4.0 SOURCES OF FLOOD RISK

4.1 Fluvial Flood Risk

4.1.1 Information relating to flood risk at the site has been obtained from the Environment Agency and from the Gov.uk website. The Flood Map for Planning shows that the site is wholly located within Flood Zone 1 as seen in **Figure 3**, the site is also identified to be at 'very low' risk of fluvial flooding based on the long-term fluvial flood risk mapping (refer to mapping in **Appendix B**).

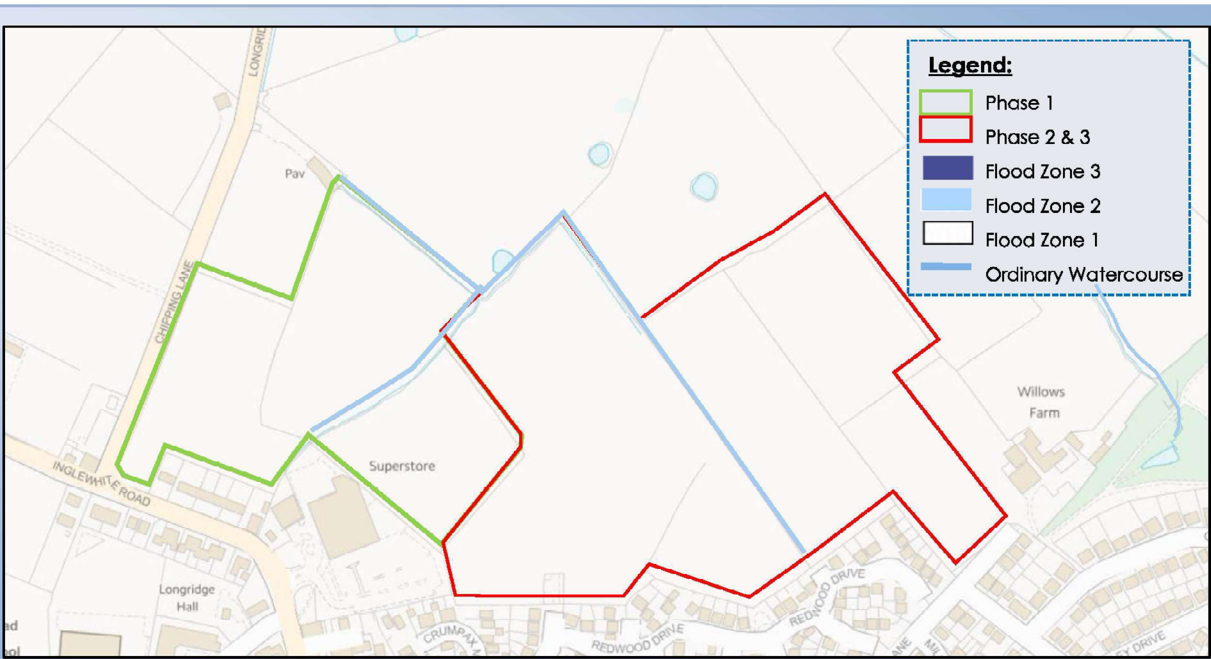

Figure 3: Fluvial/Tidal Flood Zone Map for Planning Extract (GOV.UK 2021)

4.1.2 There is an existing Ordinary Watercourse crossing the development site, which flows north until the watercourse outfalls into Higgin Brook approximately 1km to the north. Higgin Brook flows north and eventually outfalls into the River Loud (Main River) located approximately 1.2km north of site. Due to the distance of site to the nearest Main River, the risk associated is 'very low'.

4.1.3 In terms of the Ordinary Watercourse, consultations with the EA, RVBC and LCC also did not identify any historic flooding at the site and review of the topographic survey suggests that the existing site levels are 800mm above the bed levels of the Ordinary Watercourses crossing the site. Due to the nature and scale of the existing Ordinary Watercourse, the flood risk associated is considered to be 'very low'.

4.1.4 The LLFA (LCC) will require a maintenance easement to be maintained from the existing Ordinary Watercourse for future maintenance. The LCC typically require an 8m easement to be maintained from the Top of Bank of Ordinary Watercourses into the development area. The easement should provide clear and unimpeded access for future maintenance including no fencing, walls or buildings. Ordinary Watercourses are also required to remain open channel where possible. Culverting of the watercourse for crossing purposes however, is typically accepted by LCC as with Phase 1 of development, providing the culverting is kept to a minimum and follows LCC design requirements. Early discussion with LCC is advised to get approval of any culvert proposals.

4.1.5 As part of the Phase 1 application, hydraulic modelling of the Ordinary Watercourse crossing the site was undertaken to determine the potential flow risks associated with the proposed part culverting the Ordinary Watercourse for crossing. The section below draws on outcomes of the modelling exercise to further evidence the risk to the proposals from the Ordinary Watercourse is low.

Hydraulic Assessment

4.1.6 For full details of the Ordinary Watercourse model build and parameters, refer to the full separate Hydraulic Assessment (HA) Report which has been included in **Appendix H**). This section of the Flood Risk Assessment will summarise the key findings of the separate report. The HA used The Flood Estimation Handbook (FEH) to obtain the catchment descriptors for Higgin Brook upstream of a point north of the development site. Three smaller sub-catchments (Sub A, Sub B and Sub C) upstream of the 600mm culvert located adjacent to Chipping Lane to the north of the site were identified using LiDAR data (see Hydraulic Assessment in **Appendix H** for full methodology).

4.1.7 The Revitalised Flood Hydrograph (ReFH) method was then applied for each sub-catchment based on catchment descriptors. The full hydrographs for all sub-catchments in all return periods are shown in **Appendix H**. The HA considered the following events:

- 1 in 5 year (20% AEP)
- 1 in 30 year (3.3% AEP)
- 1 in 100 year (1% AEP)
- 1 in 100 year (1% AEP) plus Climate Change (CC)

4.1.8 The results of the simulations have been presented in the form of longitudinal profile and cross sections (including peak water levels) included in **Appendix H**. The results show that water levels remain in bank for most of the Ordinary Watercourse reach in all Annual Exceedance Probabilities in the existing scenarios. In the proposed scenario a 600mm diameter pipe, approximately 26m long, was inserted upstream to simulate a proposed culvert crossing. Comparison of the existing and post development levels in the 1% AEP plus climate change event shows that peak levels remain largely unchanged, although with some small increases in places. These increases are relatively small and do not increase flood risk to the proposed development or neighbouring areas.

4.1.9 Sensitivity analysis was carried out on the model parameters and showed that water levels were not particularly sensitive to changes in channel roughness, therefore the impact of the proposed development on flood depths in vicinity of the site and the wider floodplain are low and within modelling tolerances. Overall, when the outcomes of the proposed scenario of the previously completed FRA are considered, the risk of the proposed development as part of Phase 2 & 3 is minimal.

Safe Access and Egress

4.1.10 The access road to site was previously approved as part of the Phase 1 application (Ref: 3/2014/0764). This is shown on the EA's Flood Zone Map for Planning, to also be located within Flood Zone 1. Safe access and egress will therefore be maintained via Chipping Lane (through Phase 1).

4.2 Tidal Flood Risk

4.2.1 The coastline is located approximately 30km west of the proposed site and the Ribble Estuary is located approximately 20km west of site. Due to the distance from the coast, the associated flood risk from these sources is considered to be 'very low'. This is supported by the EA's Fluvial/Tidal Flood Zone Map for Planning as the site is shown to be located within Flood Zone 1.

4.3 Flood Risk Vulnerability Classification and Flood Zone Compatibility

4.3.1 The proposals are solely 'residential' in nature and as such is classified as 'More Vulnerable' in Table 2: Flood Risk Vulnerability Classification within the PPG. Table 3: Flood Risk Vulnerability and Flood Zone 'Compatibility' within the PPG confirms that this type of land use is appropriate for Flood Zone 1, providing there is no increase in flood risk elsewhere due to the proposals.

4.4 Surface Water Flood Risk

4.4.1 Surface water flooding occurs when rainwater is unable to drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead. The risk associated with surface water run-off is indicated by the long-term flood mapping (extract shown in **Figure 4**).

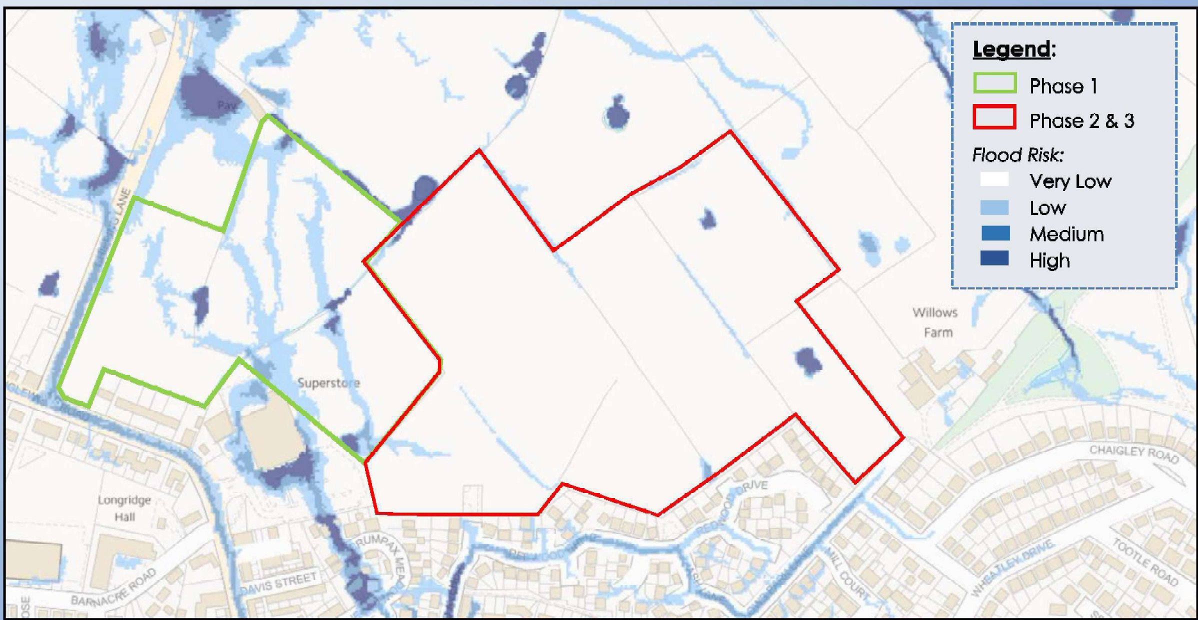

Figure 4: Surface Water Flood Map Extract (GOV.UK, 2021)

4.4.2 As indicated in **Figure 4**, the site is predominantly at 'very low' to 'low' risk from flooding associated with surface water. There are however some existing areas of 'medium' to 'high' risk shown onsite. A review of the existing topography shows that these higher flood risk areas are closely associated with the natural low-lying drainage ditches or existing water bodies including the Ordinary Watercourse and existing pond features onsite. These low-lying areas would be susceptible to ponding in the extreme rainfall events as the surrounding ground levels are elevated in comparison (refer to **Appendix F** for topographic survey).

4.4.3 The flood risk to the proposals from surface water will be inherently reduced, post-development through the design and implementation of a sustainable surface water drainage regime onsite. Interception methods may be beneficial along any boundary where run-off can enter site or cause risk to others. For any residual risks it is advised that (following any re-grade of the site) FFL are raised above the external levels to provide overland flood routes for excess surface water run-off; this will help protect properties from excess surface water run-off.

Pluvial (Overland run-off) Flood Risk

4.4.4 Intense rainfall that is unable to soak into the ground or enter drainage systems can run-off land and result in flooding. Local topography and the land use can have a strong influence on the direction and depth of flow. The topography of the surrounding undeveloped areas means there is little potential for overland flows to impact on the site, as levels generally fall towards the existing watercourses.

4.4.5 The volume and rate of overland flow from land can be exacerbated, if development increases the percentage of impermeable area. Any overland flows generated by the development must be carefully controlled; safe avenues directing overland flow away from adjacent development is advised.

Sewer Flood Risk

4.4.6 In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and waste water known as 'combined sewers'. Foul water flooding often occurs in areas prone to overland flow and can result when the sewer is overwhelmed by heavy rainfall and will continue until the water drains away.

4.4.7 United Utilities (UU) records identify there to be a foul water pumping station onsite adjacent to the southern boundary (see sewer records in **Appendix C**). This pumping station has been accounted for within the planning proposals and a public foul water sewer (375mm.dia) associated with the pumping station has also been identified onsite adjacent to the southern boundary. In addition, there is also a public surface water sewer (375mm.dia) which presently crosses the development site from the southern boundary towards Phase 1. Consultation with UU, identified no recorded historical sewer flooding issues on or near to the proposed development site (see **Appendix C** for correspondence).

4.5 Groundwater Flood Risk

4.5.1 High groundwater levels are usually the key source of groundwater flooding, which occurs when excess water emerges at the grounds surface (or within manmade underground structures such as basements). Groundwater flooding is often more insistent than surface water flooding and would typically last for weeks/months rather than days meaning the result to property is often more severe.

4.5.2 In general terms groundwater flooding can occur from three main sources:

- If groundwater levels are naturally close to the surface, then this can present a flood risk during times of intense rainfall. No groundwater flood risk has been identified during consultation with the various interested parties.
- Seepage and percolation occur where embankments above ground level hold water. In these cases, water travels through the embankment material and emerges on the opposite side of the embankment. At present there are no reported problems with groundwater flooding.
- Groundwater recovery/rebound occurs where the water table has been artificially depressed by abstraction. When the abstraction stops the water table makes a recovery to its original level. There is the potential for groundwater flooding in low lying areas where groundwater levels have been depressed below their pre-pumping conditions, where these were at or close to ground level. As with the seepage scenario the likelihood of flooding from this source is low.

4.5.3 The mapping data for groundwater shows that the site is underlain by a Secondary A Bedrock Aquifer with Secondary 'Undifferentiated' Superficial Deposits (**Appendix B**). The site has been identified to be in a Low Groundwater Vulnerability Area to a Minor Aquifer.

4.5.4 No historical groundwater flooding of the site has been identified during consultation with the various interested parties. Irrespective, it is advised that external levels fall away from the property (where feasible) to minimise the flood risk from a variety of sources. By keeping the finished floor levels elevated relative to the externals, this should help create an overland flow route.

4.6 Artificial Sources of Flood Risk

4.6.1 National policy states that an FRA should consider the potential risks from a variety of other flood sources including artificial sources (such as risks from reservoirs and canals).

Reservoirs

4.6.2 The EA recognises reservoirs as bodies of water over 25,000cu.m, the site is not considered to be influenced by any flooding associated with a breach or failure in the neighbouring reservoirs.

4.6.3 There are a number of small bodies of water (less than 25,000cu.m) located to the north of the development site and are understood to aid in the natural drainage of the surrounding area. The risk they pose to site is considered to be 'low' due to the natural topography and the scale/nature of these small drainage features.

Canals

4.6.4 The nearest identified canal systems to the proposed development site is the Lancaster Canal located approximately 1km to the west of site. Due to the proximity and the local topography, the associated flood risk is considered to be 'low'.

4.6.5 Irrespective, it is advised that external levels fall away from the property (where feasible) to minimise the flood risk from a variety of sources. By keeping the Finished Floor Levels elevated relative to the externals, this should help create an overland flood flow route in the event of a breach or any other source of flooding that could lead to overland flow.

4.7 Historical and Anecdotal Flooding Information

4.7.1 An internet-based search for flooding did not identify any historical flooding directly to the site however, the internet-based search did identify surface water flooding issues to the neighbouring Longridge area during extreme storm events. Furthermore, review of the Lancashire County Council's and Ribble Valley Borough Council's Preliminary Flood Risk Assessment and Strategic Flood Risk Assessment, did not highlight any historic flooding pertinent to this FRA.

4.7.2 Consultation with various interested parties including the EA also failed to highlight any historical flooding on the site. No historical sewer flooding issues onsite were highlighted by UU or within the wider area (correspondence in **Appendix B** and **C** respectively).

4.8 Flood Risk Mitigation Measures & Residual Risks

4.8.1 The site is located within Flood Zone 1 and considered to be at little risk of fluvial/tidal flooding. To observe a conservative approach however, mitigation measures have been proposed below to safeguard the development with regards to other potential residual sources of flood risk and to consider the uncertainties of climate change in accordance with the NPPF and PPG.

Mitigation Measures

4.8.2 For 'more vulnerable' development located within Flood Zone 1, it is typical to set the Finished Floor Levels (FFL) of residential dwellings to a minimum of 150mm above the existing ground levels. By ensuring the FFLs are raised sufficiently above the external levels (following any re-grade) should mitigate any risk of flooding from a variety of sources, including groundwater and surface water run-off risks at the proposed development.

4.8.3 Any overland flows generated by the development must be carefully controlled. Safe avenues directing overland flow way from any existing and proposed buildings are advised. Some areas of the site are shown to be at higher risk from surface water, these areas correspond with the existing drainage ditches and pond features. It would be recommended that the existing drainage features be retained where practical and/or mimicked within the development to make allowance for natural conveyance through the proposals.

4.8.4 In accordance with LCC there is a requirement to maintain an easement from the existing Ordinary Watercourse for future maintenance. The LCC typically require an 8m easement to be maintained from the Top of Bank of Ordinary Watercourses into the development area. The easement should provide clear and unimpeded access for future maintenance including no fencing, walls or buildings. Ordinary Watercourses are also required to remain open channel where possible. Culverting of the watercourse for crossing purposes however, is typically accepted by LCC as occurred on Phase 1 of development, providing the culverting is kept to a minimum and follows LCC design requirements. Early discussion with LCC is advised to get approval of any culvert proposals.

4.8.5 To minimise the flood risk to the neighbouring properties it is recommended that the surface water run-off generated by the proposals be managed effectively with the peak rates of run-off being restricted to the equivalent of the pre-development situation (with betterment). The proposed onsite surface water drainage system will need to be sized to contain the 1 in 30yr return period event below ground with exceedance from storm events up to and including the 1 in 100yr return period storm event with a 40% allowance for climate change being contained onsite.

4.8.6 As with any drainage system blockages within either the foul or surface water system have the potential to cause flooding or disruption. It is important that should any drainage systems not be offered for adoption to either the Water Company or the Local Authority then an appropriate maintenance regime should be scheduled with a suitably qualified management company for these private drainage systems.

Residual Risks

4.8.7 If an extreme rainfall event exceeds the design criteria for the drainage system it is likely that there will be some overland flows that are unable to enter the system, it is important that these potential overland flows are catered for within the development site if the capacity of the drainage system is exceeded.

5.0 SURFACE WATER MANAGEMENT

5.1 Pre-Development Surface Water Run-off

5.1.1 Phase 2 & 3 of the development covers 10.66ha. The proposed development area (excluding areas onsite such as the POS areas and the area allocated for a new school) and will cover 6.24ha based on the proposed planning proposals. At present the development area is 100% permeable and is understood to drain naturally to the onsite Ordinary Watercourse, which ultimately outfalls into Higgin Brook located to the north of the site.

5.1.2 The peak rates and volumes of run-off generated by Phase 2 & 3's development area has been calculated for the peak events shown in **Table 1** (full details **Appendix J**). The surface water run-off rates have been calculated using the FEH Statistical Method.

Site Area	Run-Off Rates				Run-Off Volumes	
	1 In 1 Year	1 In 30 Year	1 In 100 Year	QBar	1 In 1 Year	1 In 100 Year
6.236ha	73.8l/s	144.3l/s	176.5l/s	84.9l/s	710.7cu.m	2178.7cu.m

Table 1: Pre-Development Surface Water Run-Off Rates (Betts Hydro, 2021)

5.2 Post Development Surface Water Run-Off

5.2.1 At present the indicative proposals show the development area to cover 6.24ha of the wider site. Based on the planning layout we have estimated that the post-development impermeable areas will increase to approximately 45% of the development area. The unrestricted post-development run-off rates have been detailed in **Table 2**.

Site Area	Run-Off Rates		
	1 In 1 Yr	1 In 30 Yr	1 In 100 Yr +CC
2.806ha	150.2l/s	291.3l/s	488.5l/s

Table 2: Post-Development Un-Restricted Run-Off Rates (Betts Hydro, 2021)

5.2.2 In accordance with national and local planning policies it is necessary to restrict surface water run-off rates where at all practical to mimic a pre-development greenfield situation. The proposals will therefore be to discharge surface water run-off from site mimicking the pre-development greenfield situation (**Table 1**). Further details of proposed drainage strategy can be found in Section 5.6.

5.3 Sustainable Drainage Systems (SuDS)

5.3.1 Sustainable Drainage Systems (SuDS) can address the four key sustainability objectives including: water quantity, water quality, amenity and biodiversity. Peak surface water discharge rates to watercourses and sewers should be appropriately managed and where possible reduced. Preference should always be given to SuDS over the traditional methods of buried sewers wherever possible and practical.

5.3.2 It would be beneficial to implement wider green space/Public Open Space area(s) in one or more locations within site, where SuDS features could be implemented. Multiple benefits to using SuDS include the improvement of bio-diversity, aesthetics, ecology and water quality. Opportunities should also be taken to provide soft landscaping where at all possible on site to assist in minimising surface water run-off.

5.3.3 Given the indicative layout, there may be the opportunity to incorporate SuDS methods such as swales and ponds (**Figure 5**) within the non-developed areas, to provide a degree of treatment before flows are carried offsite. It would also be recommended that permeable paving and bio-filtration be considered in non-adopted areas where at all feasible; to assist locally with surface water management (subject to optimum ground conditions). If infiltration is not feasible then a connection into the main drainage systems would be needed.

Figure 5: SuDS Photographs (SusDrain, 2012)

5.3.4 Promoting SuDS to deal with surface water at the source, will limit the required attenuation and in turn reduce the volume of surface water in the nearby watercourse and sewer infrastructure. There may be the potential to utilise SuDS features for conveyance/attenuation of surface water flows within the proposed drainage strategy, opposed to the traditional below ground storage methods. Detailed design should confirm whether this site would be suitable for incorporation of SuDS following more detailed analysis of levels, ground conditions and attenuation requirements.

5.4 Methods of Surface Water Management

5.4.1 At present the development area for Phase 2 & 3 covers 6.24ha and the proposed impermeable area is assumed to increase from 0% to 45%. There are three methods that have been reviewed for the management and discharge of surface water. These may be applied individually or collectively to form a complete strategy and should be applied in the order of priority listed below:

- Discharge via infiltration
- Discharge to watercourse
- Discharge to public sewerage system

5.5 Discharge via Infiltration

5.5.1 Any impermeable areas that can drain to soakaway or an alternative method of infiltration would significantly improve the sustainability of any surface water systems.

5.5.2 The Cranfield Soil and AgriFood Institute (CSAI), Soilscapes viewer identifies the soils to be slowly permeable, seasonally wet, slightly acid but base-rich loamy and clayey. The British Geology Survey (BGS) mapping data indicates that the bedrock geology consists of a mixture of Bowland Shale Formation (Mudstone) and Pendleside Sandstone Member (Sandstone) and has superficial deposits associated with Till and Devensian.

5.5.3 Based on the ground conditions identified by the published online datasets, it can be considered that infiltration would not likely provide a viable drainage solution for the development site due to the impermeable strata. A ground investigation report (Ref: STN3505NM-G01) was also undertaken for Phase 1 and identified soakaways were not suitable to be used as a method for managing surface water run-off. Infiltration rates however, vary on a site by site basis and therefore it would be recommended further investigation in the form of Soakaway Testing to BRE365, takes place within Phase 2 & 3 areas upon planning approval, to confirm these areas are also not suitable for an infiltration-based solution.

5.6 Discharge to Watercourse

5.6.1 Assuming infiltration is not suitable for managing all the surface water run-off generated by the development, the next method in the drainage hierarchy is discharge surface water to a watercourse. As previously mentioned, most of the site naturally drains into the Ordinary Watercourse crossing the development site.

5.6.2 The surface water run-off generated by the development is therefore proposed to mimic the existing situation and discharge into the existing Ordinary Watercourse crossing the development site, as illustrated in the preliminary drainage proposals plan (**Figure 6**). This approach is similar to that proposed and agreed for the earlier Phase 1 and mimics the existing situation through the current mechanisms of run-off management.

5.6.3 Detailed design will need to be carried out to confirm whether a site wide gravity solution can be achieved. Although, the site naturally drains to the Ordinary Watercourse at present, when the development proposed levels are considered and formal connections made. It is likely that multiple surface water outfalls will be required to accommodate the layout proposals, the specifics will be confirmed during detailed design.

5.6.4 Consents will be required from LCC who are the LLFA and responsible in part for Ordinary Watercourses in terms of proposed works. Consent would be required for any new outfall structures on the Ordinary Watercourse, and any culverting (to accommodate crossings shown on the layout). Agreement would also be required for the proposed rates of discharge to the Ordinary Watercourse, to ensure no increase risk to others result from the site.

5.6.5 In accordance with the LCC, there is a requirement to maintain an easement from existing Ordinary Watercourses and Main Rivers. The EA and LCC both require an 8m easement to be maintained from the Top of Bank of the watercourse into the development area. The easement should provide clear and unimpeded access for future maintenance no fencing, walls or buildings should be present within the designated easement as shown within the proposed planning layout.

Figure 6: Preliminary Proposed Drainage Plan extract (Betts Hydro, 2021)

5.6.6 In accordance with the SuDS Manual (CIRIA 753) and the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) all sites should endeavour to achieve as close to pre-development greenfield rates as is viable. Based on the development area, the pre-development greenfield rate (QBar) is calculated to be 84.9l/s using the FEH Statistical Method (see summary in **Appendix J**). The proposals are therefore to restrict surface water run-off to mimic a pre-development greenfield situation. The overall rate of discharge would need to be proportioned between the number of outfalls where necessary. This will be confirmed during detailed design, when the drainage technical detailed are reviewed.

Impermeable Area (2.806ha)	1 In 1 Year	1 In 30 Year	1 In 100 Year + 30% CC
Restricted Run-Off Rate	84.9l/s	84.9l/s	84.9l/s
Estimated Stormwater Storage Volume	117cu.m-290cu.m	515cu.m-853cu.m	1113cu.m-1720cu.m

Table 4: Estimated Stormwater Storage Requirements (Betts Hydro, 2021)

5.6.7 It would be beneficial to implement SuDS features where at all feasible, subject to ground investigation and a detailed levels review. If designed appropriately the SuDS features such as a pond/basin could potentially aid in the attenuation requirements for the proposals (if located appropriately) and provide added benefits in terms of water quality improvements. Detailed design will be required to confirm whether SuDS can be incorporated, at present indicative proposals allow for the inclusion of SuDS, including a pond/basin at multiple outfall points proposed.

5.7 Discharge to Public Sewer Network

5.7.1 UU sewer records identify there to be a public surface water sewer (375mm.dia) which presently crosses the development site from the southern boundary towards Phase 1. Should infiltration not be feasible then the surface water flows generated are proposed to discharge to the existing Ordinary Watercourse crossing the site and not the existing sewer network.

5.8 Climate Change

5.8.1 There are indications that the climate in the UK is changing significantly and it is widely believed that the nature of climate change will vary greatly by region. Current expert opinion indicates the likelihood that future climate change would produce more frequent short duration and high intensity rainfall events with the addition of more frequent periods of long duration rainfall. It is believed that the impact of climate change means there is likely to be a long-term increase in the average sea levels, with an expectation that sea levels will rise gradually. An increase in flood water levels means that future flooding events will occur more frequently and will have a greater impact.

5.8.2 In light of the future uncertainties Climate Change should be accounted for within the design of all new developments. The recently published Environment Agency document '*Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities*' supersedes Defra's policy statement on Flood Risk and Coastal Erosion Risk Management (2009) and should be used for future proposals. Climate change factors have been considered and any increase in the level of flood risk (to the site) from climate change is likely to be related to the increase in rainfall intensity and duration and its impact upon the surface water drainage system.

5.8.3 The site is subject to an existing outline approval (Ref: 3/2014/0764) and the design of Phases 2 & 3 of this development will conform to the criteria already agreed and embedded in the approved planning documentation. The Climate Change factor that has been considered for an increase in rainfall intensity is 30%

6.0 FOUL WATER MANAGEMENT

6.1 Due to the existing land-use onsite, no existing foul water connections to the public sewer network are present. Review of the UU sewer records identifies a foul water pumping station onsite adjacent to the southern boundary. This pumping station has been accounted for within the planning proposals and a public foul water sewer (375mm.dia) associated with the pumping station has been identified onsite adjacent to the southern boundary (see sewer records in **Appendix C**).

6.2 Phase 1 has a separate approved drainage management strategy (REF: HYD068_CHIPPING.LANE_FRA&DMS) was detailed in the approved supporting FRA&DMS, which shows foul from this portion of development will outfall into the foul water system located within Inglewhite Road to the south-east of Phase 1 (**Appendix C**).

6.3 Based on the proposals for the construction of up to 198no. residential units for Phase 2 & 3, the approximate peak foul water flows generated by the development are 9.2l/s. This is based on 4000 litres per dwelling per 24 hours; the guidance contained within Sewers for Adoption (SfA).

6.4 The proposals are therefore to connect flows from Phase 2 & 3 to the foul water pumping station within Phase 1 which ultimately connects into the public sewer network within Inglewhite Road. The pumping station within Phase 1 has been designed to also accommodate flows from Phase 2 & 3 however, formal consent is still required from UU approving this connection, discussion with UU shown in **Appendix C**.

6.5 A pre-development enquiry was sent to UU in 2018, and an agreement in principle was confirmed allowing foul water to discharge at an unrestricted rate into the 300mm dia. public foul water sewer within Inglewhite Road. It is understood that this response has now expired and therefore a new pre-development enquiry has been sent to UU; however, a response is currently outstanding.

6.6 Detailed design will confirm the full technical details based on the engineering constraints. Consent from UU will be required for works to the public sewer infrastructure. It is recommended that early discussion is undertaken to confirm acceptance of the strategy and identify any additional considerations such as preferred point of connection and capacity constraints. Initial discussion has been carried out to get an agreement in principle at this time.

7.0 SUMMARY AND CONCLUSIONS

7.1 This Flood Risk Assessment and Drainage Management Strategy was commissioned by Barratt Homes referred to hereafter as 'the client'. This report has been prepared to support a full planning application for the construction of a residential development on land to the east of Chipping Lane in Longridge. Phase 1 has planning approval (Ref: 3/2014/0764) and is supported by a separate, approved Flood Risk Assessment and Drainage Management Strategy (HYD068_CHIPPING.LANE_FRA&DMS). This assessment therefore focuses on the residential development proposed as part of Phase 2 & 3 only. Phase 2 & 3 collectively cover 10.66ha, although the proposed development area covers a smaller portion at 6.24ha.

Flood Risk

7.2 The site is located wholly within Flood Zone 1 based on the Environment Agency Flood Map for Planning. The proposals are for a residential-led development, which is considered 'More Vulnerable' in Table 2: Flood Risk Vulnerability Classification within Planning Practice Guidance. This 'More Vulnerable' development is confirmed to be appropriate within Flood Zone 1, providing there is no increase in flood risk elsewhere due to the proposals.

7.3 Consultations with the Environment Agency, Ribble Valley Borough Council, Lancashire County Council and United Utilities have been undertaken and did not identify any historical incidents of flooding to the site or within the neighbouring areas. This assessment has considered all sources of flood risk, this includes the existing Ordinary Watercourse crossing the site which is understood to outfall into Higgin Brook 1km north of the site. As part of Phase 1, hydraulic modelling of the Ordinary Watercourse was undertaken to determine the potential flow risks associated with the proposed culverting the Ordinary Watercourse for vehicular crossing as part of Phase 1. The outcomes of the modelling exercise evidenced the risk to the proposals from the existing Ordinary Watercourse is low. The full Hydraulic Assessment has been appended to this assessment for full details. To summarise the proposed Phase 2 & 3 development area will, following the implementation of mitigation measures remain flood free in all key storm events, including the 1 in 100-year (1% AEP) plus Climate Change event without having any impact on the neighbouring land/properties.

7.4 The site is at 'very low' to 'low' flood risk from the reviewed sources of flooding. The primary source of flood risk is considered to be from surface water where the risk varies across the site from 'very low' to 'high' within the natural low-lying areas of site. The risks post-development from surface water will be effectively managed through implementation of the mitigation measures proposed within this assessment, including appropriate ground levels design and inclusion of a suitable surface water management infrastructure. To minimise flood risk from surface water it would also be recommended that natural drainage routes through the site be maintained within the proposals, including the existing Ordinary Watercourse, crossing the site from the southern boundary to the north.

Drainage Strategy

7.5 To ensure surface water flood risk to others does not increase, it is important to ensure surface water run-off is appropriately managed in accordance with the sustainable drainage hierarchy. Three methods have therefore been reviewed for the appropriate management of surface water run-off. These have been applied in the order of priority being; discharge via infiltration, to a watercourse and finally to public sewerage system.

7.6 Based on the ground conditions identified by the published online datasets, infiltration is not considered to provide a viable drainage solution for the development due to the impermeable strata. A ground investigation report (Ref: STN3505NM-G01) was also undertaken for Phase 1 and identified soakaways were not suitable to be used as a method for managing surface water run-off. As infiltration rates can vary on a site by site basis, the Local Planning Authority may still require onsite Soakaway Testing to be undertaken to evidence this is true for Phase 2 & 3, prior to full commencement of works.

7.7 Assuming infiltration is not feasible, the next method in the drainage hierarchy should be discharge to a watercourse. Most of the site naturally drains to the Ordinary Watercourse crossing the site at present and the proposals are therefore to mimic the existing situation, discharging surface water run-off from the site to the watercourse using the existing onsite features where practical. Detailed design will need to confirm feasibility of a site wide gravity solution, although this is anticipated as most of the site naturally drains in this manner at present. It is assumed that multiple outfalls to the watercourse will be required given the scale of the development and formal consents will be required from Lancashire County Council for any works to the Ordinary Watercourse, including agreement of the proposed discharge rates and points of connection.

7.8 In accordance with the SuDS Manual and the Non-Statutory Technical Standards for Sustainable Drainage Systems, all sites should endeavour to achieve as close to pre-development greenfield rates as viable. The proposals are to therefore discharge to the watercourse crossing the site mimicking pre-development greenfield situation, QBar is calculated to be 84.9l/s and will need to be proportioned between the multiple proposed points of outfall. Restricting the rate of discharge will generate an onsite stormwater storage requirement which will be catered for on the site prior to discharge to the watercourse. It would be beneficial to implement SuDS features including permeable surfaces and bio-filtration where at all feasible (subject to ground investigation and contamination review). Given the scale of development it is proposed that pond/basin features be included onsite near to the proposed outfall location(s). If designed appropriately the SuDS features could potentially aid in the attenuation requirements for the proposals and provide added benefits in terms of water quality. Detailed design will be required to confirm whether SuDS can be incorporated.

7.9 This Flood Risk Assessment and Drainage Management Strategy has been prepared in consultation with the relevant interested parties and incorporates their comments where possible. The report is commensurate with the scale and nature of the development proposals and in summary, the development can be considered appropriate in accordance with the Planning Practice Guidance.