surfaces is

2072m^3. We have therefore assumed that the anticipated water level for the 1 in 100 year event will be 114.5m. This would give an estimated worst case depth of water for the total blockage scenario of 1.0m from the escape route along the north west boundary.

A Taking climate change into account, an extra 700m^3 of water would be generated which spread out over the area would give a water level of approximately 114.70m.

3.4 Mitigation Measures

3.4.1 To assist in making sure the site does not act as a storage facility for heavy rainfall events, it is proposed to open up the culvert as it passes through the site. This will present a large area for surface water to pass through and with the culvert being opened up there is more chance for surface water to find an escape route through the site. This will only be carried out for part of the site as there is a TPO on the tree to the eastern boundary preventing alterations here.

3.4.2 It is also proposed to add two grill screens to the proposed new inlet to the culvert on the development site. These will be the responsibility of the site owner and provide protection to the culvert against blockages.

3.4.3 In the event of a blockage the home owner could be given sufficient warning to evacuate by installation of a suitable warning system.

3.4.4 Access to the open channel will be restricted to ensure it is safe for residential usage.

3.4.5 The large area of the catchment is principally greenfield space and as such we would expect a significant proportion of the area will drain back into the ground and soakaway.

3.4.6 The ground floor FFL of the new property is proposed to be set at 113.500m & 113.800m. An emergency exit should be located ot the north of the site onto the proposed new driveway and then up to dry areas on Lower Lark Hill.

A

3.4.7 The site levels are to be adjusted to suit the proposed layout. The house is located towards the north of the plot where levels are generally higher. The footprint is to be raised and other areas of the site are to be lowered to compensate. These areas should not attract depths of water in excess of 1.25m in the extreme case of a total blockage occurring for the 1 in 30 year event.

3.4.8 The boundary walls are to be formed to direct any flood waters from offsite towards the open channel, away from the property.

3.4.9 The foul sewer within the confines of the site could act as a relief conduit should the surface water flood levels build up on the site. Further thought and investigation into this should be considered at final design stage including discussions with Yorkshire Water.

3.4.10 There is an open grate on site which should be investigated fully to determine its outfall location and whether it could be of any use as an emergency overflow for the site.

4 PROPOSED DRAINAGE ASSESSMENT

4.1 Surface Water Drainage

4.1.1 The surface water generated from the new development should drain into the culvert. All calculations within this report relating to the amount of surface water generated include the area of the development site.

4.1.2 The proposed site drainage will be discharged directly to the culvert / open channel for the roof areas, with hard surfaces discharging into the ground. The total roof areas are no greater than those that appear to have discharged historically. The total discharge will not be significantly increasing and it has been demonstrated that the culvert has sufficient capacity for the catchment area.

4.1.3 In the event of a blockage of the culvert upstream of the site flood water may flow across the surface of the neighbouring plot to the west onto the development site. It is proposed to control this flow using boundary walls back into the open sections of the culvert on the site.

4.1.4 In the event of a blockage of the culvert downstream of the site a significant amount of storage will be available in the landscaped areas of the site. It should be noted that there is only a small section of the culvert beyond the site boundary to the east for which a blockage would impact the site. The culvert falls at approximately 1 in 30 and the surface levels also fall significantly. Eventually there will be an emergence down slope rather than on site.

4.1.5 There are potentially two emergency overflows into an unidentified system and into the foul water system in an extreme event. An escape route to the rear of the property through a personnel gate can be installed.

4.1.6 If water levels continue to rise in this event an appropriate warning system will enable the residents to evacuate the property or move to upper floor levels.

4.1.7 The development site will not adversely affect properties downstream of the site. Storage will still be available and the risk of blockages will be improved through the site.

4.1.8 Flood resilient construction should be used for the proposed building. See Appendix K.

4.2 Foul Water Drainage

4.2.1 Foul water from the proposed development should discharge to the foul water sewer passing through the site. This will need confirming with Yorkshire Water at detailed design stage.

5 CONCLUSIONS AND RECOMMENDATION

- The Surface Water Flood Maps generated do not take into account the presence of structures and as such water discharging through the culvert on site is not taken into account.
- It has been demonstrated that the culvert beneath the site has the capacity to discharge the surface water which is shown as flood water on the SWFM.
- The existing culvert as it passes through the site should be opened up to present further opportunity for surface water to drain away.
- Trash screens / grills should be introduced to the onsite open channel / proposed culvert entrance.
- A flood warning system should be installed for extreme conditions, and an evacuation route installed.
- Further investigation into the foul sewer and the open grate on site should be carried out to see if there are possibilities for these to be utilised in emergency situations.
- Flood resilient construction methods should be incorporated into the design of the building.
- The site, provided the recommendations stated are put into practice, does not increase flood risk for neighbouring properties.