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Your Ref:	FUL/2024/0001	LLFA Ref:	FW2024_0255
Date:	03/05/2024	Tel No.:	0344 800 8020
NCC Member:	Cllr Alexandra Kemp	Email:	llfa@norfolk.gov.uk

Case Officer: [redacted], Senior Flood Risk Officer
Reviewed by: Mark Ogden, Flood and Water Manager

Dear Sir/Madam,

Town and Country Planning (Development Management Procedure) (England) Order 2015

Development of 3.5km of new single lane access road known as the West Winch Housing Access Road (WWHAR), with a new roundabout junction between the WWHAR and the A47 trunk road providing access to the planned Hardwick Green development. Additional works include: a new roundabout junction between the WWHAR and the A10 at the southern end of the WWHAR; Roundabout Junctions on the WWHAR to provide access to the residential allocation area; Treatment of local roads which will be severed by the WWHAR, including a new road over bridge with shared footway, cycleway on Rectory Lane to cross over the proposed WWHAR and the permanent stopping up of Chequers Lane for vehicular traffic; Modification and re-orientation of the Hardwick Interchange; Dualling of the A47 to the north of the existing highway alignment between the WWHAR and the A10/A47 Hardwick Interchange junction; Temporary working areas for road construction including haul routes and two sets of National Grid gas main diversion works including construction compounds and temporary access and working areas; demolition of Hill Cottages on A47 Constitution Hill; construction of drainage basins, swales and associated maintenance access tracks. Land to the east of West Winch Village, King's Lynn

Thank you for your consultation on the above site, received from the Local Planning Authority (LPA) on 21 March 2024. The County Council, as Lead Local Flood Authority (LLFA), have reviewed the application as submitted and have the following comments.

This is a full planning application for the creation of a new bypass. It is understood that the permanent works consists of 3.5km single lane access road to the east of West Winch

connecting the existing A10 to the existing A47 east of Kings Lynn Hardwick Interchange. Summary on ancillary works include a new roundabout junction with the A47 trunk road at the northern end and similarly a roundabout on the A10 at the southern end of the access road. Several other intermediate roundabout junctions are proposed along the length on the access road to provide links with proposed residential growth area to the west of the new road. Flyovers for local roads which will be severed by the development including Rectory Lane and Chequers Lane. Alterations to the Harwick Interchange and dualling A47 to the north of the existing highway alignment between the WWHAR and the A10/A47 Hardwick Interchange junction. Construction of drainage basins, swales and associated maintenance access tracks and river crossings.

Temporary works will include the construction of haul routes for road construction including construction compounds, temporary access and working areas. Works associated with the diversion of two sets of National Grid gas mains.

At this full planning stage, **the LLFA require further information on the access road layout in terms of flood risk and the SuDS layout**, therefore the LLFA will work closely with the applicant and the County Council as the LPA in the absence of an acceptable Flood Risk Assessment (FRA) / Drainage Strategy / supporting information relating to:

- Drainage Strategy not complying with BS8582:2013, Design Manual for Roads and Bridges (DMRB), Design and Construction Guidance (DCG), SuDS Manual (C753) and Non-Statutory Technical Standards for SuDS.

Reason
To prevent flooding in accordance with National Planning Policy Framework paragraph 173, 175 and 180 by ensuring the satisfactory management of local flood risk, surface water flow paths, storage, and disposal of surface water from the site in a range of rainfall events and ensuring the SuDS proposed operates as designed for the lifetime of the development.

As a reminder, at the full planning stage the LLFA are generally looking for all detail to be submitted upfront, details of all drainage components for the proposed system must be provided in accordance with the LLFA's local SuDS guidance.

We will review the proposals further if the following issues are adequately addressed:-

- Clarification that no runoff during the post-development scenario is crossing catchments as per Chapter 7.3.16 as may lead to a worsening in flood risk for the receiving watercourse.
- Evidence of offsite connectivity for watercourse in Chequers Lane to check whether a culvert is required to maintain conveyance here.
- Additional groundwater monitoring and site-specific infiltration testing must be undertaken at each of the 7 detention basins to inform their design and clarify whether mitigation measures are needed to oppose uplift forces and ingress of groundwater into the basins. Independent geotechnical advice may be required if lining is necessary to oppose any infiltration and uplift forces due to high groundwater table.
- Interception storage is not provided at any of the 7 detention basins – this is critical for the new access road of this type and scale.

- Global variables for the hydraulic calcs need confirming or adjusting as per LLFAs guidance v7. A copy of the LLFA Guidance can be found here.
- HAWRAT assessment is required for water quality checks.
- Further details on whether any compensatory floodplain is required at the northern end of the development.
- Standard detail drawings of main SuDS components

Further detailed comments can be found in the attached Annex.

Further guidance on the information required by the LLFA from applicants can be found at https://www.norfolk.gov.uk/rubbish-recycling-and-planning/flood-and-water-management/information-for-developers.

Yours sincerely,

[redacted] MSc C.WEM MCIWEM GMICE
Senior Flood Risk Officer (Technical Lead)
On behalf of Norfolk County Council as Lead Local Flood Authority

Disclaimer
We have relied on the accuracy and completeness of the information supplied to us in providing the above advice and can take no responsibility for incorrect data or interpretation, or omissions, in such information. If we have not referred to a particular issue in our response, it should not be assumed that there is no impact associated with that issue.

Annex: Norfolk County Council LLFA Additional Information to LPA

LPA Application Ref: FUL/2024/0001	LPA: Norfolk County Council
LLFA Ref: FW2024_0225	Applicant name: Norfolk County Council Highways Project Team
Site name/Description: Land to the east of West Winch Village, King's Lynn	Greenfield or Brownfield Development: Greenfield
Planning Stage: Full	Summary of Surface Water Drainage Proposed: An attenuation type SuDS scheme with 7 large storage basins fed by a conveyance system in the road consisting of combinations of filter strips + filter drains, swales and traditional piped carrier drains. For the existing drainage ditches and channels, flows will be maintained by the installation of culverts which will run under the new road. SuDS quantity benefit: included SuDS quality benefit: included SuDS amenity benefit: indicative via landscape masterplan SuDS biodiversity benefit: indicative via landscape masterplan

Documents Reviewed: -

Title	Ref	Version	By	Dated
ES Appendix 1.1.A: Scheme Layout	3.01.01	01	WSP	Dec 2023
ES Chapter 2: Existing Site	3.02.00	01	WSP	
ES Chapter 3: Description of Proposed Scheme	3.03.00	01	WSP	
Environmental Statement Road Chapter 11: Water Environment	3.11.00	01	WSP	
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment	3.11.01	01	WSP	Dec 2023
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix A: Site Location Plan	3.11.01a	01	WSP	Dec 2023
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix B: Sewer Logs	3.11.01b	01	WSP	May 2023
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix C: BGS Logs	3.11.01c	01	WSP	1977
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix D: Ground Conditions Appraisal	3.11.01d	01	WSP	Feb 2021
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix E: EA & IDB Correspondence	3.11.01e	01	WSP	Dec 2023

Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix F: SFRA Maps & LLFA Correspondence	3.11.01f	01	WSP	Dec 2023
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix G: Greenfield Run Off Rates	3.11.01g	01	WSP	Nov 2023
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix H: Drainage Strategy	3.11.01h	01	WSP	31 Jan 2024
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix I: Hydraulic Calculations	3.11.01i	01	WSP	Nov 2023
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix J: SuDS Maintenance Plan	3.11.01j	01	WSP	Nov 2019
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix K: Const SW Management Plan	3.11.01k	01	WSP	Dec 2023
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix L: Anglian Water Correspondence	3.11.01l	01	WSP	July 2019
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix M: LLFA Correspondence	3.11.01m	01	WSP	Dec 2023
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix N: Basin Survey Technical Note	3.11.01n	01	WSP	Feb 2024
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix O: Topographical Survey Information	3.11.01o	01	WSP	Dec 2023
Environmental Statement Road Chapter 11: Water Environment Appendix 1: Flood Risk Assessment Sub Appendix P: Hardwick Rgbt 2023 Scheme Drawings	3.11.01p	01	WSP	Sept 2002
Environmental Statement Road Chapter 11: Water Environment Appendix 2: HAWRAT Assessment	3.11.02	01	WSP	Nov 2023
Environmental Statement Road Chapter 11: Water Environment Appendix 2: HAWRAT Assessment Sub Appendix A: Routine Runoff on Surface Water Quality	3.11.02a	01	WSP	Nov 2023
Environmental Statement Road Chapter 11: Water Environment Appendix 2: HAWRAT Assessment Sub Appendix B: Routine Runoff on Groundwater Quality	3.11.02b	01	WSP	Nov 2023
Environmental Statement Road Chapter 11: Water Environment Appendix 2: HAWRAT Assessment Sub Appendix C: Spillage Risk Assessment Data	3.11.02c	01	WSP	Nov 2023
Environmental Statement Chapter 12: Appendix 12.3: Ground Investigation report	3.12.03d	01	WSP	Jan 2021
Environmental Statement Chapter 12: Appendix 12.3C: Exploratory Hole Logs and Laboratory Data	3.12.03c	01	WSP	Jan 2021

Local Flood Risk: Summary of Local Flood risks in the vicinity of the site

Surface Water (Blue Corridors)

There are several areas at risk of surface water flooding within and adjacent to the development site boundary of 3.33% and 1% annual probability flood event as shown in the Environment Agency's (EA) Risk of Flooding from Surface Water (RoFSW) maps. The LLFA consider that the 0.1% annual probability flood map can provide an indication of the 1% annual probability flood

including an allowance for climate change but may require more detail where people and property are at risk.

It is proposed that natural overland flow paths of surface water that are bisected by the WWHAR will be mitigated by the installation of open channels or filter drains at the toe of the road embankments and will convey water to receiving watercourses. This methodology is acceptable.

Main River/Tidal

Chapters 4.2.3 to 4.2.5 indicate that a small proportion of the A47 and Hardwick Interchange at the northern end of the site may require compensatory floodplain. Approx 0.004ha of the site will sit within Flood Zone 2 extent. The LLFA recommend that the EA are consulted on this further for comment.

Ordinary Watercourses

- There are several watercourses known to exist that cross the red line boundary of the development site and proposed access road. In total the LLFA count at least 5 ordinary watercourses within our regulatory authority that will be affected by the development: -

Name	*Location*	*Flow Regime*	*Existing Culvert*	*Consenting Body*
Unnamed Drain	*Under A47 – approx. 1km South East of Hardwick Interchange*	*North East towards Pierrepoint Drain*	*Yes*	*NCC LLFA*
Unnamed Drain	*170m North of Rectory Lane*	*Due West towards Puny Drain*	*No*	*NCC LLFA*
Unnamed Drain	*333m South of Rectory Lane*	*Due West towards Puny Drain*	*No*	*NCC LLFA*
Unnamed Drain	*Adjacent to Chequers Lane, northside*	*Unclear*	*No*	*NCC LLFA*
Unnamed Drain	*210m east of Poplar Rd, West Winch*	*Due East and then South East but still towards Puny Drain*	*No*	*NCC LLFA*

- For these existing field drains the developer has proposed to keep the status quo by installation of appropriately sized culverts to maintain existing flows under the new road unimpeded thus maintaining the pre-developed state. In Section 7.3.44 of the FRA/DS it is stated that the proposed culverts have been sized according to the catchment area upstream of where the road crosses the ditch at each of the corresponding locations above. Each culvert size has been derived using the flood estimation technique ReFH2 and calculating the 1% AEP storm event with allowance for climate change. Corresponding pipe sizes are given in Table 7.4 however there doesn't appear to be any supporting calculations provided in Appendix G and at this full stage the LLFA require justification that the indicative barrel sizes can convey all flow regimes as stated up to the 1% AEP + CC.

- We also remind the applicant that separate permission or land drainage consent is required for final approval from the consenting body. For all cases above that is the LLFA.

LLFA recommend that further information is requested i.e. photographic evidence and trace surveys. The calculations for the greenfield run-off rates and culvert sizes in Appendix G are missing.

- Again, there should be evidence of a 3.5m wide maintenance strip and clear access arrangements along all of these existing ditches across the site where they are to be retained. ***We recommend that further information is requested.***

- The site does not lie within an Internal Drainage Board (IDB) area for the regulation of ordinary watercourses but the LLFA wish to make note that the ES has incorrectly stated the relevant risk management Authority for the Puny Drain and Middleton Drain in Chapters 1.4.2 and 1.4.4 – the LLFA are not the regulatory authority for these watercourses and the Downham Market IDB and Kings Lynn IDB are respectively. Any works which could affect the flow in an ordinary watercourse which is outside of an IDB area will need consent from the LLFA, Norfolk County Council.

Groundwater

- The FRA and ES provide results of ground investigations and groundwater monitoring in Chapter 12 of ES. Several investigations have taken place over periods dating from 2012, 2017 and most recently in 2020. The former by Geo Environmental and Atkins investigations were predominantly north of the development and recorded groundwater levels in the range of 1.10mbgl to 7mbgl although falling head test locations are not provided.

  Norse Group then undertook further exploratory GI and groundwater monitoring in August 2020 to November 2020 and again undertook falling head tests at 6 locations across the development. On average water strikes were recorded between 0.7mbgl and 2.8mbgl which does indicate a shallow groundwater level in the area generally. Groundwater strikes were associated with the predominantly granular strata, such as the Tottenhill Sands and Gravels, Mintlyn Beds and Roxham and Runcton Beds Formation, which corresponds with previous investigations.

- In terms of source protection zones, the application site is not within any groundwater protection zone.

Historical Flooding

- LLFA have no records of flooding to properties within the redline boundary as it's predominantly undeveloped land , but there is a long record of flooding in West Winch to the west of the site predominantly from surface water flooding. Fluvial sources of flooding in West Winch have not been recorded. This is referenced in section 4.7 of the FRA/DS.

Assessment: Summary of submitted drainage proposals

The Flood Risk Assessment / Drainage Strategy titled "Environmental Statement – Appendix 11.1 – Flood Risk Assessment and Drainage Strategy" (ref:- ncc/3.11.01 by WSP and dated December 2023) submitted with the planning application, has been assessed against the National Planning

Policy Framework (NPPF), the Non-Statutory Technical Standards for SuDS (NSTS) (March, 2015), BS8582:2013, Design and Construction Guidance, DMRB CG501 and the policies of the adopted Norfolk Local Flood Risk Management Strategy including NCC's Local Guidance for Developers v7.

This FRA/DS covers the drainage proposals for the full 3.5km access road and associated alterations to the A47. Two phases of development are covered; firstly the full drainage strategy for the operational phase and secondly a Construction Surface Water Management Plan covering the temporary construction phase(s) of the development and impacts on the wider environment as the road is built out.

Intro

The FRA/DS splits the 3.5km access road into 7 distinct cells in accordance with natural drainage patterns, ground elevations and potential outfall locations. The FRA/DS states that no significant profiling of the site is proposed and external levels will largely mimic existing topography, hence the resultant drainage strategy and existing blue corridors will replicate the existing drainage regime of the area. From a masterplanning perspective, the surface water drainage layout presented in Appendix H's general arrangement drawings appear logical given the local topography and existing drainage features. The strategy uses open SuDS features only and there are no underground or closed systems such as tanks. The positioning of these open SuDS in the lowest regions of each cell or "subcatchment" are logical hence the strategy can rely upon positive drainage systems for capturing and conveying runoff from the impermeable surfaces to the storage basins. This keeps the design philosophy simple and more sustainable which the LLFA welcome.

The total impermeable area for the 3.5km access road is 16.5ha and approx. 80% is new impermeable area (accounting for alterations/dualling of the existing A47 and Hardwick Interchange).

1) SuDS discharge location

   The national drainage hierarchy has been considered in the FRA/DS by firstly assessing infiltration potential across the site. Widespread soakage testing was undertaken by Norse Group in 2020 and generally soakage results were favourable due to the largely granular superficial deposits in the area within the Tottenhills Sand & Gravel, Mintlyn and Roxham and Runcton beds, with very low values for the Lowestoft formation. However as previously mentioned groundwater ingress was recorded in nearly all test locations to an average of 0.7 to 2.8mbgl with is generally quite shallow.

   Please note that the soakage tests were based on falling head tests only. The LLFA only accept soakage testing in accordance with BRE365 methodology. Falling head tests alone would not normally suffice.

   But when considering a typical depth of an infiltration basin (circa 1.5m-1.7m) this would result in clearance levels to groundwater failing that standard and at best being in the range of 1.1-1.3mbgl which is generally not acceptable. The Environment Agency via their Groundwater

Position Statements require a minimum of 1.2m unsaturated zone beneath any proposed infiltration devices. Due to shallow groundwater observed in 2020, the LLFA agree with the conclusion of the report that there isn't sufficient clearance from the base of any infiltration structure to groundwater and therefore infiltration should be discounted as a method of surface water disposal.

As no significant cut is proposed, the risk of groundwater flooding is considered low however the LLFA require further groundwater monitoring to ascertain the risk of uplift forces on the formation level of any proposed open SuDS features. **Further information is requested.**

Therefore, the designer has reverted to the second option on the hierarchy which is to discharge to the local watercourses highlighted earlier at a restricted single outflow rate of 2l/s/ha or Qbar whichever is higher as per the recommended simple approach in the LLFA guidance. At this stage the LLFA agree with the chosen discharge locations given the local topography and drainage patterns. The only watercourse not used for draining the access road is Chequers Lane ditches which is sensible given its offsite connectivity is not clear and appears to be on a ridge.

All other watercourses can be traced on OS maps and topographical/channel surveys in Appendix O provide enough evidence of offsite connectivity. **No further information is requested.**

Finally water reuse has been discounted as a technique on the hierarchy with measures such as rainwater harvesting and green roofs discounted due to nature of the development and the uncertainty of pollution levels when reusing road runoff. These measures are more catered for residential and commercial developments where clean roof water is more easily captured.

LLFA recommend that additional groundwater monitoring and site-specific infiltration testing should take place <u>now</u> to inform the full design of the drainage strategy. As a minimum the LLFA would advise this is undertaken at each of the 7 proposed detention basins but the developer should also seek opportunities to tap into more favourable ground conditions where there is greater headroom to the local water table i.e. headwater locations. Therefore, the LLFA request that the coverage of confirmatory testing is widespread. Given the largely favourable soakage test results from previous site investigations this should be explored further to ascertain whether a hybrid approach is possible or not possible.

2) <u>SuDS Options</u>

Table 7.1 sets out the potential SuDS techniques possible across the access road for both storage and conveyance. Overall, the preferred options of filter strips, filter drains, swales and detention basins are logical for this type of development and form a robust SuDS management train. Those options discounted are logical and justified as well.

The design criteria and overall drainage philosophy uses principles and advise set out within BS8582; Sewer Sector Guidance - Design and Construction Guidance (DCG) and LLFA local guidance. Generally, principles out of the DMRB CG501 are ignored. The LLFA welcome this as the design standards in the DMRB are somewhat dated compared to other national drainage standards such as Sewer Sector Guidance DCG. Overall, the developer is using a criteria of 1) no surcharging in the 50% AEP or 1 in 2 year probability event, 2) no flooding in

the 3.33% AEP or 1 in 30 year + CC probability event and 3) All site control (storage) basins are designed to store the worst case 1% AEP + CC or 1 in 100 event + CC without any flooding. The LLFA find this acceptable for the conveyance system and storage devices. Please note that the DMRB CG502 5.3 does allow for flooding of the highway during a 1% AEP + CC but not beyond the highway boundary.

As per Table 7.1 the LLFA welcome the use of filter strips and filter drains as the main carrier drain system for capturing and removing surface water runoff from the carriageway + roundabouts and passing this runoff volume down to attenuation basins via a simple management train. The terminal detention basins where runoff will be stored and slowly discharged into the receiving watercourses appear sensible in their locations at this time and will each have an associated flow control device calibrated to the respective greenfield rate for the respective catchment/cell area.

Runoff over the majority of straight sections of carriageway and footway sections will be promoted into carrier drain systems by using an “over the edge” approach. Essentially this is where the carriageway is flush with the roadside filter drains or swales and a single camber promotes runoff directly in the surface channels without the need for gullies or kerb offlets. On tight bends or roundabouts where road safety standards dictate, traditional gully or kerb drainage are to be used. It proposed to use a filter drain underlain by a perforated pipe to convey surface water downstream.

The drainage strategy layout drawings in Appendix H provide a preliminary detail of the overall network and storage features and largely the layout appears logical given the topography and location of possible outfall locations to existing local watercourses. An impermeable area plan is provided which is excellent and is well annotated. But the general arrangement drawings are preliminary in nature and do not provide the reviewer with enough detail at this full planning stage. Missing information include pipe and manhole locations, ID’s, pipe sizes, gradients, levels and most importantly do not cross reference with the hydraulic calcs – so pipe numbers, manhole ID’s, Invert and Cover levels are all missing from the drawings in Appendix H on the conveyance network. This means the reviewer cannot compare the calcs to the engineering layout. The LLFA has spotted that a drainage schematic of the conveyance networks are provided however at the end of each cells InfoDrainage results sheet – so why has this not been translated over to the engineering drawings at this full application stage?

Furthermore, there are no standard detail drawings provided illustrating the typical design for the street scenes or a typical cross section for the access road. Crucially, there should be a road contours plan to highlight that the crossfall is greater than the longfall on the straight sections where “over the edge” drainage is proposed.

There are other standard detail drawings that the LLFA would expect to see at this full stage too such as details of kerbing/upstands where “over the edge” drainage is proposed. Standard detail drawings of the basins and flow control chambers showing max water levels for all storm scenarios, side slopes, wet benches, and sediment forebay details etc. All of these items are not considered by the LLFA to be “detailed design” and must be provided upfront at this stage of planning. **Further information is required at this full planning stage**

<u>Greenfield Rates</u>

The greenfield rates proposed in Table 7.2 have been calculated using the FEH statistical method using BFIHOST index classes from the Flood Estimation Handbook method. This is the preferred method of the LLFA, however given the granular nature of the soil conditions in the area the resulting Qbar rates are lower than 2l/s/ha and hence the latter has been used for the permitted discharge rate. Overall the LLFA have no objections to this, the calculated rates in Appendix G are satisfactory even though they are superseded by the 2l/s/ha rule.

Proposed Catchment (Cells)	Area (ha)	Greenfield Catchment	QBAR per Ha (l/s)	Catchment QBAR (l/s)	2/l/s/ha Discharge Rate (l/s)
1	1.93	1	0.84	1.62	3.86
2	2.93	2	0.89	2.61	5.86
3	0.87	3	0.88	0.77	1.74
4	3.20	4	1.03	3.30	6.40
5	1.64	4	1.03	1.69	3.20
6	2.38	5	1.03	2.45	4.76
7	3.54	5	1.03	3.65	7.08

However, as stated at the end of chapter 7.3.16 some Cells may be draining to a catchment located outside their natural catchment area. This is a problem also known as crossing catchments and is not acceptable. The LLFA seek further clarification on this matter and require a plan of the greenfield catchments and existing flow directions within Appendix G compared to the proposed catchments areas. To confirm, no greenfield discharge rate should include any additional greenfield area from outside its catchment boundary even though it may be technically possible to positively drain into it. ***Further clarification is required on this matter as this governs the space required for SuDS. Please provide a natural catchment plan in Appendix G, showing the split lines in the road catchments for the access road compared to natural contours.***

We would also require evidence on how greenfield runoff volumes from open spaces / verges will or will not be directed away from the formal drainage scheme. It should be noted that if there is a natural Greenfield Runoff Volume that occurs and can be intercepted by formal drainage schemes depending on the design of the proposed development, this must be included within the storage design and conveyance system design as a contributing area. Further details of this called pervious uplift can be found in the LLFA guidance v7 Chapter 6.7. ***Further information is required on this matter as this governs the space required for SuDS.***

3) Hydraulic Calcs + Drainage Layout Drawings

The applicant has provided Hydraulic Calcs in Appendix I for proving that the design philosophy set out in Section 2 above is adhered to for each cell and the final discharge rates are restricted to the corresponding greenfield rate as set out in Table 7.2. General comments:

It would have been useful in the main FRA/DS document to specify the global design settings and simulation criteria used for each of the calculations run in the InfoDrainage Software.

By reviewing Appendix I the LLFA can see that the designer has used the following simulation criteria and input variables, some variables align with the LLFA's requirements in our local

guidance but some don't, please see summary of these below (red requires a change or more commentary required)

i. Urban Creep not included which is fine.
ii. Volumetric Coefficient value isn't provided for both summer and winter storms. Must be set to a CV of 1
iii. FEH 22 Rainfall data appears to have been used but please confirm as 2013 is referenced in the calcs. As a check that the 2022 data is being read, please provide a comparison of the hydrograph for the 100yr 1hr event and compare to the requested FEH data.
iv. Output Interval default period is 5min, however this simplifies and changes the results. Therefore, recommend that a shorter output interval (eg 1min) is used where possible, or that a sensitivity analysis is carried out to find the suitable interval.
v. Run times and durations need extending for longer storm checks – LLFA require up to a 4 day storm (5760min) to be analysed.
vi. Design storms for the 3.33% AEP & 1% AEP have been run with added climate change allowance of 35% and 40% respectively.
vii. Area summary – a PIMP of 20% has been used for several areas assigned to manholes/nodes. Please explain?

Moreover, the LLFA require the following additional parameters to be set in the calcs:-

I. Please turn off any additional storage allowances or MADD factors (i.e. 20m3/ha).
II. Please provide the Connections Summary ranked by max water level as well as max flow because this may alter which connections/nodes are at flood risk.

Table 7.3 - Please add a column showing all the flow control sizes for the vortex or orifice devices. Please note any flow control less than 50mm in diameter is not acceptable.

Generally, though the hydraulic calcs have been undertaken thoroughly with correct input of flow control devices using the correct design heads ignoring freeboard in the basins. The area summaries match the impermeable area plan albeit there is the query above regarding 20% PIMP value for some contributing areas and confirmation of why this is used.

Furthermore, the representation of the conveyance system is quite conservative and uses just pipes whereas in reality there will be filter drains and swales which provide extra storage and potential infiltration in places (if it can later be proven to be viable from additional soakage tests and groundwater monitoring). The LLFA require use of correct link types or "connection" types that mimic what is actually proposed on the general arrangement drawings for each cell to accurately represent what is proposed to be built out.

LLFA require the hydraulic calcs to be rerun using the correct input parameters and link types. Please update the hydraulic calcs accordingly for each of the 7 cells.

4) ***Specific SuDS component elements***

4.1) Stormwater Controls (Basins) – overall the principles look acceptable at this full stage. The crest or cover level used for each basin has been set using in-situ survey data as described in Appendix N and O. The LLFA are pleased that in-situ levels have been used to ground truth LiDAR levels which appear were originally used to set design levels for the

drainage strategy. Using Lidar sometimes can be misleading and lead to unreliable data as can be seen with Basin 7 in Appendix N where the LiDAR elevation was up to +/- 500mm out compared to the actual ground levels which were obtained at a later date. This would have significant bearing on the technical design and the LLFA are pleased to see that actual ground levels have now been used in the design and translated over to the hydraulic calcs. However, there are a few concerns which still require further information or clarification: -

Please provide standard detail drawings and commentary showcasing the formation level of each basin compared to water levels in the receiving watercourse(s). The LLFA have concerns that due to the high groundwater table in the area that basins may be subject to reverse flows from the watercourse systems or surcharged outfall conditions when these existing watercourses are in high flow conditions especially in wet winters (above average catchment wetness like 2020/21 and 2023/24). Have water levels in the receiving watercourses been surveyed at the outfalls for the 7 basins? If yes, please can you point the LLFA to these levels or isolate them in the report because it is unclear from Appendix O Part 1 which cross sections are relevant and the scale of the layout plan is very difficult to read. To maximise the hydraulic head and positive outflow to the watercourses, the formation level of each of the basins should be set as high as possible whilst also allowing for all incoming carrier drains from the proposed access road (taking into account minimum cover requirements).

Similarly, it is stated in Chapter 7.3.29 that due to high groundwater level in the area, it's possible that certain basins will need an impermeable liner. This is very important as some basins are 2m+ deep in total depth i.e. Basin 5 and 7. At this full stage the LLFA need to know which of these this is likely to be an issue for as the available storage and general design could be affected. Further in-situ groundwater checks should be undertaken at the locations of the basins most at risk. At this full planning stage to ignore this issue would be very concerning as this could affect the design levels for each of the Basins and thus the available storage. Please state which basins may be subject to uplift forces and groundwater ingress and provide an independent geotechnical review for any liners if they are deemed necessary. The LLFA would like to be kept in the loop on this, but will be practical and open to other mitigation approaches like "building up" to maintain the required attenuation storage as long as any embankment can be evidenced to withstand lateral water pressures and access to maintain is not compromised.

Generally, the design philosophy and morphology for the basins is satisfactory except one major omission in interception storage which will be covered later. The applicant has stated minimum safety requirements including any safety fencing will be outlined at detailed design stage. As a reminder for residential or publicly accessible spaces the LLFA will require the following parameters for the design of the basins: -

i. A nominal water depth no more than 1.2m deep
ii. Side slopes no steeper than 1:3 gradient
iii. A 1.5m wide aquatic wet bench at the max water level surface or 600mm above the formation level as per ROPSA RP992.
iv. Sediment forebay at approx. 10% of the total plan area.
v. 3.5m wide maintenance strip around the perimeter and suitable access arrangements

vi. Freeboard of 300mm to top of bank

4.2) Junctions + Connections (Conveyance System)

The main omission for the conveyance system are standard detail drawings for each component used and how they fit into the wider design code for the access road. A typical cross section or "street scene" is required that provides the reviewer with full information for the makeup of the road drainage including other elements like landscaping and boundary treatment. There should also be separate standard detail drawings for each of the components used in the conveyance system including filters drains and their design details such as typical trench depths, surround/aggregate type etc. Details of filter strips widths and upstand details for the highway edge. Details of the crossfall on the carriageway and footways etc – this is especially important as the crossfall must be greater than the longfall. Swale dimensions, depths, base widths, side slopes, longitudinal gradients and typical planting details. ***We recommend that further information is requested.***

No plant zone around all systems with an underdrain / pipe/or geocellular system. Seek advice from the proposed adoptee on the buffers otherwise use Sewers for Adoption 6th Edition. ***We recommend that further information is requested.***

5) Water quality

Chapter 7.3.18 covers the water quality element for the proposed access road. An overview of water quality requirements has been considered and states that a HAWRAT assessment is required as required by DMRB and SuDS Manual**.** Yet this has not been undertaken and the Ciria SuDS Manual Simple Indices Approach has been used instead. At this full planning stage the HAWRAT assessment will be needed as per the requirements in the relevant standards. LLFA also have the following comments:

a. As a baseline the Access Rd has been assessed to be a medium level of risk for pollutants – generally the LLFA agree with this baseline assessment. The A47 dualling and interchange alterations have been classified differently as high level risk given the A47 is a trunk road - again LLFA have no concerns with this baseline condition.
b. Interception Storage is missing though from the designs - everyday rainfall or first 5mm over the site (known as the first flush) must be captured and retained within the basins by setting the formation level below the invert of the outgoing pipe, typical guidance is 200mm deep. This allows for natural biodegradation and evapotranspiration to occur within the vegetated level of the sump to treat concentrated pollutants over longer time period after these first flushes.
c. General - We remind the applicant that oil interceptors are classed as pre-treatment and do not account for any treatment required as part of a SuDS scheme.

6) Phasing Plans – currently there doesn't appear that any of the phases are reliant on one another for the drainage system to operate effectively. Each cell will dispose of its own surface water independently, but the greenfield rates and cross catchment issue need to be resolved.

7) Freeboard allowances are kept to 300mm in all basins, and this appears to be verified in all 7 basins for all storms. However the network is flooding according to latest hydraulic calcs onto the highway, particularly across Cell 6 in the 1% AEP + 40CC event but the extend of this flooding is unknown as the "Max Flood Volume" output results has not be activated in the results file. Although flooding is generally allowed in the 1% AEP event both in the DCG and

DMRB, state that flooding on the highway should be safe and not escape the highway boundary. As the LLFA cannot see the expected flood volumes, the exceedance routes on the main general arrangement drawing may be misleading. ***Further information is required on flooded volumes and exceedance routing.***

8) A preliminary Adoption and Management plan has been submitted and discussed in chapter 7.3.14. It states the site area is 9.5ha whereas the impermeable areas alone add up to 16.5ha so there is a discrepancy there. Secondly states that NCC will be the responsible body for maintaining the assets, but who has the overall ownership watercourse culverts?. The LLFA question the validity of the maintenance schedules given that no standard details drawings have been provided at this full application stage yet. For example, the filter drain schedule says the grass cutting is required yet filter drains are typically stone filled trenches? The maintenance schedules must be based on the design drawings being submitted, although the bulk of the activities appear reasonable. ***Further information is required.***

9) CSWMP

LLFA have reviewed the developer's response to controlling and mitigating the impacts of the construction stage. Several possible compound areas, haul roads and temporary works areas are proposed as part of the construction stage which can lead to increased runoff quantities and pollution linkages. A Construction surface water management plan has been provided as a high-level review to outline mitigation measures and good construction practices to ensure the development does not cause increased flood risk, or pollution of watercourses or groundwater. Generally, the proposals are sound and reference the control measures for vehicular and fuel storage facilites, impact of temporary paved surfaces and protecting areas from any undue flooding. Overall the document covers the main points required by the LLFA including but not limited too

I. Temporary drainage systems
II. Measures for managing pollution / water quality and protecting controlled waters and watercourses.
III. Measures for managing any on or offsite flood risk associated with construction.

As the scheme develops the LLFA recommend the document is updated with further method statements, scaled and dimensioned plans and drawings detailing the surface water management proposals for the temporary construction stage but at this point the details are sound. ***No further information is required.***

SuDS Standards: Summary of alignment to relevant Non-Statutory Technical Standards for Sustainable Drainage systems

S2 (Greenfield) – Infiltration is not proposed as although previous SI has proved infiltration to be mostly viable across the site, shallow groundwater has limited where this can occur. However, there is a viable alternative in discharge to local watercourse at restricted discharge rates of 2l/s/ha. The LLFA have recommended that further infiltration testing in accordance with BRE365 is undertaken at each of the 7 proposed detention basins and areas where filter drains are proposed. Further monitoring of Groundwater levels is also required. **Further information is required for the drainage hierarchy.**

S4/S6 (Greenfield) – The predevelopment greenfield runoff volumes have been calculated and are satisfactory. Contributing area plans appears justified and reasonable, post development storage features have only used the impermeable areas and due to the site layout larger open spaces may drain to them. **Permitted runoff rates are not agreed for Cell 5 and 7 but others are all ok and demonstrate how flood risk will not increase from this development. Suggest a review of any green spaces that may contribute a percentage to overall runoff entering the proposed drainage system needs to be undertaken, although this may be related to various PIMP figures used in the calcs.**

S7 – The FRA/DS states that there will be no flooding on the site for a 3.33% from the network. The supporting calculations do demonstrate this for the drainage network however the input variables may need revising and better representation of the connection types i.e. filter drains/swales may alter these overall results once changes are incorporated. **Please review the hydraulic calcs input variables and connection types.**

S8 – *W*hilst DMRB does allow the main carriageway to flood in the 1% AEP+ CC event it must do so safely and be contained to the highway boundary, further details are required on this as there is some flooding in Cell 6 currently and the "flooded volumes" are unknown as the hydraulic calcs don't provide these. There are no details of any utility plant (e.g., electrical sub stations or pumping stations) during the 1 in 100-year rainfall event being affected from the excess water within the drainage system. We recognise that operational areas such as the carriageway may be difficult to fully prevent surface water ponding, but information should be presented to assess the consequences of flooding. **Further information is required.**

S9 – The FRA has indicated exceedance routes for flows more than a 1% annual probability rainfall event, but consideration should be given to the expected depth/velocity of flood water to quantify any potential risks to people and property in the event of exceedance of the drainage inlets/outlets. **Further information is required.**