

Technical design note

Project name	Lotmead Farm, Swindon		
Design note title	Response to LLFA & Case Officer Comments		
Document reference	22006-HYD-XX-TN-C-0004		
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1. Executive Summary

Purpose of Document

The purpose of this technical note is to respond to comments raised by Swindon Borough Council Case Officer (Ron Moss) and the LLFA officer (Richard Bennett) as part of consultation process for the live s73 application. In particular, the note provides an explanation of:

- a. Further information provided relating to typical level raising required to facilitate the discharge of surface water runoff; and
- b. Further information provided relating to existing ditches and bunds on the site.

Response to Point a.

In order to demonstrate the necessary level raising required to achieve the drainage strategies for the Original FRA Addendum and the Revised FRA Addendum site sections have been produced at three locations across the site,

The sections compare the proposed ground profile against the existing for both drainage strategies. The locations of the sections shown on the drawings are Phase 1 in the south-west corner of the site, Phase 2 and 3 in the centre and Phase 9 in the north-west corner.

As noted below the locations of the sections chosen are representative of the remaining phases of the site in terms of level raising required to achieve the two FRA drainage strategy options.

Points to Note on the Section Drawings

- » The existing site is relatively flat and therefore level raising is required so that surface water can flow downhill via conveyance features such as pipes, swales, ponds etc. from the dwellings at the furthest point of the parcel to the point of outfall such as an existing ditch or watercourse. This requires the topography to fall from upstream to downstream
- » A Cut and fill analysis has been prepared to determine finished site levels arising from the Original FRA Addendum and the Revised FRA Addendum drainage strategies. The ground models produced for the two cut and fill analysis has been used to generate the site sections and enable a comparison to be made of the likely level raising required for both drainage strategy options.
- » A section through development **Phase 1** was chosen for the following reasons:
 - a. The outfall at Dorcan Stream is subject to fluvial flooding. A comparison can therefore be made of the level raising required as a result of setting the base level of the attenuation

features above and below the fluvial flood level for the Original and Revised FRA drainage strategies respectively.

- b. A detailed drainage and finished level design has been carried out for the submitted reserved matters application which allows the actual drainage features and levels to be represented in the sections.
 - c. Designing the drainage to the Original FRA Addendum requires the levels to be raised by an average of 1.7m compared to an average level raise of 600mm if the Revised FRA Addendum drainage strategy is utilised. The difference in level raising (+1.1m) between the two drainage strategies is a result of setting the base level of the attenuation below the fluvial flood level.
 - d. Phase 1 can be considered similar to Phase 6 in terms of the level raising required.
- » A section through development **Phase 2 and 3** was chosen for the following reasons:
- a. The outfall to an existing ditch in the centre of the site is not subject to fluvial flooding and therefore there is no requirement to set attenuation features above the flood level for both the Original and Revised FRA drainage strategies.
 - b. The Original FRA Addendum drainage strategy proposes a greater number of swales to convey surface water through Phase 2 and 3. The swales require a piped underdrain to provide adequate water storage and convey flows to the outfall ditch.
 - c. The Revised FRA Addendum drainage strategy proposes fewer swales and more larger diameter pipes to store and convey water.
 - a. The smaller diameter pipework required as an underdrain to the proposed swales utilised on the Original FRA Addendum drainage strategy is laid at a steeper gradient which increases the level raising required when taking account of the pipe cover required between the top of the pipe and the finished ground level above.
 - d. Designing the drainage to the Original FRA Addendum requires the levels to be raised by an average of 1.5m compared to an average level raise of 0.975m if the Revised FRA Addendum is utilised. The difference in level raising (+0.525m) between the two drainage strategies is a result of using larger diameter pipes laid at flatter gradients for the Revised FRA Addendum drainage strategy when compared to using swales with piped underdrains at steeper gradients for the Original FRA Addendum strategy.
 - e. Phase's 2 and 3 can be considered similar to Phase 4 in terms of the level raising required.
- » A section through development **Phase 9** was chosen for the following reasons:
- a. The outfall location for the surface water discharge arising from Phase 9 is an existing ditch for the Original FRA Addendum drainage strategy and a direct connection to the River Cole situated to the north of Parcel 9 for the Revised FRA Addendum drainage strategy. Both outfalls are subject to fluvial flooding therefore a comparison can be made of the level raising required as a result of setting the base level of the attenuation features above and below the fluvial flood level for both drainage strategies.
 - b. Phase 9 of the development was chosen as it demonstrates the worst-case level raising across the development site as determined by the cut and fill analysis.
 - c. Designing the drainage to the Original FRA Addendum requires the levels to be raised by an average of 2.5m compared to an average level raise of 1.0m if the Revised FRA Addendum drainage strategy is utilised. The difference in level raising (+1.5m) between the two drainage strategies is a result of setting the base level of the attenuation below the fluvial flood level and connecting directly to the River Cole for the Revised FRA Addendum drainage strategy when compared to connecting to an existing ditch and setting the base

level of the attenuation ponds above the fluvial flood level for the Original FRA Addendum drainage strategy.

- d. Phase 9 can be considered similar to Phase's 5, 7 and 8 in terms of the level raising required.

Site Sections Conclusion

- » The sections demonstrate that level raising is greater for the Original FRA Addendum drainage strategy than that required to achieve the Revised FRA Addendum strategy.
- » Setting the drainage outfall and attenuation ponds below the modelled flood level (Revised FRA Addendum option) allows the drainage network to be cut deeper into the existing ground which consequently reduces the height of level raising required.
- » The three section locations chosen are representative of the level raising required to achieve a surface water drainage strategy across the whole site

Response to Point b.

In their response to the s73 application the LLFA have referred to the proposed development not utilising enough of the existing ditch network across the Lotmead site.

Points to Note on the Existing Ditch & Bund Survey Drawing

- » It should be noted that there are bunds along many of the field boundaries which were incorrectly labelled as ditches within the original PBA / Stantec FRA Addendum drainage strategy drawing. Therefore, the number of existing ditches across the site is not as extensive as originally indicated within the PBA / Stantec FRA Addendum report prepared as part of the original outline application.
- » In order to clarify the correct extent of the existing ditch network representatives from Hydrock and Countryside Partnerships visited the site on the 13th of September 2023 to verify the information provided on the topographical survey. Drawing No. 22006-HYD-PO-XX-DR-C-2800-Site Wide Existing Ditch and Bund Survey was produced showing cross sections and photographs for each location in order to confirm the presence and depth / height of the ditch or bund.
- » All of the existing ditches are being maintained throughout the development and will be used for surface water outfalls from the proposed development. Flows will be restricted to greenfield runoff rates as previously agreed in the outline planning consent.
- » Many of the ditches are within protected hedgerows which restricts construction activity required to form surface water outfalls.
- » Some of the existing ditches are too shallow to use as a surface water outfall.

Existing Ditch and Bund Survey Conclusion

- » The original FRA Addendum report incorrectly identified the number of ditches across the development site, overstating the number of existing features.
- » The Revised FRA Addendum utilises as many of the existing ditch network features as possible for surface water outfall.

Executive Summary Conclusion

It is felt that the information provided within this Technical Note and the drawings referred to within addresses the comments and queries raised by the case officer and the LLFA in respect of the level raising required and use of the existing ditch network across the site.

2. Introduction

The purpose of the following sections of this technical note is to respond in detail to the comments raised by Swindon Borough Council Case Officer (Ron Moss) and the LLFA officer (Richard Bennett) as part of consultation responses received to the live s73 application. In particular, the note provides an explanation of:

- a. Further information provided relating to typical level raising required to facilitate the discharge of surface water runoff; and
- b. Further information provided relating to existing ditches and bunds on the site.

The technical note firstly sets out the comments received from the Case Officer and LLFA Officer relating to the above points. It then provides a response to each, with point a) addressed through the provision and explanation of a set of Section drawings, and point b) addressed through the provision and explanation of a Site Wide Existing Ditch and Bund Survey.

3. Comments Received

The following comments were raised in relation to the two points above:

- a. *Email from the Planning Officer Ron Moss dated 23rd June 2023 –*

On the matter of requiring to considerably build up ground levels with the accompanying lorry loads of earth being brought in, it would be helpful for a bit more clarity. Whilst appreciating that the site is fairly flat, is there an absolute need for it to all drain to one point? I also recollect that Andy pointed out that the farmer had put in rhynes to keep the land from flooding. Could these be used at all as features within the proposed development?

- b. *LLFA Consultation Response (objection) dated 27th July 2023 –*

"The existing site drains via the ditch network to the main rivers flowing through the site. The proposed development must maintain them and utilise them to discharge proposed flows."

"The surface water management strategy needs to ensure the detailed design of the development utilises natural drainage wherever possible and it needs to influence the layouts, proposed ground levels etc. not the detailed layouts changing the natural routes and encouraging deeper drainage systems."

4. Detailed Response to Comments from the Case Officer

- a. *Email from Ron Moss dated 23rd June 2023 –*

On the matter of requiring to considerably build up ground levels with the accompanying lorry loads of earth being brought in, it would be helpful for a bit more clarity. Whilst appreciating that the site is fairly flat, is there an absolute need for it to all drain to one point? I also recollect that Andy pointed out that the farmer had put in rhynes to keep the land from flooding. Could these be used at all as features within the proposed development?

Response

The existing site topography is relatively flat so level raising is necessary to deliver drainage strategies pursuant to both the Original FRA Addendum and the Revised s73 FRA Addendum, as a means of providing adequate gravity fed falls from the furthest point of the development parcels to the point of outfall which is either the existing ditch network or the adjacent watercourses that bound the site.

Three cross sections have been produced across the development site to demonstrate the difference in level raising typically required to achieve both FRA Addendum drainage strategies (original approved and s73 option).

The locations of the three site sections are:

1. **Drawing No. 22006-HYD-P0-XX-DR-C-2721 Drainage Section 1-P03**
 - » Phase 1 of the development where a detailed level and drainage design has been prepared and the outfall into Dorcan Stream is affected by fluvial flooding,
2. **Drawing No. 22006-HYD-P0-XX-DR-C-2722 Drainage Section 2-P03**
 - » Phase 2 and 3 of the development which is located centrally in the site with a drainage outfall into an existing ditch which is unaffected by fluvial flooding and
3. **Drawing No. 22006-HYD-P0-XX-DR-C-2723 Drainage Section 3-P03**
 - » Phase 9 to the north east of the site which has a surface water discharge point into the River Cole which is subject to fluvial flooding and demonstrates a worst case in terms of level raising across the site.

The remaining Phases of the development follow a similar pattern to the chosen section locations in terms of level raising and therefore the sections denoted on the three drawings should be considered typical for the whole site.

The matters listed below have been considered in the drainage strategy design and subsequent level raising assessment for both the Original FRA Addendum and the Revised FRA Addendum Sections:

- » Surface water has to run downhill from the plot at the furthest point of the parcel to the point of outfall via conveyance features such as pipes, swales, ponds etc. This requires the topography to fall from upstream to downstream
- » The existing levels at the point of outfall (either the existing ditches or watercourse) are fixed and all drainage features have to raise from this point to the furthest point of the parcel to enable water to flow from upstream to downstream. Protected trees and hedgerows are present along the routes of the existing ditches which prevents the ditches from being reprofiled to make them deeper which drop the point of outfall.
- » The existing ground profile throughout the entire site is relatively flat (dashed green line on the sections)
- » The Original FRA Addendum requires the base level of attenuation features to be set above the fluvial flood level. It is noted from the sections that the fluvial flood level is close to existing ground level which consequently requires the ground to be raised above existing to form embankments around the ponds to contain the water so that the necessary storage is provided in the attenuation basin.
- » Roadside swales have to be connected to piped underdrains in order provide sufficient water storage and allow water to flow to the attenuation ponds and the point of outfall (ditch / watercourse). Furthermore, where roads intersect a swale a pipe is required under the road so that water can flow from one side to the other.
- » The minimum distance between the top of the pipe and the finished road level is 1.2m, this is mandatory requirement often referred to as 'pipe cover'.
- » The pipe cover constraint is a contributing factor to setting the finished ground profile levels throughout the development parcels.
- » The drainage strategy for the Original FRA Addendum and Revised FRA Addendum assumes wherever possible pipes and swales are laid to the slackest gradients to meet design standards and ensure they are not elevated more than necessary.
- » Piped private drainage is required to connect the rainwater pipes on the dwellings to the adopted sewers in order to satisfy Building Regulations.
- » Where piped drainage is situated beneath private driveways the pipe cover required is 0.9m.
- » Banking is required to overcome the level differences between the existing ground beyond the root protection zones of the existing trees and hedgerows and the dwelling boundary.

An explanation of each drawing (and Section within) is provided below, demonstrating the implications of the Original FRA Addendum and Revised FRA Addendum on levels raising in different parts of the site. The purpose of preparing the sections is to demonstrate that the Original FRA Addendum drainage strategy requires greater level raising than the drainage strategy for the Revised FRA Addendum option.

4.1 Development Phase 1

Drawing No. 22006-HYD-PO-XX-DR-C-2721 Drainage Section 1-PO3

Overview of Development Phase 1

- » A section through Phase 1 of the development was chosen as this phase benefited from a detailed level and drainage design for the reserved matters planning application that was submitted to the LPA.
- » The sections on the drawing demonstrate the impact of level raising required for the drainage strategies associated with the Original FRA Addendum versus the Revised FRA Addendum whereby SuDS and attenuation features are set **ABOVE** the fluvial flood level for the Original FRA addendum and **BELOW** the flood level for the Revised FRA Addendum.
- » The outfall location for the surface water discharge arising from Phase 1 is Dorcan Stream situated on the eastern boundary of the parcel. Dorcan Stream is subject to fluvial flooding.
- » The shallow ditch on the northern boundary of Phase 1 has been discounted as an outfall option due to the presence of a strategic water main which would clash with any proposed pipework thus preventing a connection being made.
- » Both sections (Original FRA Addendum and Revised FRA Addendum) show the existing and proposed ground profiles and work upstream from the point of outfall at the Dorcan stream to a proposed dwelling on the eastern boundary of Phase 1. This plot is a typical example of a dwelling located at a point furthest away from the outfall location and close to the site boundary.

Points to note on the Phase 1 Original FRA Addendum Section:

- » The level of the outfall into Dorcan Stream is set close to the flood level and is fixed by the existing ground profile at this location.
- » The base level of the attenuation basin immediately upstream is set **ABOVE** the modelled flood level (denoted by a horizontal blue line on the drawing) which is close to the existing ground level (denoted by a dashed green line).

Points to note on the Phase 1 Revised FRA Addendum Section:

- » The outfall into Dorcan stream and the attenuation basin immediately upstream is set **BELOW** the modelled flood level.
- » The onsite drainage including the attenuation basin has been sized and hydraulically modelled to account for the outfall pipe being submerged during flood events. Surface water would be held in the attenuation basin and released back into Dorcan stream at the controlled greenfield runoff rate as the flood water subsides in the stream.
- » Setting the outfall and SuDS features **BELOW** the fluvial flood level enables the base of the attenuation basin to be **cut 1.1m deeper** into the existing ground when compared to the

Original FRA Addendum scenario. This allows the upstream drainage to be set at a lower level thereby reducing the extent of level raising required.

Phase 1 Conclusion

- » The existing ground profile is relatively flat so level raising is required to provide an adequate fall across the finished levels to enable surface water to flow from the eastern side of the parcel to the western side where the attenuation basin and the outfall into Dorcan Stream is located.
- » Dorcan stream on the western boundary is the only feasible location within Phase 1 of the development for the proposed drainage systems to discharge to.
- » The extent of level raising is determined by adequate pipe cover (distance between the top of the pipe and the finished surface) and the gradient of the drainage features and used to convey the surface water to the point of outfall (Dorcan Stream).
- » Setting the drainage outfall and attenuation ponds below the modelled flood level (Revised FRA Addendum option) allows the drainage network to be cut deeper into the existing ground which consequently reduces the height of level raising required. The attenuation basin and drainage design for this option has been hydraulically modelled and sized appropriately to take account of the flood water surcharging the outfall pipe.
- » Drawing No. 22006-HYD-PO-XX-DR-C-2721 Drainage Section 1-PO3 demonstrates that the site levels need to be raised by an average of 600mm above existing to achieve the Revised FRA Addendum drainage strategy compared to 1.4m to 1.9m to achieve the Original FRA Addendum drainage strategy. This is due to the requirement within the Original FRA Addendum to set the attenuation and SuDS features above the fluvial flood level whereas the drainage strategy pursuant to the Revised FRA Addendum proposes cutting the attenuation basin 1.1m deeper into the existing ground below the flood level.

4.2 Development Phase 2 & 3

Drawing No. 22006-HYD-PO-XX-DR-C-2722 Drainage Section 2-PO3

Overview of Development Phase 2 and 3

- » A section through Phase 2 and 3 of the development was chosen as it sits centrally within the site and the area is above the fluvial flood level therefore the surface water outfall into the existing ditch network is not affected by fluvial flooding.
- » Instead, the ground profile and depth of the ditch at the outfall location determines the outfall level of the drainage and the subsequent upstream level raising required for this parcel.
- » The sections on the drawing demonstrate the impact of level raising required for the drainage strategies associated with the Original FRA Addendum versus the Revised FRA Addendum.
- » The outfall location for the surface water arising from Phase 2 and 3 is an existing ditch situated in the centre of the site to the north of the development parcel. The ditch level is higher than the fluvial flood level. Therefore, there is not a requirement for SuDS and attenuation features to be set above the flood level in this location.
- » There are bunds along the field boundaries to the east and west of the Phase 2 & 3 parcel therefore the only surface water outfall option is to connect to the ditch to the north of the development parcel. Refer to Drawing No. 22006-HYD-PO-XX-DR-C-2800-Site Wide Existing Ditch and Bund Survey enclosed within the s73 application submission.
- » Both sections (Original FRA Addendum and Revised FRA Addendum) show the existing and proposed ground profiles and work upstream from the point of outfall at the existing ditch to an indicative proposed dwelling on the south-eastern boundary of Phase 2 and 3. This plot is a typical example of a dwelling located at a point furthest away from the outfall location within the development parcel and adjacent to a protected hedge.

- » Phase 2 and 3 does not benefit from a detailed layout plan of the development therefore roads and drainage features have been assumed and are shown indicatively on the site sections.

Points to note on the Phase 2 & 3 Original FRA Addendum Section:

- » The Original FRA addendum drainage option utilises more swales to convey surface water and additional attenuation basins within the parcel. Providing additional swales and ponds within the catchment uses more developable land, which reduces the residential capacity of the site.
- » The swales need to be connected to piped underdrains in order provide sufficient water storage and allow water to flow to the attenuation ponds and point of outfall (existing ditch). The smaller pipework required as the underdrain in the base of the swale is laid at a steeper gradient than that required for a larger pipe. The steeper pipe gradient and associated pipe cover results in greater level raising.

Points to note on the Phase 2 & 3 Revised FRA Addendum Section:

- » The Revised FRA Addendum option utilises larger pipes for surface water storage and water conveyance. Larger pipes can be laid to flatter gradients which reduces the amount of level raising.
- » Utilising less swales and more underground pipework allows a larger area of developable land and therefore a greater capacity for residential development.

Phase 2 & 3 Conclusion:

- » The existing ground profile is relatively flat so level raising is required to provide an adequate fall across the finished levels to enable surface water to flow from the southern end of the parcel to the northern end where the attenuation basin and the outfall into the existing ditch is located.
- » The existing ditch located centrally within the site is the only feasible location within Phase 2 and 3 of the development for the proposed drainage systems to discharge to as there are no ditches, only bunds, located along the eastern and western boundaries of the development phase (refer to Drawing No. 22006-HYD-PO-XX-DR-C-2800-Site Wide Existing Ditch and Bund Survey).
- » The extent of level raising is determined by adequate pipe cover and the gradient of the drainage features used to convey the surface water to the point of outfall (the existing ditch to the north of the parcel).
- » The smaller diameter pipework required as an underdrain to the proposed swales utilised on the Original FRA Addendum drainage strategy is laid at a steeper gradient which increases the level raising required when taking account of the pipe cover required over the top of any pipework.
- » Drawing No. 22006-HYD-PO-XX-DR-C-2722 Drainage Section 2-P03 demonstrates that the site levels need to be raised by an average 0.975m above existing to achieve the Revised FRA Addendum drainage strategy compared to an average raise of 1.5m to achieve the Original FRA Addendum drainage strategy.
- » Providing a greater number of swales and ponds within the catchment as required by the Original FRA Addendum uses more developable land, which reduces the residential capacity of the site.

4.3 Development Phase 9

Drawing No. 22006-HYD-PO-XX-DR-C-2723 Drainage Section 3-P03

Overview of Development Phase 9

- » A section through Phase 9 of the development was chosen as it demonstrates the worst-case level raising across the development site. This was determined by a high level cut and fill analysis which assessed the level raising required for the Original FRA Addendum and the Revised FRA Addendum drainage strategies. The cut and fill analysis identified Phase 9 as the area of the site that required the greatest elevation of level raising.
- » The sections on the drawing demonstrate the impact of level raising required for the drainage strategies associated with the Original FRA Addendum versus the Revised FRA Addendum whereby SuDS and attenuation features are set **ABOVE** the fluvial flood level for the Original FRA Addendum and **BELOW** the flood level for the Revised FRA Addendum.
- » The outfall location for the surface water discharge arising from Phase 9 is an existing ditch for the Original FRA Addendum drainage strategy and a direct connection to the River Cole situated to the north of Parcel 9 for the Revised FRA Addendum drainage strategy. Both outfalls are subject to fluvial flooding.
- » The outfall at the River Cole (for the Revised FRA Addendum drainage strategy) is approximately 900mm lower than the existing ditch level proposed for the Original FRA Addendum strategy. A direct connection to the River Cole allows the upstream drainage to be set at a lower level thus reducing the level raising required to achieve the Revised FRA Addendum strategy.
- » Both sections (Original FRA Addendum and Revised FRA Addendum) show the existing and proposed ground profiles and work upstream from the point of outfall described above to a proposed indicative dwelling at the southwestern corner of Phase 9. This plot is a typical example of a dwelling located at a point furthest away from the outfall location adjacent to a protected hedge.
- » Phase 9 does not benefit from a detailed layout plan of the development therefore roads and drainage features have been assumed and are shown indicatively on the site sections.

Points to note on the Phase 9 Original FRA Addendum Section:

- » The base level of the attenuation basin immediately upstream of the outfall ditch is set **ABOVE** the modelled flood level (denoted by a horizontal blue line on the drawing) which is close to the existing ground level (denoted by a dashed green line).
- » The Original FRA Addendum drainage option utilises more swales to convey surface water and additional attenuation basins within the parcel. Providing additional swales and ponds within the catchment uses more developable land, which reduces the residential capacity of the site.
- » The swales need to be connected to piped underdrains in order provide sufficient water storage and allow water to flow to the attenuation ponds and point of outfall (existing ditch). The smaller pipework required as the underdrain in the base of the swale is laid at a steeper gradient than that required for a larger pipe. The steeper pipe gradient and associated pipe cover results in greater level raising.

Points to note on the Phase 9 Revised FRA Addendum Section:

- » The outfall into the River Cole is set **BELOW** the modelled flood level.
- » The onsite drainage including the attenuation basin has been hydraulically modelled to account for outfall pipe being submerged during flood events. Surface water would be held in the

attenuation basin and released back into the River Cole at the controlled greenfield runoff rate as the flood water subsides in the river.

- » Setting the outfall below the fluvial flood level enables the base level of the attenuation basin to be set **BELOW** the modelled flood level which is consequently cut deeper into the existing ground than the Original FRA Addendum scenario.
- » By setting the base level of the pond below the fluvial flood level and connecting the outflow pipe directly to the River Cole, rather than the existing ditch, the pond base level is approximately 1.5m lower than the base level of the pond required for the Original FRA Addendum option. This allows the level raising to be reduced in height by approximately 1.5m when compared to that required for the Original FRA Addendum drainage strategy.
- » The Revised FRA Addendum option utilises larger pipes for storage and water conveyance. Larger pipes can be laid to flatter gradients which also reduces the amount of level raising required.

Phase 9 Conclusion:

- » Working upstream from the pond to a plot situated in the south-western corner of the parcel whilst providing adequate pipe cover over the drainage features referred to above results in raising levels above the existing ground. This is because the existing ground is relatively flat and the drainage features need to fall towards the point of outfall.
- » Allowing the drainage outfall and attenuation ponds to be set below the modelled flood level (Revised FRA Addendum option) enables the drainage network to be cut deeper into the existing ground which consequently reduces the height of level raising required.
- » Drawing No. 22006-HYD-PO-XX-DR-C-2723 Drainage Section 3-P03 demonstrates that the site levels need to be raised by an average of 1m above existing to achieve the Revised FRA Addendum drainage strategy compared to an average of 2.5m to achieve the Original FRA Addendum drainage strategy. This is due to the requirement within the Original FRA Addendum drainage strategy to set the attenuation and SuDS features above the fluvial flood level whereas the Revised FRA Addendum drainage strategy proposes cutting the attenuation basin 1.5m deeper into the existing ground and below the flood level.
- » The Revised FRA Addendum drainage strategy also connects directly to the River Cole which is approximately 900mm lower than the existing ditch within the development parcel. This in combination with setting the attenuation basin below the fluvial flood level further assists with reducing the level raising required.
- » Providing a greater number of swales and ponds within the catchment as required by the Original FRA Addendum uses more developable land, which reduces the residential capacity of the site.

4.4 Summary of Conclusions from the Site Section Drawings

- a. The three section drawings produced provide a typical example across the development site of the level raising required to achieve both of the drainage strategy options i.e. the Original FRA Addendum and the Revised FRA Addendum.
- b. The entire site is relatively flat which consequently requires level raising in order to provide sufficient falls to convey surface water arising from the development area to the point of discharge.
- c. Two of the three development phases shown on the section drawings (Phase 1 and Phase 9) are subject to fluvial flooding and Phase 2 and 3 are not.

- d. In cases where the development phases are subject to fluvial flooding the flood level is close to the existing ground level.
- e. The Original FRA Addendum requires the SuDS and attenuation features to be positioned above the fluvial flood level. This results in the base level of the ponds and other SuDS features being set close to ground level.
- f. With respect to the Revised FRA Addendum drainage strategy, situating the base level of the attenuation ponds below the fluvial flood level and designing the attenuation to take account of the flooded outfall allows the pond to be cut deeper into the existing ground which consequently reduces the site raising required within the parcel.
- g. Providing a greater number of swales and ponds within the catchment as required by the Original FRA Addendum uses more developable land, which reduces the residential capacity of the site.
- h. The extent of existing ditches across the entire site is shown on Drawing No.22006-HYD-PO-XX-DR-C-2800-Site Wide Existing Ditch and Bund Survey. Not all parcels benefit from a suitable ditch along the parcel boundaries into which surface water can discharge to. Many of the ditches are too shallow to use as an outfall for the proposed drainage. There are also bunds below the protected hedge lines bounding the existing fields.
- i. Where an outfall to an existing ditch or water course is provided, sufficient attenuation is required within the upstream drainage system so that flows can be restricted to the agreed greenfield runoff rates. Providing such storage within each catchment uses more developable land, which reduces the residential capacity of the site (Original FRA Addendum strategy). Providing more below ground piped storage and end of line attenuation allows more developable land to be utilised (Revised FRA Addendum strategy).
- j. The remaining development phases will require a similar extent of level raising to drain the surface water. The extent of level raising will range between that shown for Phases 1, 2 and 3 and that shown for Phase 9 which is considered the worst case.

5. Further information relating to existing ditches and bunds

b. LLFA Consultation Response (objection) dated 27th July 2023 –

"The existing site drains via the ditch network to the main rivers flowing through the site. The proposed development must maintain them and utilise them to discharge proposed flows."

"The surface water management strategy needs to ensure that the detailed design of the ongoing phases of development utilise the natural drainage wherever possible and this needs to influence the detailed layouts, proposed ground levels etc. not the detailed layouts changing these natural routes and encouraging deeper drainage systems."

In their objection correspondence the LLFA have referred to the proposed development utilising the existing ditch network across the Lotmead site. It should be noted that there are bunds along many of the field boundaries which were incorrectly labelled as ditches within the original PBA / Stantec FRA Addendum drainage strategy drawing. Therefore, the number of existing ditches across the site is not as extensive as originally indicated within the PBA / Stantec FRA Addendum report.

In order to clarify the correct extent of the existing ditch network representatives from Hydrock and Countryside Partnerships visited the site on the 13th of September 2023 to verify the information provided on the topographical survey. Drawing No. 22006-HYD-PO-XX-DR-C-2800-Site Wide Existing Ditch and Bund Survey was produced showing cross sections and photographs for each location in order to confirm the presence and depth / height of the ditch or bund.

Response

The following provides a response to each comment raised by the LLFA

1. **LLFA Comment**

The existing site drains via the ditch network to the main rivers flowing through the site. The proposed development must maintain them and utilise them to discharge proposed flows.

Response

- » As referred to above the existing ditch network is not as extensive as originally identified in the PBA / Stantec FRA Addendum report.
- » Hydrock have produced 'Drawing No. 22006-HYD-PO-XX-DR-C-2800-Site Wide Existing Ditch and Bund Survey' to further clarify the location and depth of the existing ditch network across the site. The drawing also superimposes the location of the intended outfalls from the proposed drainage strategy networks into the ditch network to clearly demonstrate the extensive use of the ditch network across the site.
- » The drawing confirms the presence of three main ditches identified by a blue dashed line on the plan, one on the eastern side of the site, one through the centre of the site and one on the western side all of which fall gently from south to north.
- » There are also sections of relatively short ditches to the south-east of the existing farm buildings and a section in the centre of the site running in an east to westerly direction.
- » All of the existing ditch network is being maintained and utilised wherever possible to discharge surface water from the proposed development at restricted greenfield runoff rates.
- » As the detailed design for the site evolves the ditches can also be utilised if necessary for land drainage from the proposed soft landscaping areas thus mimicking the existing situation.
- » The proposed discharge locations are identified on Drawing No. 22006-HYD-PO-XX-DR-C-2800-Site Wide Existing Ditch and Bund Survey.
- » There are several constraints to providing more frequent piped connections to the existing ditch network:
 - e. Some of the ditches are too shallow as denoted on the ditch cross sections (approximately 0.5m deep)
 - f. Adequate attenuation is required upstream of any outfall point which requires room within the parcel. This consequently uses more developable land and reduces the residential capacity of the site.
 - g. Many of the ditches are within protected trees and hedgerow which would need to be removed in order to lay the necessary pipework and headwall and provide the mandatory 6m sewer easements. Therefore, the more outfall locations that are provided across the site a greater extent of hedgerow requires removal.

2. **LLFA Comment**

The surface water management strategy needs to ensure the detailed design of the development utilises natural drainage wherever possible and it needs to influence the layouts, proposed ground levels etc. not the detailed layouts changing the natural routes and encouraging deeper drainage systems.

Response

- » Almost all of the existing ditch network is being maintained and utilised wherever possible to discharge surface water arising from the proposed development. Minor changes will be necessary where highways and infrastructure are required to cross over them.
- » There are no proposals within the Revised FRA Addendum drainage strategy to change the natural routes and encourage deeper drainage systems. Many of the ditches are within protected hedgerows which precludes changes to them.

- » Where an outfall to an existing ditch or water course is provided, sufficient attenuation is required within the upstream drainage system so that flows can be restricted to the agreed greenfield runoff rates. Under the requirements of the Original FRA Addendum providing storage features such as swales within each catchment uses more developable land which reduces the residential capacity of the site and consequently affects the layout.
- » Deeper drainage is proposed in the Revised FRA Addendum to reduce the extent of level raising required across the flat site. This is achieved by setting the base level of the drainage features below the fluvial flood level and designing it with a surcharged outfall to take account of the presence of possible flood water. The base levels of the existing ditch network will remain unchanged contrary to the comments raised by the LLFA.