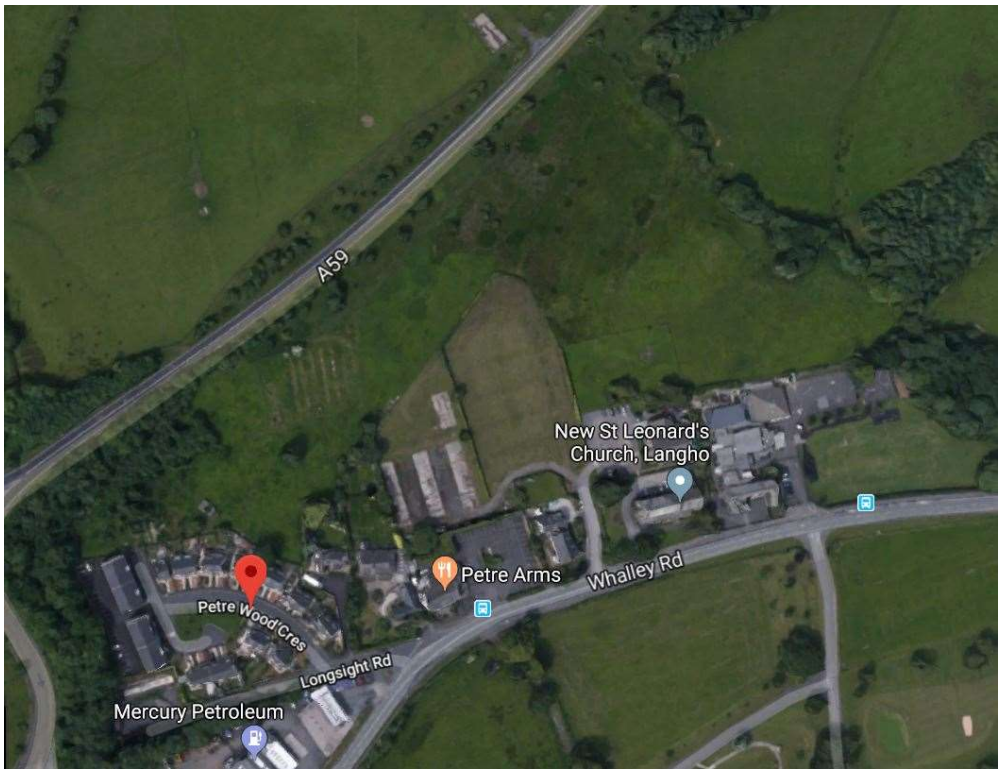
PETRE WOOD, PHASE 3 – GREAT PLACES



14/08/2019

FLOOD RISK ASSESSMENT

The Alan Johnston Partnership LLP

Job Ref: 219-021

Document Reference : PET-AJP-ZZ-XX-RP-C-3000-P2

Prepared By

Document Owner(s)	Project/Organization Role
Jonathan Smith	Partner
John Marshall	Civil Engineer

Project Closure Report Version Control

Version	Date	Author	Change Description
P2	20.08.19	JCM	Amended to Client Comments

Record of Approval

Originator	Approved	Date
JCM	JLS	14.08.19
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Contents

1.0 INTRODUCTION

This Flood Risk Assessment (FRA) has been prepared on behalf of Great Places for the development of Phase three of the Petre Wood, Langho development, following successful completion on the previous phases. The site is greater than 1 hectare in size and shall provide 31 new dwellings in service of the local area with both rental, shared ownership and sales properties. The site was is currently uncultivated farm land, leaving the site classified as Greenfield.

This FRA has been prepared in accordance with the general requirements of the National Planning Policy Framework and the Technical Guidance to the National Planning Policy Framework, both published by the Department for Communities and Local Government. This involves the identification of flood risk to new development(s) on the site, the possible effect of this development on flood risk elsewhere and the investigation of the impact on the development as a result of increased sea levels, fluvial flows and larger pluvial events due to increased impermeable areas and climate change.

The purpose of this report is to present a site-specific assessment of flood risk based on available information, to identify relevant flood levels affecting the site with respect to a particular probability of flooding. The flood levels identified are dependent on the correctness of the current conditions, as stated in this report and the prediction of future climatic conditions implicit in the National Planning Policy Framework.

For any size of storm event, the procedure will always yield a probability that the event will occur in any year, albeit the probability is smaller for larger events. The predicted storm event has a probability of occurrence in any year and the derived flood level has an associated probability of exceedance. This means that there is always a risk that property flooding could occur one or more times in any year.

Therefore, this report should not be interpreted or relied upon as providing a guarantee against flooding. There is always a residual risk that flooding will occur, and it is not possible to predict a zero risk of flooding.

In accordance with National Planning Policy Framework (NPPF) and the associated Technical Guidance document, flood risk must be assessed for all sources including tidal (from the sea), fluvial (from rivers), pluvial (from land), groundwater, sewer and artificial water bodies (e.g. reservoirs, canals, major water supply infrastructure etc.).

More specifically, the development of any site must be carried out in such a way as to mitigate any potential flood risk, both on and off site from all sources of flooding.

2.0 SITE DESCRIPTION

The proposed development site is located in the Langho area of Lancashire, to the north of the Petre Arms Pub, at National Grid Reference SD 70933 34939. The location of the existing site is illustrated in Appendix A and the extent of the area to which the application relates is shown as a red line boundary in Appendix A and on the aerial photo enclosed in Appendix B.

The total site area available is 1.05 ha, which includes an elongated roughly rectangular shaped plot of grassed pastureland. The north western boundary is formed by a grass embankment alongside the A59, the north eastern boundary by a small ordinary watercourse, to the south by hedgerows and to the west by previous phases of the development. The site location and surroundings are as shown in Appendix A.

The site area within the bounds field has a mounded area circa 1.25m high on the western boundary, which ties into the southern boundary. In general the levels fall from South west to north east, falling from 78.5m AOD to 64.5m AOD at the watercourse, a general gradient of 1 in 18.

An aerial photo is included in Appendix B to illustrate the site at the present day and the topographic survey is included in Appendix C.

2.1 Geology

The British Geological Survey 1:50,000 Bedrock geology maps show that the development site is underlain superficial deposits comprising of Till Devensian Diamicton Underlying bedrock is reported to be of the Bowland Shale Formation, This is reinforced by the Phase II site investigation as shown in Appendix K which indicates firm to stiff brown or light grey cohesive strata almost immediately below the surface with some points of excessive made ground. The bedrock was not encountered at up to 5m below ground level (bgl) within the Phase II Geotechnical report, with the cohesive strata increasing in strength in accordance with the depth below ground.

2.2 Hydrogeology

The DEFRA groundwater magic maps show that the Glacial Till superficial deposits are classified as a Secondary (undifferentiated) Aquifer the groundwater maps also show that the underlying Bowland Shale Formation is classified as a Secondary (undifferentiated) aquifer.

The DEFRA magic map also indicate that the development site is a Minor Aquifer low in terms of groundwater vulnerability and therefore site activities shall not likely impact potable water supplies in the area.

The investigatory Boreholes in the Phase II S.I, that show multiple water strikes occurred at depths and that damp strata was encountered in the majority of the trial holes, which is likely to be evidence of perched water at the point glacial till was interacting with made ground. Groundwater monitoring determined that groundwater was recorded at depths between 0.54m to 1.80m bgl. Based on evidence within the Phase II SI report the groundwater table is likely to be shallow and perched water a regular issue within the glacial till.

2.3 Hydrology

The nearest watercourse is the ordinary watercourse on the north eastern boundary of the site, which is likely to be a tributary of Bushburn Brook. The nearest named watercourse is Bushburn Brook which is located approximately 0.84 km north of the site. The site is located in Flood Zone 1, as an area identified by the Environment Agency (EA) not at risk of flooding from rivers and streams.

3.0 PROPOSED DEVELOPMENT

The proposed development consists of circa 31 new dwellings consisting of 20 houses and 11 bungalows accessed by the newly proposed highways to connect to the previous phase highways onto Whalley Road.

The proposed development site covers a total area of approximately 1.05 ha, the development layout is shown within Appendix E indicating the dwellings, proposed highway and associated parking provision.

The total impermeable area from the proposed development is 0.546 4ha, encompassing, the proposed houses, apartment buildings alongside the associated driveways and proposed highway to facilitate the development

To enable a viable scheme, the proposed site levels are constrained by the surrounding highway embankment and residential developments, however the site will be significantly re-graded to allow for the designed levels of the highway and shall require retaining structures to its boundaries. A proposed site plan is attached in Appendix E.

4.0 PLANNING POLICY

The National Planning Policy Framework (NPPF) sets out the Government's policy on meeting the challenges of climate change, flooding and coastal change. The NPPF states that:

"Planning plays a key role in helping shape places to secure radical reductions in greenhouse gas emissions, minimising vulnerability and providing resilience to the impact of climate change, and supporting the delivery of renewable and low carbon energy and associated infrastructure. This is central to the economic, social and environmental dimensions of sustainable development. Local planning authorities should adopt proactive strategies to mitigate and adapt to climate change taking full account of flood risk, coastal change and water supply and demand consideration."

This Flood Risk Assessment proposes recommendations to facilitate the proposed development so that it takes into account flood risk at all stages of the development.

4.1 Sequential and Exception Test

Based on the site's location in outside a flood zone, the development is deemed appropriate according to NPPF therefore the development is appropriately situated and the Sequential Test is not required.

4.2 Exception Test

NPPF classifies the residential element of the development as 'More Vulnerable' but as the site is located outside a flood zone the Exception Test is not required.

5.0 ASSESSMENT OF FLOOD RISK

The Technical Guidance to the National Planning Policy Framework requires all forms of flooding to be considered.

5.1 Flooding from Rivers

The Flood Risk map is included in Appendix F.

It can be seen from the map that the site is located in Flood Zone 1 with a chance of flooding of less than 0.1% (or 1 in 1000).

The nearest designated main river is Bushburn Brook which is located approximately 0.84 km north of the site, with one of its tributaries on the eastern boundary and the lowest point of the site area, therefore the risk of flooding to the new development from river is considered to be low.

5.2 Flooding from the Sea

The site is not at risk of flooding from the sea. The lowest level of the site is approximately 64.50m AOD, i.e. well above tidal flood levels, as demonstrated in Appendix E. This level is based on the topographic survey in Appendix C.

5.3 Flooding from Land

Intense rainfall, often of short duration, that is unable to soak into the ground or enter drainage systems can run quickly off land and result in local flooding.

The Surface Water Flooding map is included in Appendix F. It can be seen from the map that the site is classified as having a low risk of surface water flooding at the lowest point of the development area as S.W Flows run in accordance with the existing topography.

The Low risk identified to the east of the site area shall be mitigated by the development not constructing within this area of the site. Therefore, the risk of flooding from overland flows due to surface water flooding is considered to be low and as such the overall site is considered to be at low risk of flooding from surface water/surrounding land.

5.4 Flooding from Groundwater

As set out within the Site Investigation within Appendix K, no ground water was encountered within the boreholes and ground water monitoring determined that there was likely to be a shallow water table, with much of the damp strata determined to be perched water.

As a result of the shallow water table within the site area, the risk of groundwater flooding can be considered to be moderate. The moderate flood risk suggests that there is a risk of flooding to property where there are proposed basements and finished floor levels are set below the existing ground level.

To mitigate the flood risk from groundwater the development shall ensure that it has no proposals for basements and finished floor levels are to be set at or above existing ground levels, during detailed design the development, with adequate S.W drainage systems ensuring the surface run off from the development does not discharge to ground and end up perched.

Should finished floor levels need to be set below existing ground levels due to site constraints, it is recommended that detailed groundwater flood risk information is obtained to fully delineate the groundwater flood risk within the site, to review the viability of proposed finished floor levels.

5.5 Flooding from Sewers

A record of Public Sewers surrounding and serving the development site has been obtained from United Utilities and this is included in Appendix G. As can be seen there are no public sewers running across the proposed site and the nearby public sewers are located within the adjacent highways of the previous phases of the development. This means that should any flooding from sewers occur this should be contained within the highways and not encroach upon the proposed site dwellings.

Therefore, as a result of the public sewers being located within the existing, the site itself is considered to be at low risk of flooding from sewers.

5.6 Flooding from Reservoirs, Canals and Other Artificial Sources

The Reservoir Flood Risk map is included in Appendix F. It can be seen from the map that the site is at risk of flooding from the Number 4 Reservoir, with no other water bodies in proximity to the site. The reservoir flood maps are used to identify the extent of flooding caused in the event of a catastrophic failure event and therefore the site is considered to be at low risk of flooding from reservoirs.

6.0 DEVELOPMENT AND DRAINAGE STRATEGY

6.1 Effect of Proposed Development on Flood Risk

As previously outlined in Section 2.0, the existing site covers a total area of 1.05 ha and is a greenfield, An indication of the existing impermeable areas and the proposed impermeable areas are included in Appendix H, it indicates that with the introduction of the new roof area, access road and parking area, the development will lead to an increase in impermeable

For the proposed development, the changes to the existing site will increase the volume of impermeable areas and as such, the proposed development in these areas will lead to an increase in the;

- Volume of surface water ponding on the site
- Volume of surface water runoff leaving the site or discharging into surrounding areas
- Peak discharge rate from the site.

Accordingly, site-wide drainage systems are required to drain the foul and surface water flows arising from the proposed development. Where possible, any existing drainage networks should be utilised. Appropriate design and construction of these systems as set out in Section 6.3 should ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

6.2 Existing Drainage Systems

As can be seen from the United Utilities maps, attached in Appendix G, there are no existing public sewers located within the site boundary. As part of the previous development of Petre Wood sewers were installed and adopted by United Utilities, they are not represented on the UU current records but can be viewed in Appendix D on the western boundary of the site, lying within the highway of the previous phases.

6.3 Proposed Drainage Strategy

As outlined above in section 5.1, site-wide drainage systems are required to drain the foul and surface water flows arising from the proposed development. The proposed drainage systems must ensure that there is no increase in offsite flood risk that would otherwise impact downstream areas.

6.3.1 Surface Water Drainage

The Building Regulations - Approved Document H (2002) details a hierarchy of potential methods for disposing of surface water as shown below in order of preference:

- Discharge via infiltration
- Discharge to watercourse
- Discharge to sewer

Considering the hierarchy above, the surface water network for the proposed site should infiltrate to ground where viable.

As laid out within section 2.2 the site investigation information and the British Geological Survey (BGS) 1:50,000 superficial geology maps show that that the site is underlain Till Devensian Diamicton that is boulder clay with little or no granular strata. This has been fully supported by the exploratory investigation carried out within the Geotechnical Site investigation that is shown within Appendix K, which also detailed a shallow ground water table.

Therefore, as a result of the underlying strata and ground water, infiltration drainage and SUDS systems are not a viable option for the discharge of surface water.

As the possibility of infiltration is ruled out by the existence of groundwater, the intention for the development would be to discharge to watercourse. The nearest watercourse is Bushburn Brook tributary, which is located on the eastern boundary of the site. This ordinary watercourse can serve as an appropriate point of S.W discharge, due to the site topography and development design. Lancashire LLFA should be consulted over this point of discharge and a consent to discharge and construction of an outfall headwall.

While every effort to utilise, any suitable existing systems should be made, the drainage systems should be designed to suit the proposed site layout and topography which aims to provide an efficient design.

In line with Sewers for Adoption (6th Edition), the requirements for the design of a new surface water drainage systems are as follows:

- Below ground piped drainage to be sized to accommodate the 1 in 2-year (50% AEP) design storm without surcharge.
- System to be designed not to flood any part of the site in a 1 in 30-year (3% AEP) design storm.
- For events in exceedance of the 1 in 30 year design storm and up to and including the 1 in 100 year event, site drainage and topography should be designed where practicable to route surface water run-off away from buildings to safe above-ground storage areas on site, thereby removing flood risk to properties and preventing this run-off from leaving the site and increasing flood risk elsewhere.

For each design case described above, the design storm is the critical storm duration for the site conditions. In the case of the 1 in 100-year design storm, a 40% increase in the peak rainfall intensity is applied to allow for the estimated worst-case impacts of climate change. This is in accordance with Table 5 of the Technical Guidance to the National Planning Policy Framework.

Suitable systems of below ground drainage will be required to contain as a minimum requirement, the 1 in 30-year event. Additionally, any surface water run-off from events that exceed the design capacity of the new drainage system, up to and including the 1 in 100-year (+40%) event, will be contained within the drainage network or retained on-site in safe storage areas.

Should they be required, measures to prevent oil and other contaminants being passed forward to the existing surface water sewer should also be incorporated into the design of the surface water system, through the use of appropriate oil separators or other appropriate pre-treatment methods.

In line with common practice and Lancashire LLFA guidelines, it is proposed the surface water discharge from the proposed development should discharge at rates not in excess of the existing greenfield run off rate from the site area.

An assessment of the existing greenfield surface water run-off from the existing site area has been carried out and is available within Appendix H, therefore in accordance with reducing flood risk and compliance with Lancashire LLFA requirements, a restricted flow rate of 6.8**l/s** is recommended for the proposed development area for all storms up to and including the 1 in 100 year return period, with an allowance for climate change.

Based on the above discharge limits, there shall be a new S.W network to serve the proposed development that shall discharge into the ordinary watercourse on the eastern boundary of the site.

As shown in Appendix J outline drainage layout the proposed S.W Network shall consist of carrier drains that shall discharge into a detention basin, subject to control by a vortex flow control system prior to discharging to the ordinary watercourse.

The surface water drainage systems are to be designed to restrict the discharge to the required rate, up to and including a 1 in 100 year return period plus 40% climate change design storm, while ensuring that no flooding occurs within the 30 year return period and that any flood water for the 100 year return period shall be appropriately accommodated away from proposed and existing dwellings. .

Using a total post development impermeable area of 0.546 ha at the restricted discharge rate of 6.8l/s, for the 1 in 100 year + 40% return period design storm, as seen in the WinDES hydraulic calculations, attached in Appendix J, it is anticipated that the attenuation storage will be provided in the form of a detention basin with an attenuation volume of 320m^3, using a vortex flow control device to restrict the discharge.

The surface water drainage strategy and discharge rate should be confirmed via more detailed discussions with United Utilities and the Lead Local Flood Authority prior to the commencement of any works.

6.3.2 Foul Water Drainage

Foul water drainage disposal is set out in Part H of the Building Regulations in order of priority the preferred methods are;

1. Public sewer
2. Septic tank

3. Cesspool.

The foul water system shall be designed in accordance with;

- BS EN 752:2008 (Drain and sewer systems outside buildings)
- Sewers for Adoption (7th Edition)
- Technical Guidance to the National Planning Policy Framework document (Department for Communities and Local Government, March 2012).
- BS EN 12056-2:2000 (Drainage systems inside buildings)
- Building Regulations Approved Document H, Drainage and waste disposal. (Office of the Deputy Prime Minister, December 2010).

The public sewers which provide a potential location for connection of the foul water drainage from the site are the existing public Foul water sewers within the adjacent surrounding highways, that serve the previous phases of the development.

Due to design site levels and existing topography, not all dwellings shall be able to discharge via gravity to the existing F.W Sewer, therefore provision for a pumping station should be made to carry F.W flows to the adopted sewer system. The proposals for the transmission of the F.W flows to the adopted sewerage system can be seen in Appendix J as part of the outline drainage layout.

The foul water drainage strategy and discharge rate should be confirmed via more detailed discussions with United Utilities and the Lead Local Flood Authority prior to the commencement of any works.

6.4 Compliance with LASOO Non-Statutory Technical Standards for SUDS

In compliance with the runoff destinations guidance within the LASOO Non-Statutory Technical Standards for Sustainable Drainage: Best Practice Guidance, infiltration is not feasible, therefore the surface water runoff is designed to discharge to the public sewer.

S1. Where the drainage system discharges to a surface water body that can accommodate uncontrolled surface water discharges without any impact on flood risk from that surface water body (e.g. the sea or a large estuary) the peak flow control Standards (S2 and S3) and volume control Standards (S4 to S5) need not apply.

The site does not discharge to a surface water body that can accommodate uncontrolled surface water discharges and therefore Standards S2 – S5 shall apply.

6.4.1 Peak Flow Control

S2. For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1-year rainfall event and the 1 in 100-year rainfall event should never exceed the peak greenfield runoff rate for the same event.

As the site is greenfield the proposed development S.W run off shall be accommodated by a detention basin and its discharge rates control to not exceed the Qbar greenfield run off rate of 6.8l/s, this is less than the 1 in 100 year run off of 14.8l/s, in compliance with S2.

S3. For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

The site is a greenfield site.

6.4.2 Volume Control

S4. Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100-year, 6-hour rainfall event should never exceed the greenfield runoff volume for the same event.

S5. Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.

S6. Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with S4 or S5 above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.

While other SuDS components such as a detention basin have been utilised to accommodate flows, measures such as infiltration have not been feasible due to the ground conditions. Other SUDS measures including green roofs or rainwater harvesting may assist in constraining the volume of surface water runoff, these have not been feasible due to proposed construction methods and space considerations for the development, therefore S5 cannot be complied with.

Accordingly. The run off volume shall be discharged at a maximum flow rate in compliance with S2 with no flooding within the attenuation system, reducing the rate of run off to not adversely affect the flood risk, in accordance with standard S6.

6.5 Future Maintenance

The proposed drainage solution uses SUDS techniques in accordance with the CIRIA SUDS Manual C753, due to appropriate space for their viable use. The surface water run-off is restricted using a vortex flow control device and the attenuated run-off stored using a detention basin.

It is proposed that the surface and foul water drainage systems and Surface water systems will be adopted and therefore will be the responsibility of United Utilities. The detention basin shall likely remain private and therefore be the responsibility of a responsible organisation in accordance with the CIRIA SUDS Manual C753. Accordingly, as stated in the SUDS Manual the operation and maintenance of the attenuation shall be as the modified version of table 21.3 below.

Table 22.3 : Operation and maintenance requirements for detention bains

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly
	Cut grass – for spllways and access routes	Monthly (during growing season)
	Cut grass -meadow grass immediately surrounding basin	Half yearly (spring -before nesting season)
	Inspect inlets and outlets for blockages and clear if required	Every six months
	Inspect banksides and headwalls for evidence of physical damage	Every six months
	Inspect inlets and outlets for silt build up and establish frequency of removal reuqired	Monthly for first 12 months – then annualy or as required.
	Check vortex control & penstock	Annually
Remedial Action	Repair inlets and outlets	As required
	Repair erosion or other damage by reseeding or re-turfing	As required
Monitoring/Ocassional maintenance	Resseed areas of poor vegetation growth	As required
	Remove sediment from inlets & outetls	Every 5 years minimum or as required

The remaining drainage systems (Hydrobrake unit) will be maintained in accordance with manufacturer's requirements which will be provided within the O&M manual which will be issued as a compliance requirement to the maintenance contractor on completion of the works.

The hard surfaces proposed for the development that are not the responsibility of the householder shall require regular annual sweep and suction brush following leaf fall in autumn. An annual inspection of control chamber, ACO channels and the inspection chambers shall be necessary to remove any silt build up and check the free flow use of the hydrobrake.

6.6 Managing Residual Flood Risk

There is a finite risk that the design flood conditions required by current design standards are exceeded by an extreme and rare event. However, with the design measures reported such a risk is low and the exceedance flow path routes required to channel flows around the development buildings will be such that no specific flood risk management procedures are envisaged to be necessary.

7.0 CONCLUSIONS

- The site is located within flood zone 1 and has been deemed to have a low risk of flooding from rivers.
- The site is at a moderate risk of flooding from Groundwater at the surface.
- The site is at low risk of flooding from all other sources.
- BGS 1:50,000 Bedrock geology maps and the Phase II Site Investigation show the site strata being cohesive which indicates that infiltration SUDS techniques are not be a viable option for the discharge of surface water.
- The surface water discharge from the proposed site should discharge at no more than 6.8l/s for all storm events up to and including the 1 in 100-year event (+ CC)
- The Surface water shall be contained within the attenuation system for the 1 in 100-year return period (+ 40% climate Change), ensuring that no properties are at risk of flooding and all flows are contained on site.
- Foul water discharge from the proposed site should discharge, at unrestricted rate to the existing United Utilities Foul Water Sewers in the adjacent highways of phase 2. Further discussions with the Lead Local Flood Authority and United Utilities should be completed to ensure agreement of the overall approach and the proposed pumping solution.
- The proposed drainage systems comply with Standards contained within the LASOO Non-Statutory Technical Standards for Sustainable Drainage: Best Practice Guidance.

8.0 RECOMMENDATIONS

- A detention basin restricted by a vortex flow control device should be utilised to restrict the surface water runoff and prevent any flooding for rainfall events up to and including the 1 in 100 year plus 40% climate change event.
- The external ground levels around the proposed building shall fall away from the proposed building with any new levels being designed to ensure any overland flood routes, for events in excess of the 100 Year + 40% CC, exit towards the highway, for use in exceptional circumstances
- All dwellings finished floor levels shall be set at or above the existing ground levels (excluding the mounded area of made ground) to mitigate groundwater flood risk. Further information on the groundwater flood risk may detail areas not subject to groundwater flood risk, if necessary, to establish during detailed design.

Appendix A Site Location Plan

Pond
Drain
Path (um)
Foot Bridge
FB
Track
Path (um)
Pond
Northcote Stud
Helipad
Northcote Manor
(Hotel)
Issues
NORTHCOTE ROAD
A 59
A 59
A 59
A 666
WHALLEY ROAD
Petre House Farm
PETRE WOOD CRESCENT
PETRE WOOD CLOSE
Household
Waste Disposal
Centre
Garage
Shelter
LONGSIGHT Jcn
LONGSIGHT ROAD
Greenfield House
Petre Arms
(PH)
Barnacre
El Sub Sta
Community
Centre
St Leonard's C of E
School
Jamacia Wood
Jamacia
Wood
St Leonard's
C of E School
School House
St Leonard's Church
FS
75.6m
WHALLEY ROAD
Golf Course
MP 16.25
Sinks
Issues
Mytton Fold Hotel
FB
Ponds
Car Park
Golf Course
Pond
FB
5302
5301
7201
7104
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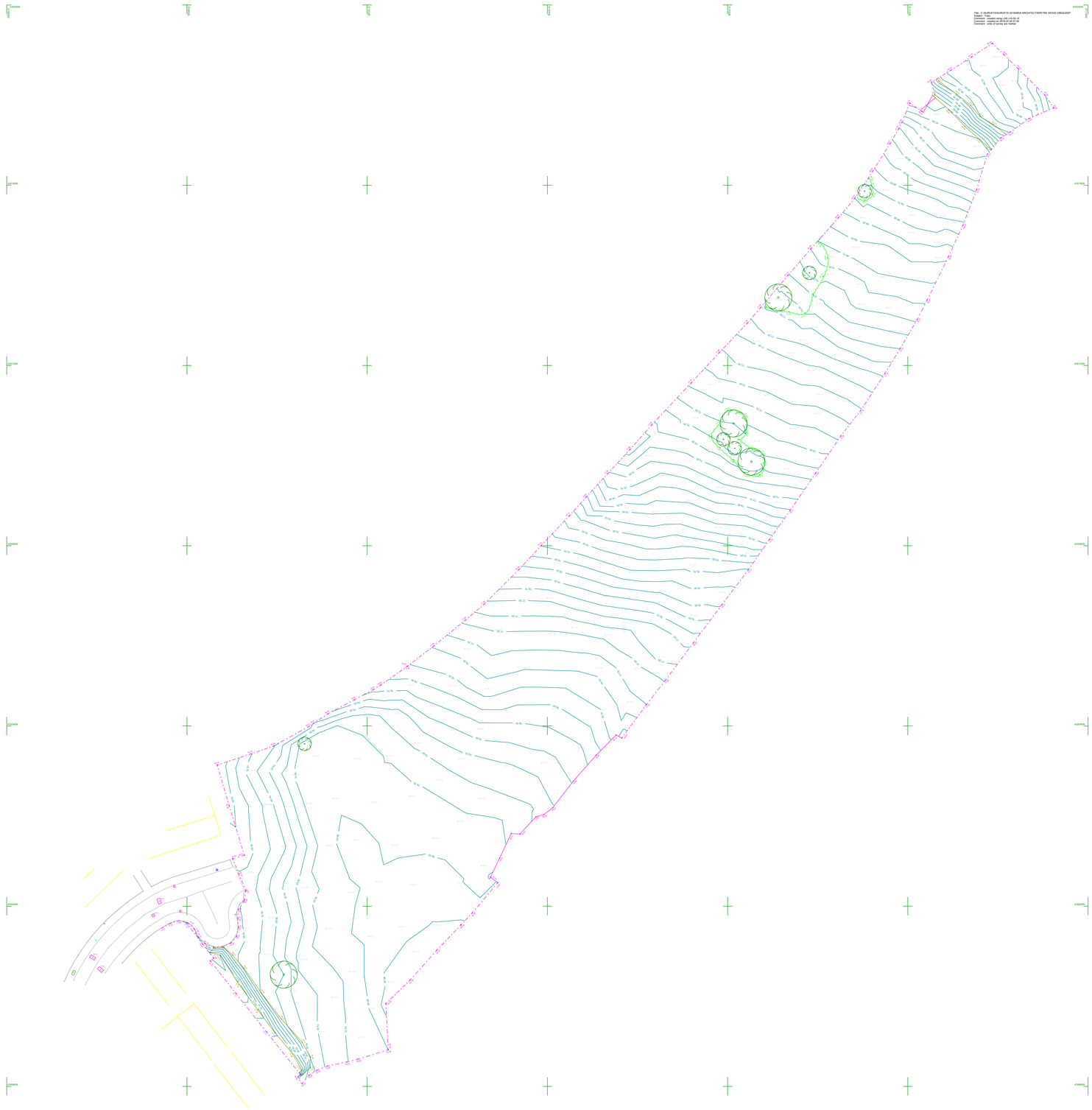
Appendix B Aerial Photograph


A59
New St Leonard's
Church, Langho
Petre Arms
Whalley Rd
Petre Wood Cres
Longsight Rd
Mercury Petroleum

Appendix C Topographic Survey



Legend:

Manhole shown thus	MH
Inspection Cover	IC
Lamphole	LH
Gully	G
Lampost	LP
Telegraph Post	TP
Electricity Poles	EP
Road Traffic Signs	RS
Traffic Lights	TL
General Post Office	GPO
Post Office Telephones	POT
Fire Hydrant	FH
Safety Valve	SV
Stopcock Water	SCW
Stopcock Gas	Gas
Unknown Stoptap	ST
Spot Level	+123.562
Kerb Line	
Fence Line	Wood post & rail
	Or
Hedge Line	
Contours 5m interval	105
Contours 1m interval	33
Tree Spread	S 5.0
Girth	G 1.30
Cover Level	CL 112.335
Invert Level	IL 111.733
Foul Drain	
Surface Water	
Unknown Service	Serv
Survey Station	Or S3
Floor Level	FL 10.907
Height floor to structural soffit	SC 2.87
Height floor to false ceiling	C 2.22
Height floor to sill	S 0.67
Height of window	W 1.23
Height of Door	D 1.98
Height floor to underside of Beam	BH 3.61
Vent	V
Fall Pipe	FP
Sky Light	SL
Water Closet	WC
Sink	S
Boxed Column	B
Shop fitting or cladding	

Notes:

Grid & Levels related to OSGB36 National Grid.

REV		BY	DATE
0		MH	30/03/18

Status: Survey Issue

Survey Site Solutions Ltd
Land Surveying,Site Setting Out,Volumes & CAD Estimating & Take Offs.
27 Sparkhouse Lane,
Sowerby Bridge,
HX6 3QU
TEL:-01422 832185
MOB:-07563 539856
Email:-sss_ltd@btinternet.com

Survey Site Solutions Ltd
Land, Measured & Volumes Surveys
Site Setting Out & Site Engineering

Title: Topographical Survey

Site: Petre Wood Crescent, Langho

Client: MDA Architects

Scale:	Date:	Drawn:	Checked:
1:500 @A1	30/03/18	CA	MH

Project No:	Drawing No:	Sheet:
MDA 003	MDA 003 001	1 of 1

Appendix D Phase 2 Drainage Layout

A 59

600 G/BOARD
300 G/BOARD
600 G/BOARD (reducing)
1000 GABION
1500 GABION
2000 GABION
750 GABION
1000 RWKWALL (reducing)
1800 B/WALL
ACO

13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 12. 11. 10. 09. 08. 07. 06. 05. 04. 03.

C1 FFL + 78.175
A1 FFL + 78.175
C1 FFL + 77.100
A1 FFL + 76.250
C2 FFL + 75.000
A1 FFL + 73.800
C2 FFL + 73.600
C2 FFL + 72.650
C1 FFL + 72.650
A1 FFL + 76.135
C1 FFL + 75.385
C1 FFL + 73.835
B1 FFL + 76.335
B1 FFL + 77.000
D1 FFL + 77.875

Mh SW03 CL 77.35 IL 76.00
Mh FW03 CL 77.20 IL 75.45
Mh SW04 CL 76.20 IL 74.85
Mh FW04 CL 76.15 IL 74.65
Mh SW05 CL 75.35 IL 71.65
Mh SW02 CL 75.70 IL 74.35
Mh FW05 CL 75.35 IL 73.40
Mh FW02 CL 75.80 IL 74.40
Mh SW06 CL 73.50 IL 70.00
Mh FW06 CL 73.55 IL 72.06
Mh SW07 CL 72.95 IL 69.975
Mh FW07 CL 73.00 IL 71.77
Mh SW08 CL 72.45 IL 69.941
Mh FW08 CL 72.40 IL 71.35
Mh FW01 CL 77.00 IL 75.60
Mh SW01 CL 77.15 IL 75.80

1.000 150dia PVC @ 1/18
1.001 150dia PVC @ 1/20
1.002 900dia conc @ 1/168
150dia PVC @ 1/23
1.003 150dia PVC @ 1/27.5
1.004 1050dia conc @ 1/149
150dia PVC @ 1/40

R5800mm
R2883mm
R3612mm
R2200mm
R3200mm
R3254mm
R2300mm
R3300mm
R2400mm

Flow Control at Mh SW08 is Hydrobrake SXH100
Design pass forward flow 5 litres/sec at head 0.75m

Cellular storage Area 36sqm x 2m deep

Extg FW 150dia
Extg Mh CL 71.01 IL 70.40
Extg Mh CL 72.48 IL 69.15

PETRE WOOD CLOSE
9 to 33
26

RL82.56
RL81.77
RL80.79
RL83.46
RL84.31
RL86.51

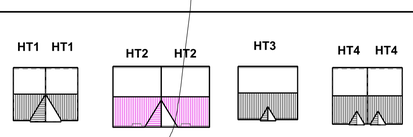
E	MHFW07 & 08 inverts amended.	21/11/13
D	MHFW09 omitted. Minor revisions to FW arrangement at site entrance.	18/10/13
C	Amendments to MHFW09 and cellular storage position adjusted. B/drop omitted at SW06. B/drops added at SW05..	15/10/13
B	General amendments per UU comment Amendments to footway widths	18/09/13
A	Amendments to SW storage pipes	22/08/13
Revisions	Comments	Dates

Client Great Places Housing Association	Date	12/12/12
	Drawn	CM
Project title Petre Wood Farm Phase 2	Approved	SL
	Scale	1:200
Drawing title Proposed Sewer Layout	Job No.	1212/09
	Dwg. No.	01

lancastermaloney
Lancaster Maloney Limited Registered Office:
Mottram House 43 Greek Street Stockport SK3 8AX
Registered in England No. 4846621
Tel: **0161 477 3500** Fax : **0161 477 3600**
E-mail: **enquiries@lancastermaloney.co.uk** www.**lancastermaloney**.co.uk

Appendix E Proposed Site Plan

N



ACCOMODATION SCHEDULE

HT1	2 Storey	2 Bed Semi	70m2	8 No
HT2	1 Storey	2 Bed Semi	63m2	10 No
HT3	1 Storey	2 bed Det	67m2	1 No
HT4	2 Storey	3 Bed Semi	83m2	12 No
Total				31 No

A 59

Ward Bdy

A 59

A59

SUDS DRAINAGE SCHEME

Proposed landscaped area

Exact redline boundary/ area to be confirmed

BLUE DOTTED LINE DENOTES ACOUSTIC BARRIER TO A59

Plot 31
Plot 30
Plot 29
Plot 28
Plot 27
Plot 26
Plot 25
Plot 24

Turning Head

Access Road

GAS
ET 75184

Assumed line of existing gas pipe. Exact route / location to be confirmed

Plot 1
Plot 6
Plot 5
Plot 4
Plot 3
Plot 2
Plot 23
Plot 22
Plot 21
Plot 20
Plot 19
Plot 18
Plot 17
Plot 16
Plot 15
Plot 14
Plot 13
Plot 12
Plot 9
Plot 8
Plot 10
Plot 11

Adopted Access Road

Unadopted Access Road

EXTENT OF BOUNDARY HEDGE & PLANTING ADJACENT SITE BOUNDARY

Exact redline boundary/ area to be confirmed

Track

Community Centre

Petre Wood Crescent

PETRE WOOD DRIVE

59
49
41
28
34
2
1
11
15

Petre House Farm

Greenfield House

St Leonard's Church

FS

Longsight Road

Site Area - 1.02Ha

PROJECT
Land at Petre Wood Crescent
Langho. BB6 8FD

TITLE
Proposed Site Plan
amended to Highways comments

SIZE A1

STATUS Planning

PROJECT No 1714

DRAWING No SK04

DRAWN by ...

CHECKED ...

DATE April 19

SCALE (LULU) 1:500

JOHN McCALL ARCHITECTS LTD
No .1 Arts Village, Henry Street, Liverpool L1 5BS Tel: 0151 707 1818 Fax: 707 1819
Old Coop Building, Church Street, Hayfield, SK22 2JE e-mail: admin@johnmccall.co.uk

Appendix F Flood Risk Maps

Flood map for planning

Your reference	Location (easting/northing)	Created
Flood Zone	**371059/435078**	**14 Aug 2019 9:44**

Your selected location is in flood zone 1, an area with a low probability of flooding.

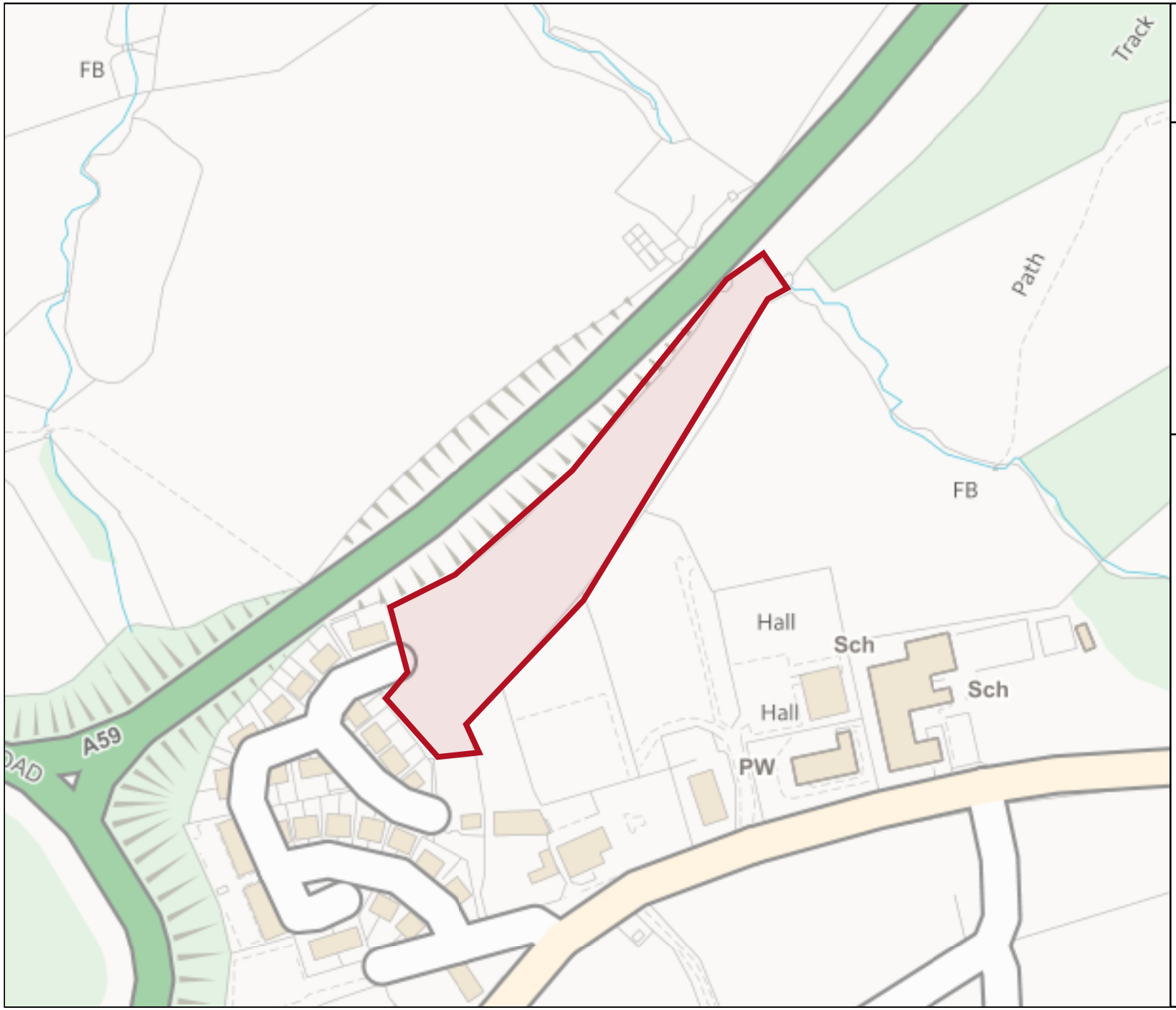
This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
Flood Zone

Location (easting/northing)
371059/435078

Scale
1:2500

Created
14 Aug 2019 9:44

- Selected area
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 20 40 60m

Flood map for planning

Your reference	Location (easting/northing)	Created
Flood Zone	**371059/435078**	**14 Aug 2019 9:45**

Your selected location is in flood zone 1, an area with a low probability of flooding.

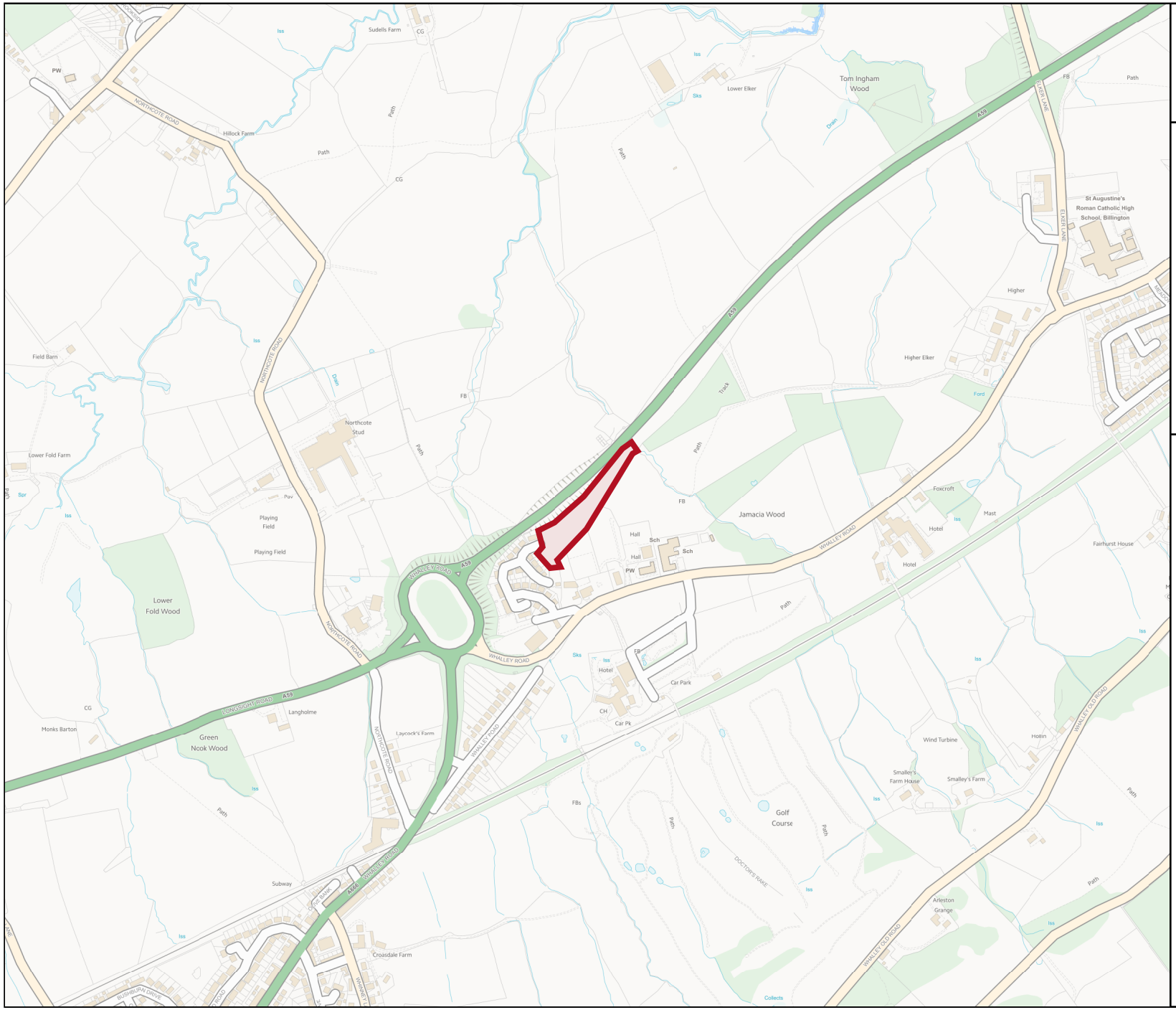
This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
Flood Zone

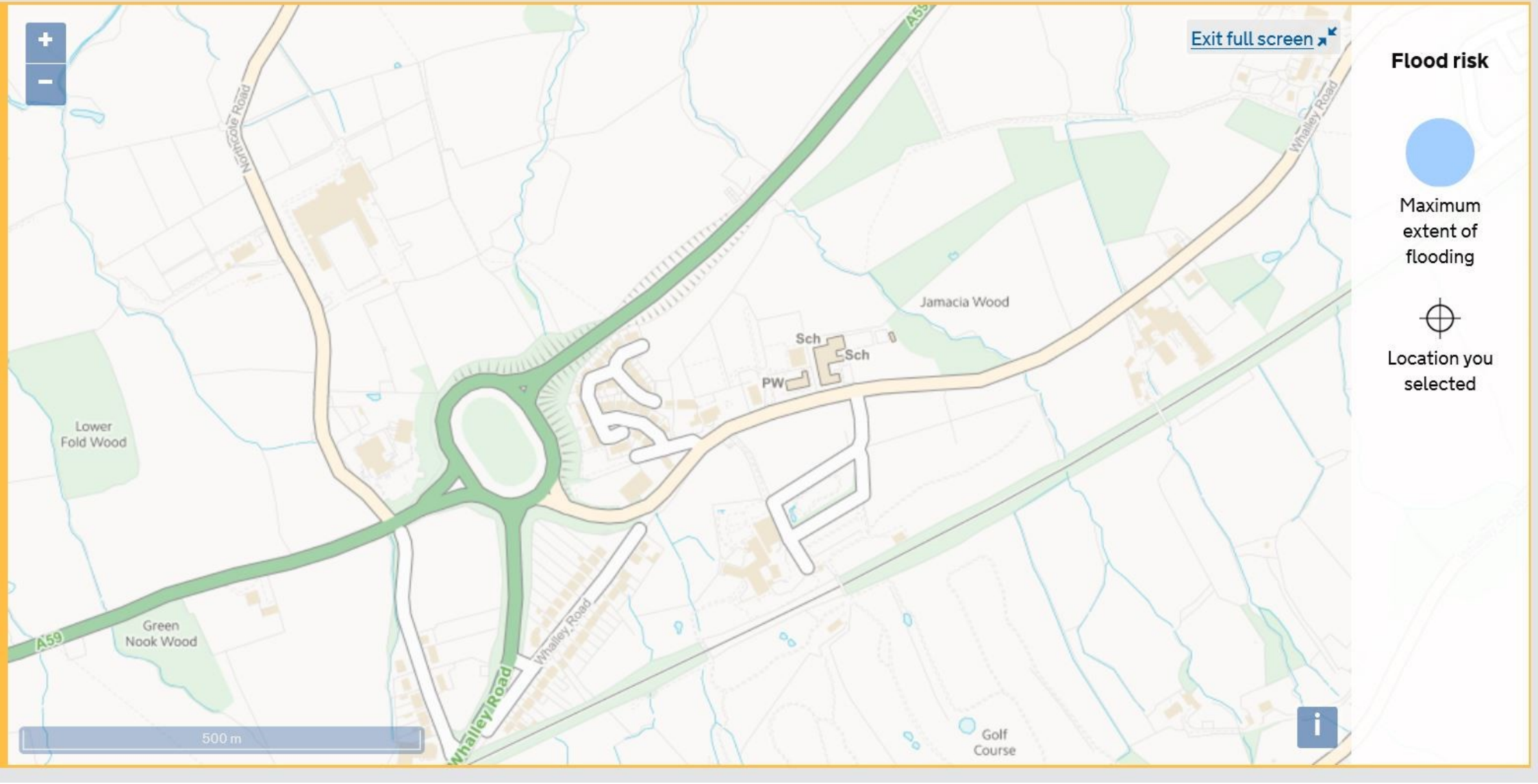
Location (easting/northing)
371059/435078

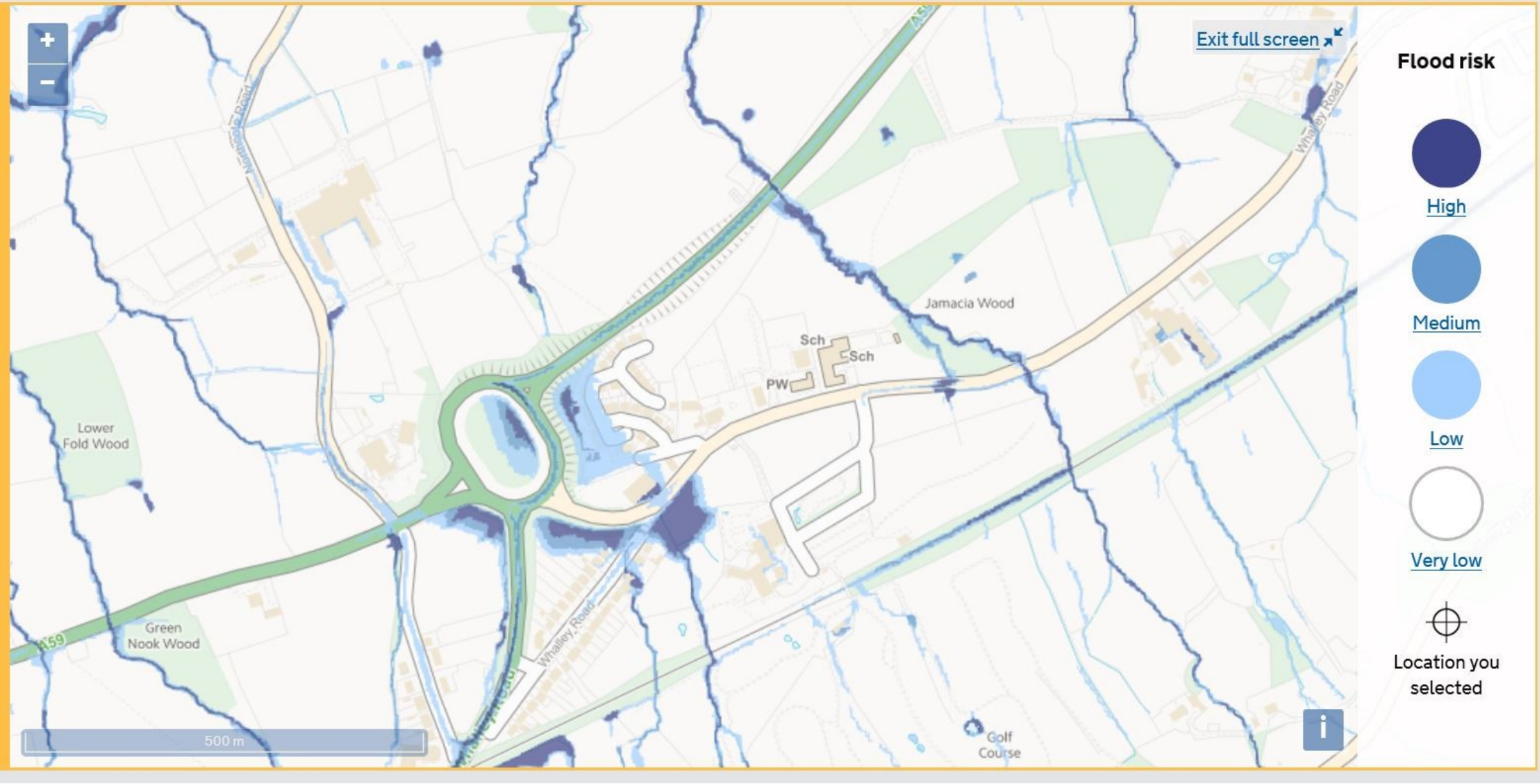
Scale
1:10000

Created
14 Aug 2019 9:45

- Selected area
- Flood zone 3
- Flood zone 3: areas benefitting from flood defences
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Flood storage area

0 100 200 300m


Exit full screen
Flood risk
Maximum extent of flooding
Location you selected
Jamacia Wood
Sch
Sch
PW
Lower Fold Wood
Green Nook Wood
A59
Whalley Road
Whalley Road
Whalley Road
Golf Course
500 m


Exit full screen
Flood risk
High
Medium
Low
Very low
Location you selected
Jamacia Wood
Lower Fold Wood
Green Nook Wood
Sch
Sch
PW
Whalley Road
A59
Golf Course
500 m

Appendix G United Utilities Map

Pond
Drain
Path (um)
Foot Bridge
FB
Track
Path (um)
Pond
Northcote Stud
Helipad
Northcote Manor
(Hotel)
Issues
NORTHCOTE ROAD
A 59
A 59
A 59
A 666
WHALLEY ROAD
Petre House Farm
PETRE WOOD CRESCENT
PETRE WOOD CLOSE
Household
Waste Disposal
Centre
Garage
Shelter
LONGSIGHT Jcn
LONGSIGHT ROAD
Greenfield House
Petre Arms
(PH)
Barnacre
El Sub Sta
Community
Centre
St Leonard's C of E
School
Jamacia Wood
Jamacia
Wood
St Leonard's
C of E School
School House
St Leonard's Church
FS
75.6m
WHALLEY ROAD
Golf Course
MP 16.25
Sinks
Issues
Mytton Fold Hotel
FB
Ponds
Car Park
Golf Course
Pond
FB
5302
5301
7201
7104
7103
7102
7101
5001
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6001
6002
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Appendix H Post Development Impermeable Areas

N

Surrounding area to pond and outfall sewers shall be re-graded and landscaped to accommodate the proposed crest and cover levels.

Proposed 12.0m x 8.0m Type 2 Foul pumping station. to lift F.W flows from 68.00m AOD to MH F6 at I.L.76.759m AOD
Wet Well to have 10m minimum distance from habitable buildings.
Lift = 8.759m
Pumping rate =0.50/s ((225l/per person/per day).i2) TBC
Wet Well to be sized to provide emergency 24 hour storage volume of 1.60m³ (160l/per dwelling)

80mmØ min I.D Rising main to pump at a minimum of half the total discharge rate (to be confirmed by specialist)

Private outfall from SUDS basin to discharge into existing watercourse. Additional topographical information required on watercourse bed levels to establish outfall head invert level.

1500mmØ PCC Control MH S4
with optimum type hydrobrake
6l/s discharge @ 1.500m head (108mmØ Orifice)
Ref -MD-SHE-0108-6000-1500-6000

SUDS Basin with 1 in 4 side slopes to attenuate flows for the 1in 100 year return period plus an allowance for climate change (321m³)
Crest Level 69.75m AOD base lvl 68.25m AOD

3 metre easement either side of F.W Sewer and S.W sewer, to outlet headwall to basin.

S.W Sewer & Rising Main shall cross the existing Cadent Gas Main, all crossing points and levels to be agreed with Cadent prior to the start of any works on site to ensure clash is avoided.

Proposed Connection into existing Foul Manhole.Invert level to be confirmed prior to the start of any works.

1.000	0.1070	
1.001	0.000	
1.002	0.042	
1.003	0.000	
1.004	0.0910	
1.005	0.0600	
1.006	0.0690	
1.007	0.0670	
1.008	0.0450	
1.009	0.0650	
1.010	0.0000	
1.011	0.000	
1.012	0.000	

REV	DATE	DESCRIPTION	BY	CHK	APP
P1	14.08.19	INITIAL ISSUE	JCM	JLS	JLS

DRAWING STATUS:
PRELIMINARY

CLIENT:
HARDGREAVES CONTRACTING

ARCHITECT:
MDA ARCHITECTS

PROJECT:
PETRE WOOD PHASE 3
LANGHO

TITLE:
S.W CATCHMENT PLAN

STATUS:	PROJECT NUMBER	DRAWING No:	REV:
S2	219-021	**PET-AJP-ZZ-00-DR-C-1040**	**P01**

SCALE @ A1:	DESIGNED:	DRAWN:	CHECKED:	APPROVED:	DATE:
1:500	JCM	JCM	JLS	JLS	APRIL 2019

alan johnston partnership LLP
CONSULTING STRUCTURAL & CIVIL ENGINEERS
1 Dale Street, Liverpool L2 2ET
Tel: 0151 227 1462
Fax: 0151 225 1187
E-Mail: Mail@ajpstructeng.com

Appendix I Greenfield Runoff Calculations

ICP SUDS Mean Annual Flood

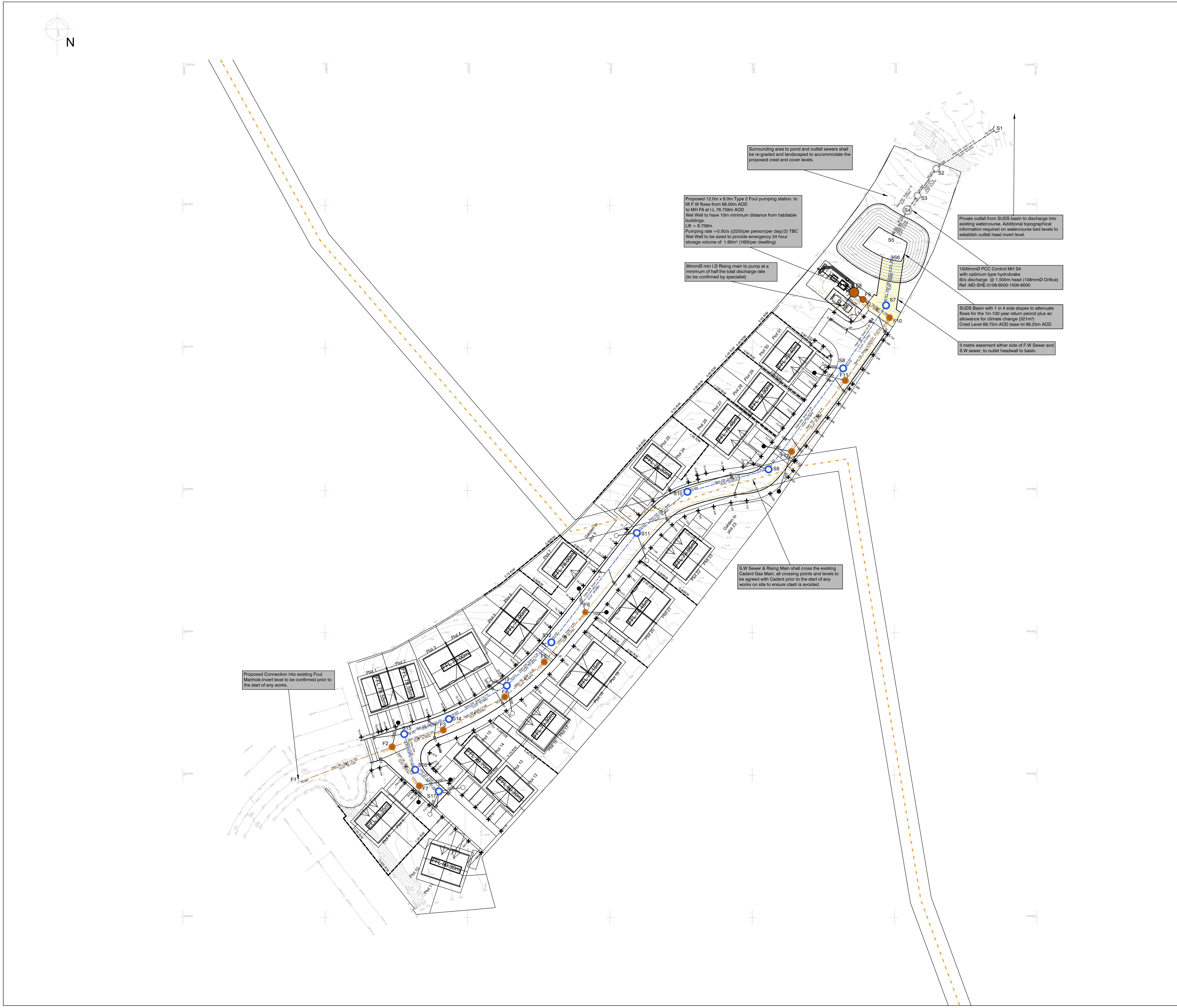
Input

Return Period (years)	100	Soil	0.450
Area (ha)	1.025	Urban	0.000
SAAR (mm)	1000	Region Number	Region 10

Results l/s

QBAR Rural	6.8
QBAR Urban	6.8
Q100 years	14.2
Q1 year	5.9
Q30 years	11.6
Q100 years	14.2

Appendix J Outline Drainage Layout & Calculations



GENERAL NOTES

1. SETTING OUT SHALL BE UNDERTAKEN USING ONLY THE INFORMATION GIVEN. DISTANCES SHOULD NOT BE SCALED FROM THIS DRAWING.
2. ALL SEWERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH SEWERS FOR ADOPTION 6TH EDITION AND UNITED UTILITIES DETAILS & GUIDELINES.
3. THE MINIMUM GRAVITY PIPE DIAMETER UNDER ADOPTABLE HIGHWAYS SHALL BE 150MM
4. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL INFORMATION GIVEN WITH REGARDS TO EXISTING SERVICES AND DRAINAGE CONNECTIONS ETC. PRIOR TO COMMENCING THE WORKS. THE RATES SHALL INCLUDE FOR HAND DIG AROUND SERVICES WHERE NECESSARY. THE CONTRACTOR SHALL ADHERE TO THE CDM REGULATIONS AT ALL TIMES
5. THE OUTSIDES OF ALL SEWERS SHALL BE A MINIMUM OF 1.0M FROM KERB LINES AND THE OUTSIDE OF MANHOLES SHALL BE A MINIMUM OF 0.5M FROM KERB LINES
6. EXISTING FLOWS IN WATERCOURSES, SEWERS AND LAND DRAINS SHALL BE MAINTAINED AT ALL TIMES 7. ONLY TRAINED PERSONNEL SHALL BE PERMITTED TO ENTER CONFINED SPACES
7. ALL MATERIALS TO BEAR THE RELEVANT B.S. KITEMARK AND COMPLY FULLY WITH THE SPECIFICATIONS. ALL CONCRETE & CONCRETE PRODUCTS MUST USE SULPHATE RESISTANT CEMENT (UNLESS THE SITE INVESTIGATION REPORT PROVES THAT SULPHATE ATTACK FROM SOILS AND GROUNDWATER WILL NOT OCCUR TO WITHSTAND A CLASS
8. ALL OPENING NOTICES ETC. AS REQUIRED UNDER HIGHWAYS ACTS ETC. ARE TO BE OBTAINED PRIOR TO COMMENCEMENT OF WORKS. ALL WORKS ARE TO BE INSPECTED BY L.A., NHBC OR THE NETWORK OPERATOR AS APPLICABLE.
9. WHERE "ULTRA RIB" UPVC PIPES (OR SIMILAR APPROVED) ARE USED IN ADOPTABLE DRAINAGE THEY SHALL STILL BE HANDLED AND LAID IN ACCORDANCE WITH THE SPECIFICATION AND GUIDANCE ISSUED BY THE HIGH PERFORMANCE PIPE ASSOCIATION.
10. A CLASS S BED AND SURROUND MUST BE USED FOR SUCH PIPES. TRENCH BACKFILL IN HIGHWAYS TO WITHIN 1M OF HIGHWAY SHALL, AS DIRECTED BY THE HIGHWAY AUTHORITY BE A SUITABLE GRANULAR MATERIAL ALL IN ACCORDANCE WITH SEWERS FOR ADOPTION CL. 4.3.4. 12. SLAB LEVELS SHALL NOT BE VARIED WITHOUT REFERENCE TO THE ENGINEER FOR GUIDANCE
11. DOMESTIC DRAINAGE SHALL BE TO BUILDING REGULATIONS APPROVED DOCUMENT H. 110MM U.P.V.C. PIPES LAID TO THE FOLLOWING MINIMUM FALLS UNLESS OTHERWISE SHOWN.

	FOUL	S.W.
HEAD RUN	1 IN 40	1 IN 60
ELSEWHERE	1 IN 80	1 IN 100

12. POLYPROPYLENE INSPECTION CHAMBERS TO BE PROVIDED TO ALL PRIVATE DRAINAGE LESS THAN 1.10m DEEP. WHERE PRIVATE DRAINAGE RUNS ARE DEEPER THAN 1.10m, REDUCED ACCESS CHAMBERS TO BE PROVIDED.
13. WHEREVER PLASTIC PIPES ARE TO BE USED FOR THE CONSTRUCTION OF ADOPTABLE DRAINAGE, STRUCTURED WALL PLASTIC PIPES MUST BE USED WHICH MUST COMPLY WITH BS EN 13476-1 AND WIS 4-35-01

LEGEND

- PROPOSED SURFACE WATER SEWER MANHOLE
- PROPOSED FOUL WATER SEWER MANHOLE
- PROPOSED COMBINED WATER SEWER MANHOLE
- EXISTING SURFACE WATER MANHOLE
- EXISTING COMBINED WATER MANHOLE
- PROPOSED FOUL 1050MMØ PCC DRAG OUT MH (TO BE AGREED WITH UU FIELD INSPECTOR)
- PROPOSED SURFACE WATER 1050MMØ PCC DRAG OUT MH (TO BE AGREED WITH UU FIELD INSPECTOR)
- PROPOSED FOUL WATER SEWER
- PROPOSED SURFACE WATER SEWER
- PROPOSED COMBINED SEWER
- PROPOSED SURFACE WATER DRAIN WITH 450mmØ INSPECTION CHAMBER
- PROPOSED FOUL WATER DRAIN WITH 450mmØ INSPECTION CHAMBER
- G HIGHWAY GULLY
- 53.000 FINISHED FLOOR LEVEL
- ACO ACO CHANNEL (OR SIMILAR)
- RAIN WATER PIPE WITH TRAPPED GULLY
- SOIL VENT PIPE
- BACK INLET GULLY
- SOIL STACK

S.W DRAINAGE STRATEGY PRELIMINARY SUBJECT TO ACCEPTANCE BY UNITED UTILITIES/ PRESCOT LEAD LOCAL FLOOD AUTHORITY AND THE ENVIRONMENT AGENCY OF DISCHARGE RATES & OUTFALL LOCATION

REV	DATE	DESCRIPTION	BY	CHK	APP
P02	27.06.2019	UPDATED TO JOHN McCALLS LAYOUT	JCM	JLS	JLS
P1	05.04.2019	INITIAL ISSUE	JCM	JLS	JLS

DRAWING STATUS: **PRELIMINARY**

CLIENT: HARDGREAVES CONTRACTING

ARCHITECT: MDA ARCHITECTS

PROJECT: PETRE WOOD PHASE 3
LANGHO

TITLE: OUTLINE DRAINAGE LAYOUT

STATUS:	PROJECT NUMBER	DRAWING No:	REV:
S2	219-021	**PET-AJP-ZZ-00-DR-C-1000**	**P02**

SCALE @ A1:	DESIGNED:	DRAWN:	CHECKED:	APPROVED:	DATE:
1:500	JCM	JCM	JLS	JLS	APRIL 2019

alan johnston partnership LLP
CONSULTING STRUCTURAL & CIVIL ENGINEERS
1 Dale Street,
Liverpool L2 2ET
Tel: 0151 227 1462
Fax: 0151 225 1187
E-Mail: Mail@ajpstructeng.com

Existing Network Details for 219-021 PROPOSED S.W NETWORK REV A.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section Type
1.000	9.000	0.450	20.0	0.107	5.00	0.600	o	225	Pipe/Conduit
1.001	10.471	0.299	35.0	0.000	0.00	0.600	o	225	Pipe/Conduit
1.002	13.246	0.078	170.0	0.042	0.00	0.600	o	225	Pipe/Conduit
1.003	18.766	0.110	170.0	0.000	0.00	0.600	o	225	Pipe/Conduit
1.004	17.457	0.503	34.7	0.091	0.00	0.600	o	225	Pipe/Conduit
1.005	39.009	2.500	15.6	0.060	0.00	0.600	o	225	Pipe/Conduit
1.006	18.294	0.915	20.0	0.069	0.00	0.600	o	225	Pipe/Conduit
1.007	23.651	1.183	20.0	0.067	0.00	0.600	o	225	Pipe/Conduit
1.008	35.290	1.765	20.0	0.045	0.00	0.600	o	300	Pipe/Conduit
1.009	21.425	1.071	20.0	0.065	0.00	0.600	o	300	Pipe/Conduit
1.010	13.656	0.137	100.0	0.000	0.00	0.600	o	300	Pipe/Conduit
1.011	6.066	0.040	150.0	0.000	0.00	0.600	o	300	Pipe/Conduit
1.012	8.219	0.055	150.0	0.000	0.00	0.600	o	300	Pipe/Conduit
1.013	4.976	0.415	12.0	0.000	0.00	0.600	o	225	Pipe/Conduit
1.014	9.231	0.769	12.0	0.000	0.00	0.600	o	225	Pipe/Conduit
1.015	19.473	1.650	11.8	0.000	0.00	0.600	o	225	Pipe/Conduit

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
1.000	17	79.179	77.450	1.504	78.756	77.000	1.531		1500
1.001	16	78.756	77.000	1.531	78.449	76.701	1.523		1500
1.002	15	78.449	76.701	1.523	78.583	76.623	1.735		1500
1.003	14	78.583	76.623	1.735	78.777	76.513	2.039		1500
1.004	13	78.777	76.513	2.039	78.919	76.010	2.684		1500
1.005	12	78.919	76.010	2.684	76.959	73.510	3.224		1500
1.006	11	76.959	73.510	3.224	75.729	72.595	2.909		1500
1.007	10	75.729	72.595	2.909	74.078	71.412	2.441		1500
1.008	9	74.078	71.337	2.441	71.662	69.572	1.790		1500
1.009	8	71.662	69.572	1.790	70.750	68.501	1.949		1500
1.010	7	70.750	68.501	1.949	69.750	68.364	1.086		1500
1.011	6	69.750	68.364	1.086	69.750	68.324	1.126		250
1.012	5	69.750	68.250	1.200	69.750	68.195	1.255	Hydro-Brake®	250
1.013	4	69.750	68.195	1.330	68.925	67.780	0.920		2100
1.014	3	68.925	66.000	2.700	67.049	65.231	1.593		1500
1.015	2	67.049	64.400	2.424	63.898	62.750	0.923		1500

Free Flowing Outfall Details for 219-021 PROPOSED S.W NETWORK REV A.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.015	1	63.898	62.750	0.000	0	0

Simulation Criteria for 219-021 PROPOSED S.W NETWORK REV A.SWS

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.100	Storm Duration (mins)	30
Ratio R	0.298		

Online Controls for 219-021 PROPOSED S.W NETWORK REV A.SWS

Hydro-Brake® Optimum Manhole: 5, DS/PN: 1.012, Volume (m³): 0.5

Unit Reference	MD-SHE-0108-6000-1500-6000
Design Head (m)	1.500
Design Flow (l/s)	6.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	108
Invert Level (m)	68.250
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	6.0
Flush-Flo™	0.448	6.0
Kick-Flo®	0.918	4.8
Mean Flow over Head Range	-	5.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.7	1.200	5.4	3.000	8.3	7.000	12.4
0.200	5.4	1.400	5.8	3.500	8.9	7.500	12.8
0.300	5.8	1.600	6.2	4.000	9.5	8.000	13.2
0.400	6.0	1.800	6.5	4.500	10.1	8.500	13.6
0.500	6.0	2.000	6.9	5.000	10.6	9.000	14.0
0.600	5.9	2.200	7.2	5.500	11.1	9.500	14.4
0.800	5.4	2.400	7.5	6.000	11.5		
1.000	5.0	2.600	7.8	6.500	12.0		

Storage Structures for 219-021 PROPOSED S.W NETWORK REV A.SWS

Tank or Pond Manhole: 5, DS/PN: 1.012

Invert Level (m) 68.250

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	75.0	0.600	172.0	1.200	312.0
0.200	100.0	0.800	215.0	1.400	365.0
0.400	135.0	1.000	262.0	1.500	395.0

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 219-021 PROPOSED S.W NETWORK REV A.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.298
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	17	15 Winter	1	+0%	100/15 Summer				77.505
1.001	16	15 Winter	1	+0%	100/15 Summer				77.063
1.002	15	15 Winter	1	+0%	30/15 Summer				76.814
1.003	14	15 Winter	1	+0%	30/15 Summer				76.732
1.004	13	15 Winter	1	+0%	100/15 Summer				76.602
1.005	12	15 Winter	1	+0%	100/15 Summer				76.087
1.006	11	15 Winter	1	+0%	30/15 Summer				73.605
1.007	10	15 Winter	1	+0%	30/15 Summer				72.697
1.008	9	15 Winter	1	+0%	100/15 Winter				71.431
1.009	8	15 Winter	1	+0%	100/15 Summer				69.675
1.010	7	180 Winter	1	+0%	30/15 Summer				68.683
1.011	6	180 Winter	1	+0%	1/120 Winter				68.677
1.012	5	180 Winter	1	+0%	1/30 Summer				68.675
1.013	4	180 Winter	1	+0%					68.233
1.014	3	180 Winter	1	+0%					66.032
1.015	2	180 Winter	1	+0%					64.430

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 219-021 PROPOSED S.W NETWORK REV A.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	17	-0.170	0.000	0.14		12.8	OK	
1.001	16	-0.162	0.000	0.17		12.7	OK	
1.002	15	-0.112	0.000	0.50		17.2	OK	
1.003	14	-0.116	0.000	0.47		17.0	OK	
1.004	13	-0.136	0.000	0.33		25.9	OK	
1.005	12	-0.148	0.000	0.25		31.8	OK	
1.006	11	-0.130	0.000	0.37		38.5	OK	
1.007	10	-0.123	0.000	0.42		45.0	OK	
1.008	9	-0.206	0.000	0.21		49.3	OK	
1.009	8	-0.197	0.000	0.25		55.4	OK	
1.010	7	-0.118	0.000	0.22		19.8	OK	
1.011	6	0.013	0.000	0.32		19.4	SURCHARGED	
1.012	5	0.125	0.000	0.10		6.0	SURCHARGED	
1.013	4	-0.188	0.000	0.07		6.0	OK	
1.014	3	-0.193	0.000	0.05		6.0	OK	
1.015	2	-0.195	0.000	0.04		6.0	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 219-021 PROPOSED S.W NETWORK REV A.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.298
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	17	15 Winter	30	+0%	100/15 Summer				77.540
1.001	16	15 Winter	30	+0%	100/15 Summer				77.103
1.002	15	15 Winter	30	+0%	30/15 Summer				76.998
1.003	14	15 Winter	30	+0%	30/15 Summer				76.881
1.004	13	15 Winter	30	+0%	100/15 Summer				76.675
1.005	12	15 Winter	30	+0%	100/15 Summer				76.147
1.006	11	15 Winter	30	+0%	30/15 Summer				73.867
1.007	10	15 Winter	30	+0%	30/15 Summer				73.035
1.008	9	15 Winter	30	+0%	100/15 Winter				71.498
1.009	8	15 Winter	30	+0%	100/15 Summer				69.764
1.010	7	15 Winter	30	+0%	30/15 Summer				69.290
1.011	6	240 Winter	30	+0%	1/120 Winter				69.203
1.012	5	240 Winter	30	+0%	1/30 Summer				69.200
1.013	4	15 Summer	30	+0%					68.233
1.014	3	15 Winter	30	+0%					66.032
1.015	2	15 Winter	30	+0%					64.430

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 219-021 PROPOSED S.W NETWORK REV A.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	17	-0.135	0.000	0.33		31.5	OK	
1.001	16	-0.122	0.000	0.42		31.1	OK	
1.002	15	0.072	0.000	1.24		42.6	SURCHARGED	
1.003	14	0.033	0.000	1.16		41.7	SURCHARGED	
1.004	13	-0.063	0.000	0.84		66.5	OK	
1.005	12	-0.088	0.000	0.66		83.2	OK	
1.006	11	0.132	0.000	0.95		99.7	SURCHARGED	
1.007	10	0.215	0.000	1.08		116.1	SURCHARGED	
1.008	9	-0.139	0.000	0.56		128.2	OK	
1.009	8	-0.108	0.000	0.66		145.7	OK	
1.010	7	0.489	0.000	1.58		145.0	SURCHARGED	
1.011	6	0.538	0.000	0.59		36.5	SURCHARGED	
1.012	5	0.650	0.000	0.10		6.0	SURCHARGED	
1.013	4	-0.188	0.000	0.07		6.0	OK	
1.014	3	-0.193	0.000	0.05		6.0	OK	
1.015	2	-0.195	0.000	0.04		6.0	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 219-021 PROPOSED S.W NETWORK REV A.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.298
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.100	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	17	15 Winter	100	+40%	100/15 Summer				78.089
1.001	16	15 Winter	100	+40%	100/15 Summer				78.003
1.002	15	15 Winter	100	+40%	30/15 Summer				77.917
1.003	14	15 Winter	100	+40%	30/15 Summer				77.741
1.004	13	15 Winter	100	+40%	100/15 Summer				77.525
1.005	12	15 Winter	100	+40%	100/15 Summer				77.026
1.006	11	15 Winter	100	+40%	30/15 Summer				75.423
1.007	10	15 Winter	100	+40%	30/15 Summer				74.090
1.008	9	15 Winter	100	+40%	100/15 Winter				71.657
1.009	8	30 Winter	100	+40%	100/15 Summer				70.737
1.010	7	30 Winter	100	+40%	30/15 Summer				70.034
1.011	6	360 Winter	100	+40%	1/120 Winter				69.744
1.012	5	360 Winter	100	+40%	1/30 Summer				69.741
1.013	4	15 Winter	100	+40%					68.233
1.014	3	15 Winter	100	+40%					66.032
1.015	2	15 Summer	100	+40%					64.430

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 219-021 PROPOSED S.W NETWORK REV A.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	17	0.414	0.000	0.55		52.0	SURCHARGED	
1.001	16	0.778	0.000	0.55		40.9	SURCHARGED	
1.002	15	0.991	0.000	1.57		54.1	SURCHARGED	
1.003	14	0.893	0.000	1.69		60.5	SURCHARGED	
1.004	13	0.787	0.000	1.06		83.5	SURCHARGED	
1.005	12	0.791	0.000	0.83		103.8	SURCHARGED	
1.006	11	1.688	0.000	1.21		127.3	SURCHARGED	
1.007	10	1.270	0.000	1.43		153.3	SURCHARGED	
1.008	9	0.020	0.000	0.74		170.2	SURCHARGED	
1.009	8	0.865	0.000	0.83		181.7	SURCHARGED	
1.010	7	1.233	0.000	1.96		180.1	SURCHARGED	
1.011	6	1.079	0.000	0.81		49.9	FLOOD RISK	
1.012	5	1.191	0.000	0.10		6.0	FLOOD RISK	
1.013	4	-0.188	0.000	0.07		6.0	OK	
1.014	3	-0.193	0.000	0.05		6.0	OK	
1.015	2	-0.195	0.000	0.04		6.0	OK	

Appendix K Phase II Site Investigation Report