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FLOOD RISK AND SEQUENTIAL ASSESSMENT

FOR PROPOSED DEVELOPMENT

at

RIBCHESTER

Prepared for

PARTNER CONSTRUCTION

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RIBCHESTER

1 INTRODUCTION

1.1 iD Civils Ltd (iD), have been appointed by Partner Construction (PC) to prepare a Flood Risk Assessment (FRA)/Sequential Site Assessment and surface water management strategy report for the proposed residential development west of Dutton Brook Nursing Home, Ribchester, Lancashire.

1.2 The report will be undertaken in accordance with Ribble Valley Borough Council (RVBC), Unitled Utilities (UU) and Environment Agency (EA) development control policy and guidance. The report will cover site use and current drainage regime, flooding history, ground conditions and use of SUDS, impact of development and proposed drainage strategy, flash flooding routes and the overall impact of development on the site and surrounds.

1.3 The report is for the sole use of PC and presents comments and conclusions based on information available at the time of writing. iD Civils reserve the right to amend conclusions if further information is made available.

2 BACKGROUND

2.1 PC is seeking detailed planning permission to develop 0.75 Ha of land to the west Dutton Brook House Nursing homes and Parsonage Close in the south east of Ribchester. A location plan for the site is included in appendix A. The land comprises arable farmland.

2.2 The development will feature a range of dwelling types which will be constructed by Partner Construction on behalf of a social housing landlord. A copy of the proposed layout is included within appendix G.

2.3 Under the requirements of National Planning Policy Framework (NPPF) the site requires a Flood Risk Assessment as it is located within Flood Zone 2.

2.3 This Flood Risk Assessment has been undertaken with reference to the following reports and documents:

- Development master plan layout
- Topographical Survey
- EA Flood Zone plans
- EA Flood model levels for River Ribble and Boyces Brook
- United Utility Sewer Records
- National Planning Policy Framework (NPPF)
- Ribble Valley Borough council Strategic Flood Risk Assessment (SFRA)
- Liaison with UU in terms of drainage strategy and outfall points
- SuDS Manual (Ciria C697)
- Soakaway Test Report undertaken by Sirius Geoenvironmental

2.4 **Site Walkover:** A site walkover was undertaken in October 2013. During the site walkover potential overland flood routes onto and from the site were inspected in order to assess the risk of flooding from external sources.

3 REGULATORY GUIDANCE

3.1 National Planning Policy Framework (NPPF), along with the Technical Guidance to the NPPF provides the regulatory framework and guidance for planning authorities in relation to Flood Issues for new developments. Any application submitted to a local planning authority will be considered in conjunction with this guidance, and dependant on the nature and location of the application, the planning authority may request a Flood Risk Assessment as part of the planning application documents.

3.2 The Environment Agency is a statutory consultee to the Planning Authority in relation to flood risk issues. In addition, RVBC have their own internal Flood Management Department who would advise on drainage and flooding issues, and work with the EA on strategic issues. The Land Drainage Act 1991 provides a regulatory framework for this issue.

3.3 RVBC has commissioned a Strategic Flood Risk Assessment (SFRA) report which reviews the flood risk and drainage issues across the Ribble Valley. The report is a level one report and focuses on strategic issues without concentrating on particular critical drainage areas. The report was adopted in May 2010.

3.4 The EA has produced a matrix for local planning authorities, which provides advice in terms of the requirements for risk assessment. 'Environment Agency Standing Advice – Development and Flood Risk' dated February 2009 tabulates the requirements relative to the scale of the development and the applicable Flood Zone. The assessment is required for all sites larger than 1 Ha in flood Zone 1 and all sites regardless of size in Flood Zones 2 and 3.

3.5 The Environment Agency have undertaken a national study of flood risk across England and published flood maps covering the country. The maps can be viewed on the agency web site at **www.environment-agency.gov.uk**. Specific locations can be studied by searching either using postcode or address.

3.6 The EA flood maps identify 3 zones.

Flood Zone 1: This zone comprises land with a less than 1 in 1000 annual probability of river or sea flooding in any one year (<0.1%)

Flood Zone 2: This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1%-0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5%-0.1%) in any year.

Flood zone 3: The zone comprises land assessed as having a 1 in 100 year or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Flood risk should be assessed from the following sources; tidal and river, surface water and flooding from land, groundwater, sewers and artificial sources e.g. canals and reservoirs.

Flood zone plans reflect the undefended flood scenario for a particular area. Many flood areas are defended with flood defences of varying types and design life. Areas benefiting from flood protection are shown hatched on the EA plans.

3.7 The level of detail and complexity of a Flood Risk Assessment can vary considerably, dependant on the scale, nature and location of the planned development. EA guidance sets out the criteria for the level of information which should be included within the FRA.

3.8 The application site is within EA Flood Zone 2 (land which has an annual probability of flooding of 0.1% - 1%).

3.9 The Technical Guidance to NPPF (Table 2) sets out to vulnerability classifications for a range of development types which are based on their sensitivity to flooding. The proposal is for a residential which is classified as 'more vulnerable'.

3.10 Table 3 in the NPPF technical guidance provides information in relation to the appropriate vulnerability classes within each of the flood risk zones. The table is presented below:

Table 3957.1 – Flood risk vulnerability and Flood Zone compatibility

Flood Risk Vulnerability Classification (Table 2 NPPF)	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	√	√	√	√	√
Zone 2	√	√	Exception Test Required	√	√
Zone 3a	Exception Test Required	√	x	Exception Test Required	√
Zone 3b	Exception Test Required	√	x	x	x

3.11 **The Sequential Test:** In accordance with NPPF, LPA's allocating land for development should apply the Sequential test, to demonstrate that there are no available sites in the area with a lower risk of flooding. As the site is within Flood Zone 2 a sequential assessment is required.

3.12 Paragraph 100 of the NPPF relates to flood risk and suggests that inappropriate development in areas at risk of flooding should be avoided, but where development is necessary, making it safe without increasing flood risk elsewhere.

3.13 A sequential assessment of development opportunities within Ribchester has been undertaken and is included within Appendix K of this report. The sequential assessment determined that this site was the most appropriate site for development at the moment.

3.14 **The Exception Test:** The exception test is relevant if, following the application of the sequential test; the development is deemed acceptable in the planned location. Table 3 (above) confirms that for sites within flood zone 2 which are a more vulnerable and use the exceptions test is **not** required.

3.15 United Utilities work within the framework of 'Sewers for Adoption', which sets the standard for adoptable surface water and foul waters sewers. They also apply development control standards which are consistent with current best practice and Building Regulations. At present UU is working to 6th edition of Sewers for Adoption pending the publication of the Mandatory build Standards and SUDS Guidance.

3.16 Developers are encouraged to make 'pre development' enquiries to UU to ensure that there is sufficient time for the company to fully assess the capacity of their network and treatment works. This process also ensures that drainage strategies are acceptable in principle, prior to planning permission and helps avoid any objections from UU during the planning process.

3.17 The emerging 'Flood and Water Management Act 2010' will fundamentally change the way developers and local authorities approach the design and adoption of SuDS drainage. New SuDS Approving Bodies (SAB) will be formed to ensure adequate consideration is given to SuDS methods of drainage and the SAB will act to approve SuDS designs and adopt the constructed drainage. It is understood that RVBC may become the SuDS Approving Body for this site.

3.18 A new set of SuDS standards is currently out to consultation amongst stakeholders, and will be implemented in April 2014. The 7th edition of 'Sewers for Adoption' will be implemented by UU following the adoption of the SuDS standards and will compliment the new standards.

3.19 The principles identified in the consultation SuDS standards have been considered in developing the strategy outlined in this report, on the assumption that the strategy will be consistent with best practice and that ultimately the site will come forward after the SAB's are in place.

4 SITE DESCRIPTION AND HISTORY

4.1 A site location plan is included within Appendix A of this report. Site details are summarised in the Table below.

Table 3957.2 - Site Location Summary

Detail	Remarks
Location	0.5 KM south west of Ribchester centre
NGR	SD 647351
Area	0.75 Ha
Current Use	'Greenfield' – Grassland

4.2 **Topography:** The topographical survey and walkover survey indicate that the site is relatively flat with a very nominal fall to the north. The unnamed road which will form the site access route is slightly higher than the southern edge of the site. The general level of the site is cc 27.0m. The highest point on the site is 27.38m in the south eastern corner and the lowest point of the site is 26.46m

4.3 The site has a typical gradient of less than 1 in 100.

4.4 The site does no contain any areas of hardstanding and is entirely Greenfield at present. There is no evidence of any connection to the local surface water or combined sewer system.

4.5 **Adjacent Land use:** The site is bounded by the following features:

Table 3957.3 -Adjacent Land Uses

North	Open Fields
South	Unnamed track, Tennis Courts and St Wilfreds Church
East	Open Fields
West	Dutton Brook House Care Home

4.6 **Access:** The site can be accessed from the unnamed track to the south.

4.7 **Hydrology:** iDC liaised with RVBC however received no response to enquiries at the time of writing this report. IDC are not aware of any culverted watercourses crossing or adjacent to the site. The nearest water body is the River Ribble which is approximately 200m to the east of the site.

4.8 No groundwater abstraction licences have been identified within 500m of the site. There is a licenses abstraction from Boyce's Brook 306m to the north of the site.

4.9 The bedrock below the site is classified as a secondary A Aquifer. The superficial deposits below the site are classified as a secondary A aquifer.

4.10 The River Ribble, Boyces Brook and Duddel brook are all classified as GQA Grade River Quality B.

4.11 Sirius Geoenvironmental has undertaken an intrusive investigation and soakaway testing (letter report C5584A/5192/MG/MG) which is presented in appendix J. The ground investigation was undertaken via window sample holes which were used to undertake soakaway testing. Ground conditions comprise of a veneer of topsoil over firm to soft clays (0.65m – 1.65m) with sands below the clay.

4.12 The water table was measured in two of the 5 holes and was located at between 1.4m and 2.5m in depth (24.8m – 25.4m AOD). The other 3 window sample holes referred to very damp soil at cc 1m-1.4m in depth.

4.13 Historical Uses; The site has no previous brownfield use.

5 EXISTING SITE DRAINAGE

5.1 iD has obtained a copy of the UU Public Sewerage Record plans for the area. A summary is presented below:

Table 3957.4 – Existing Sewers Summary

Sewer Type	Comment
Surface Water	There are no surface water sewers crossing the site. The nearest surface water sewer is located in Church Street which is approximately 165m east of the south eastern corner of the site. This system is indicated on the records as 375mm diameter.
Combined	There is a combined 375mm diameter system running in the unnamed track to the south of the site between the site and the tennis courts. Discussion with UU reveals that this may in fact be a foul sewer and the records may be incorrect.
Foul Water	There are no public foul sewers running through the site. The nearest foul sewer is within Fort Avenue/Parsonage Avenue east of the site. This foul sewer connects to the 375mm diameter combined (possibly foul) sewer referred to above.

5.2 There may be additional public sewers not shown on the current UU sewer records which have been adopted by virtue of the private sewer transfer in October 2011.

Public sewers are protected by 6m easements under Building Regulations and no development should encroach within 3m of the centre of the existing sewer unless agreed with UU.

5.3 There do not appear to be any culverted watercourses or land drainage system within the site.

6 PROPOSED DEVELOPMENT

6.1 The application is for detailed consent for a residential scheme comprising social housing which will be managed by a registered social housing company. A copy of the application layout is presented within appendix G.

6.2 The proposed scheme comprises 15 units in the central/northern part of the site and a large open space area in the southern part of the site. Dwelling types are 2 and 3 bedroom with front and rear gardens and plot cartilage parking. The net developable part of the site is approximately 0.5 ha.

6.3 The site will be accessed by the existing unnamed track which is to be improved and widened to comply with highways authority requirements.

6.4 Sewers serving the development will be adopted under a section 104 agreement with United Utilities, subject to technical approvals etc.

6.5 Highways within the site will be adopted under a section 38 agreement with Lancashire County Council.

7 FLOOD HISTORY AND SITE VULNERABILITY

7.1 Flooding can occur from a variety of sources, including tidal, rivers, watercourses, overland run-off, sewers and culverts. NPPF and RVBC guidance requires flood risk from all sources to be evaluated and suitable mitigation provided.

7.2 iDC has liaised with the EA and reviewed the RVBC SFRA to ascertain the historical flood record for the site. In addition a desk based search has been undertaken to identify flooding problems in the village.

7.3 The EA has provided a historical flood record plan which is included within appendix D of this report. The plan indicates that the site has not flooded in the past. The plan demonstrates the extent of the 1995/1998/1999/2000 flood events. The historic flood outline extends to approximately 200m south and east of the site but does not encroach on the site.

7.4 The SFRA identifies major flooding events in the Ribchester area dating from 1995 and 2000. These events are included in the historical flood outlines provided by the EA.

7.5 Flooding within Ribchester has 3 potential sources:

Boyces Beck: The beck runs around the northern and eastern edge of Ribchester flowing below Ribblesdale Road into Duddel Brook. There has been a number of incidents of flooding of dwellings in Ribblesdale Road. Numerous incidents have occurred in the past 50 years with the road being closed for several hours in 2011.

Duddel Brook: The Brook flows to the east of the village and discharged into the River Ribble. The brook flows below Blackburn road (B6245). Again numerous flood incidents have occurred and the EA information refers to flooding in 1995, 1998 and 1999

River Ribble: The River Ribble flows to the south and east of Ribchester. Numerous incidents of flooding are referred to in the EA historical flood map mainly at the confluence of Duddel Brook affecting land to the east of Ribchester.

7.6 The EA has provided flood model level information from their existing model which is noted on the plan within appendix D. A model node is located in Boyces Beck to the north of Ribchester and a node is also located on the River Ribble to the south east of the village.

Table 3957.5 – Flood Model Levels

Flood Event	Boyces Brook	River Ribble
1:100 year	29.88	25.91
1:100 year +cc	29.95	26.31
1:200 year	29.94	26.17
1:1000 year	29.97	26.68

7.7 Both model nodes are a substantial distance from the site and will not reflect flood water depth on the site due to the distance and dispersal of water over that distance. The EA flood zone 3 envelope accurately mirrors historical flood events recorded by the EA and is consistent with the current flood warning areas in the village, so the flood zone pan is considered to be a reasonable basis for the assessment of possible flood risk on the western side of Ribchester which is remote from the flood model nodes.

7.8 Flooding from Boyces Brook has been an issue where the brook is culverted below Ribblesdale Road. The EA flood zone plan indicates a flood zone to the north of the village adjacent New House Farm, however historical events in this area do not correlate to the flood map.

7.9 The historical outline indicates flooding flowing from Lower Boyce Farm along Blackburn Road and into Church Street. Whilst Church Street has nominal long fall, there is an apparent low spot at the junction of Sunnyside Avenue. Water from this low spot may potentially flow to the north of the application site in the lower lying field as indicated by the flood zone 3 extents on the EA plan.

7.10 The site is within Flood zone 2 which has a theoretical chance of flooding between the 1 in 100 and 1 in 1000 year events.

7.11 NPPF provides guidance with respect to the implications of climate change and suggests appropriate additional allowances for climate change with respect to rainfall intensities. It also recommends the following precautionary sensitivity ranges are applied to rainfall intensities for the design life of the development:

Table 3957.6 – Climate Change Allowances

Parameter	1990-2025	2025-2055	2055-2085	2085-2115
Peak Rainfall Intensity	+5%	+10%	+20%	+30%

Peak river Flow	+10%	+20%

7.12 The practice guide to PPS25 states that climate change factors should be dependant on the expected lifetime of the particular development. It is estimated that this development will have a 100 year lifetime; therefore a climate change factor of 30% should be applied subject to agreement from the planning authority.

8 FLOOD IMPACT AND MITIGATION MEASURES

8.1 NPPF guidance requires the risk from a range of potential sources to be evaluated, as follows:

8.2 **Overland Flooding:** Based on the site walkover survey, review of the topographical survey, the risk of flooding onto the site from adjacent land is considered low. Land to the north and west of the site is open fields which are set at a slightly lower level than the site. Land to the south is slightly higher than site but does not contain a significant fall towards the site and is separated from the site by a stone wall the unnamed road.

Land to the east of the site comprises the Dutton brook Care Home at the end of Parsonage Avenue and a car park. The car park is kerbed and drained and does not fall towards the site. The unnamed access road which will form the access to the site also forms the access to the car park. The road is kerbed for the majority of its length and has gullies which presumably drain to the combined sewer which runs along the field to the south of the road.

8.3 **Flooding from Rivers and the sea:** The site is approximately 200m north of the River Ribble and 350m west of Boyces Brook which are the primary flood sources. EA flood model information is very remote from the site and is cannot be interpolated with any degree of accuracy. The historical flood outline and EA Flood Zone 3 envelope are consistent and the EA flood zone plan is the most useful tool to assess the risk of flooding on the site.

There are no historical records of any previous flooding of the site and the historical flood outline extents is cc 200m from the site.

In the event of extreme flooding, flood water from Boyces beck would be conveyed to the north of the site within the lower lying field. Ground levels in the field to the north indicate the level of flood zone 3 adjacent to the site will be 26.5m. EA development control policy requires development levels to be a minimum of 600mm above the flood zone 3 level i.e. 27.1m

In the event of flood water reaching the junction of Church Street and the access road, flows would be slowly conveyed to the site via the carriageway which falls gently towards the site. The site is slightly lower than the access road and mitigation can be provided by designing the new access junction to the site with a fall towards the road and raising the plots within the site cc 300mm above the existing ground levels at the centre of the site so that floor levels are slightly above the access road. Ground levels at the centre of the site are 27.2m. A minimum floor level of 27.5m will ensure that even in the most extreme event flood water will not enter the site and cause flooding to dwellings.

8.4 **Flooding from Sewers:** There are small diameter sewers to the east of the site in Parsonage Avenue which discharge into a 375mm diameter sewer running along the edge of the playing field to the south of the site. UU have not identifies any flooding within their network in this area.

The land through which the sewer runs is slightly lower then the access road and any pluvial flooding would be contained within the playing field.

8.5 **Flooding from artificial sources:** iD Civils are not aware of any trunk or large diameter water mains crossing the site or within close proximity of the site. The site is not within the flood path of any reservoir breach.

8.6 **Groundwater:** The site is not within an area which is prone to groundwater flooding as stated in the SFRA (Para 4.25).

8.7 The EA offer a flood early warning system to properties deemed at risk in the area. A copy of the EA flood warning plan is presented in appendix C. The flood warning area does not extend up to the site and concentrates on areas to the east and south of Ribchester.

8.8 **Access and Egress:** The access road to the development is within Flood zone 2 and should not be affected by rainfall events up to the 1 in 100 year event.

9 SUDS

9.1 Building Regulations (Part H), NPPF, UU and RVBC development control policies and Environment Agency advice notes, require the consideration of sustainable drainage techniques for new developments. This existing legislation is to be reinforced by the emerging Flood Water Management Act which will provide a formal structure for the adoption of SuDS drainage and further encourage their use.

9.2 Surface Water drainage should be considered in accordance with a prescribed hierarchy aimed at minimising the impact of development. Surface Water flows should be designed to discharge to:

1. Infiltration based or sustainable drainage systems
2. Watercourses
3. Surface water Sewers
4. Combined water sewers

Designers should evaluate drainage options in accordance with this hierarchy. Developer's rights to connect surface water into the drainage system under section 106 of the Water act will be withdrawn as part of the new act until it can be proven to the SAB that methods of drainage further up the hierarchy cannot be reasonably

achieved.

9.3 Guidance on SUDS techniques can be found in the SUDS Manual (Ciria 2007). There are various forms of technique available as summarised below:

Table 3957.7 – Forms of SuDS Drainage

Technique	Description
Trenches	Shallow excavations filled with rubble or stone that create temporary storage and either filter into the ground or convey water to an outlet
Swales	Shallow linear vegetated drain ditches which can either convey flows to an outlet or infiltrate via a granular sub base to the sub strata.
Pervious Pavements	Material which allows water to permeate into underlying sub strata – best utilised on flat sites.
Geocellular Systems/Tank systems	Modular plastic geocellular systems which have a high void ratio and allow water to be storage below ground. Large diameter pipework or purposes designed tanks to allow below ground storage.
Infiltration Basins	Vegetated depressions which allow water storage and slow infiltration into the ground
Detention Basins	Surface water storage basins which remain dry when not in use and allow flood water to collect and discharge to a design flow rate
Ponds	Ponds can provide both attenuation and treatment features, together with landscape and ecology value. Run off through storms is attenuated in an upper level above ambient pond depths.

9.4 The use of SUDS techniques is designed to mitigate the impact of development on receiving watercourses or sewers by mimicking pre development conditions as far as possible. New development should not worsen flooding downstream and should attempt to improve flooding wherever practical.

9.5 Sustainable Drainage can take many forms dependant on site use, ground conditions and topography. In terms of the hierarchy of sustainable options, infiltration based systems should be considered in the first instance i.e. soakaways/infiltration swales/basins etc. The use of infiltration systems will be subject to the infiltration characteristics of the natural ground below the site. In areas with cohesive sub soils it is unlikely that sufficient percolation can be provided to allow the implementation of infiltration techniques.

9.6 PC has instructed Sirius Geoenvironmental to undertake a series of boreholes and soakaway tests across the site. The letter report which was prepared from the testing

as presented within appendix J.

10 PROPOSED DRAINAGE STRATEGY

10.1 The development of the site will require a new drainage system designed to suit the final approved layout, and in compliance with current Building Regulations and Sewers for Adoption. The system will be adopted by UU under a section 104 agreement.

10.2 iDC has not been instructed to undertake a detailed drainage design at this stage, however a strategy can be determined based on the available information and regulator liaison to date. The advocated strategy is set out below and is subject to regulator agreement and a survey of the existing drainage system within the site.

10.3 **Foul Drainage:** The site does not have a connection to the foul drainage network at present. Liaison with UU has confirmed that the site can be connected to the 375m diameter combined/foul network to the south of the site.

This network is within the playing field and will require third party landowner agreement or a sewer requisition under section 98 of the water act to complete the connection.

Record plans obtained by IDC do not show the depth of the sewer, however given the length of the network and the relative flat topography a gravity connection is considered to be likely.

UU have stated that the receiving WWTW will have capacity for foul flows only.

10.4 **Surface Water:** In accordance with the hierarchy contained within Part H of the building regulations, NPPF and the emerging SuDS standards, the surface water strategy should be considered in order of the sustainable hierarchy. The hierarchy and ability of the site to support the particular elements of the hierarchy are discussed below:

10.5 **Discharge to infiltration drainage/soakaway:** PC has instructed Sirius Geoenvironmental to undertake a series of boreholes and soakaway tests across the site. The letter report which was prepared from the testing as presented within appendix J.

10.6 The report comprised 5 window samples which were taken to depths of cc 3m. The window samples revealed the following geological sequence:

Table 3957.10 – Ground Conditions Summary

Window Sample	Topsoil Depth	Clay Depth	Sand/Gravel Depth	Water Table Depth
WS1	0 – 0.2m	0.2m – 1.4m	1.4m +	@1.4m (25.4m AOD)
WS2	0 – 0.2m	0.2m – 1.4m	1.4m +	Damp @ 1.4m

WS3	0 – 0.25m	0.25m – 0.65m	0.65m +	Damp @ 1.0m
WS4	0 – 0.2m	0.2m – 0.7m	0.7m +	Damp @ 1.0m
WS5	0 – 0.3m	0.3m – 1.65m	1.65m +	2.46m (24.8m AOD)

10.7 Soakaway testing within the 5 window samples produced results as follows:

Table 3957.11 – Soakaway Test Results

Window Sample	Percolation Rate
WS1	$8.76x10^{-6}$
WS2	$5.07x10^{-6}$
WS3	$1.83x10^{-4}$
WS4	$8.76x10^{-5}$
WS5	$2.41x10^{-4}$

10.8 SuDS Manual (Ciria C697) recommends that the water table should be 1m or greater below the base of any soakaway. The site has a superficial layer of clay which varies between 0.65m – 1.65m so any soakaway will need to be designed to have an effective soakaway area below the superficial clay layer. The level of the groundwater table identified during the investigation was between 24.8m AOD and 25.4m AOD.

10.9 Given the depth of the superficial clay layer and the requirement that the water table should be 1m below the base of a soakaway it will not be feasible to utilise soakaways as a means of drainage due to the risk of groundwater being above or close to the base of the soakaway.

10.10 **Discharge to Watercourse:** The site is not crossed by a watercourse or culverted watercourse and is cc 200m from the River Ribble. It is not possible to connect directly to a watercourse/river in this instance.

10.11 **Discharge to Surface Water Sewer:** The existing site is remote from the surface water sewer network. The nearest surface water sewer is at the junction of Church Street and the unnamed road which forms the access to the site (approx 170 to the east). UU have agreed that in the event that soakaway drainage cannot be used, a connection to this system can be made at a maximum rate of 5 litres/second.

10.12 The surface water sewer is 375mm diameter as it crosses close to the junction and ground levels at this point are cc 27.65m which is slightly higher than the site. The invert level of the network at the connection point is not known, and should be verified by locating the sewer at the surface and excavation of a trial hole onto the pipe. It is considered likely that the sewer will not be deep enough to provide a gravity outfall and that surface water flows will require pumping.

10.13 The proposed development is expected to generate an impermeable area of 0.3 Ha

based on experience of similar sites.

10.14 Unrestricted flows from a developed catchment area of 0.3 Ha would typically be around 42 l/s for a 1 in 1 year event and 63 l/s for a 1 in 30 year event. Unrestricted discharges of this magnitude exceed the allowable rate provided by UU to the public system and therefore flows should be attenuated on site.

10.15 New drainage should be designed to provide attenuation storage to flows in excess of the design flow rate of 5 l/s. Sewers for Adoption and NPPF requires attenuation storage for the 1 in 30 year event to be stored below ground. Storage between the 1 in 30 year event and the 1 in 100 year event (plus climate change) can be contained within the site above ground if levels permit without endangering property. In this instance it is considered that storage above the surface will be suitable within the open space at the front of the site where a nominal bowl can be created to hold water within the open space.

10.16 Using Microdrainage software, the anticipated stored volume for the 1 in 1 year to 1 in 100 years plus climate change factor are specified below:

Table 3957.12 – Anticipated Storage volumes for various return events

Return Period	Storage volume Required (m^3)
1 in 1 year	24
1 in 30 year	80
1 in 100 year +cc	164

10.17 **Method of Storage:** Below ground storage can be provided by means of on line oversized pipework in accordance with UU adoption standards. Pipework can comprise pre cast concrete or twin walled GRP systems. A typical arrangement is indicated on the drainage strategy plan which will store water from the 1 in 30 year event below ground. Water up to the 100 year plus climate change event will be stored above ground within the open space area.

10.18 Due to the relative levels between the site and the outfall surface water flows are likely to require pumping to the outfall sewer via a pumping main along the access road to the junction with Church Road. UU may require a short length of gravity sewer to the discharge point of the sewer. Pumping station details should be agreed as part of the section 104 technical approvals process.

11 IMPACT OF DEVELOPMENT AND RESIDUAL RISK

11.1 A detailed Flood Risk Assessment and drainage management plan has been undertaken with respect to the planned development west of Dutton Brook House in Ribchester. The FRA has been undertaken in accordance with EA, UU and LCC development control guidance, and considers the setting of the development and likely impact on surrounding areas. A drainage strategy has been outlined in the report.

11.2 The site has been identified as within flood zone 2, and therefore the flood risk is considered medium (0.1% - 1% annual probability) from fluvial sources.

11.3 An assessment has been undertaken considering the sustainable drainage hierarchy within Part H of the Building Regulations and it is considered that a connection to the local surface water sewer network is the most appropriate means of draining surface water from this development.

11.4 The assessment has identified the current site drainage characteristics and also established the current level of risk from flooding. A summary of the risks and mitigation identified is presented below:

Table 3957.13 - Summary of Main Issues

Issue	Summary	Residual Risk
Flood zone	Zone 2 (0.1% - 1% annual probability of flooding) Development proposed is compatible to the flood setting in accordance with Table 3 of NPPF technical guidance.	**Low**
Fluvial flooding	Medium risk of flooding from fluvial sources (River Ribble). Plots levels will provide mitigation to potential flood water from the watercourse	**Low**
Pluvial flooding	No significant risk of pluvial flooding noted.	**Low**
Overland Flooding	No significant risk of overland flooding due to the area topography.	**Low**
Artificial Sources	No significant artificial sources known.	**Low**
Flood Mitigation	Mitigation to be designed by adopting a minimum floor level across the site of 27.5m AOD which is effectively 1m above the level of the flood zone 3 envelope indicated on EA plan north of the site.	**Low**

Surface Water Management	Attenuation to 5 l/s minimum is required with on site storage via oversized pipe work. Storage for the 1 in 30 year event to be provided below ground. Upper storage to be provided in shallow bowl within the open space.	**Low**

11.5 On the basis of the above report it is considered that the site can be designed in a safe manner and can contribute to a reduction in the flows within the sewer system.

Rev	Description	By	Date

Client:

Partner Construction

Project Title:

Ribchester

Drawing Title:

Location Plan

Scale	Date
NTS @ A3	15.10.13

Drawing No	Revision	Status
3957_FRA01	0	Final

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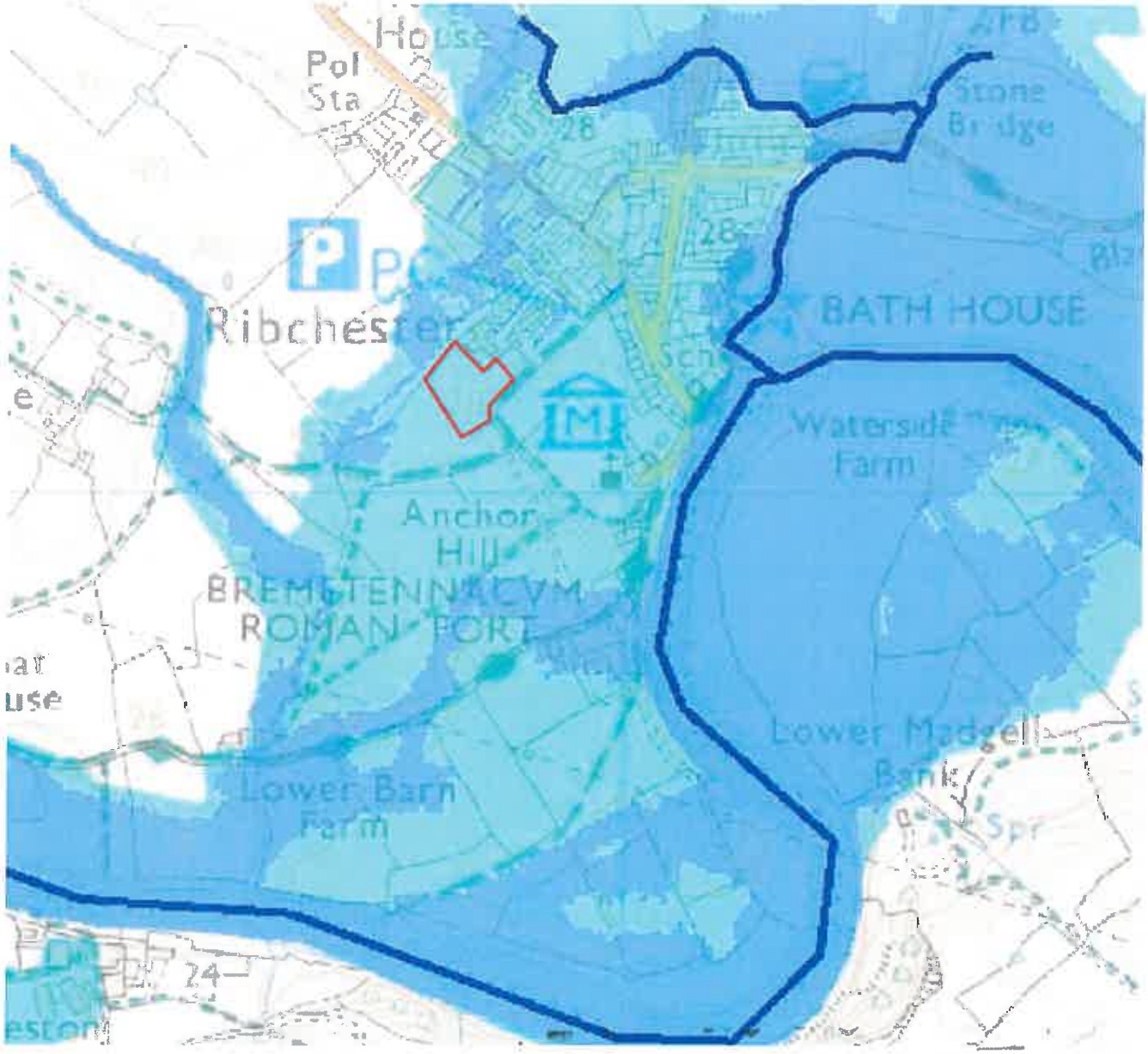

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OS Ref: SD 64797 35111
Postcode: PR3 3ZH

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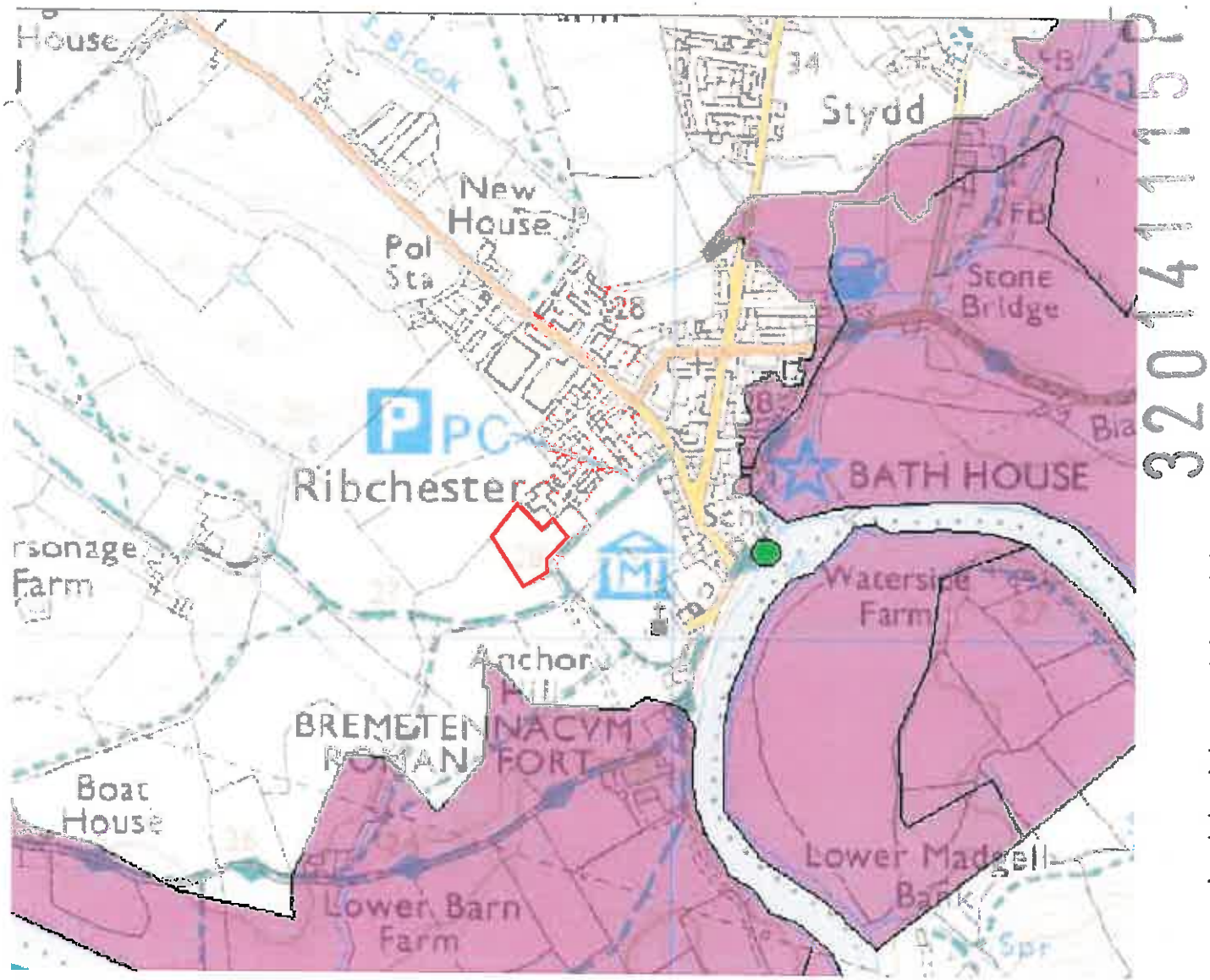
Rev	Description		Date

Client: Partner Construction

Project Title: Parsonage Road, Ribchester

Drawing Title: Flood Zone Plan

Scale	Date	Drawing No	Revision	Status
NTS @ A4	Aug 2013	3957-FRA02	0	Final



LEGEND

Areas where we issue flood alerts

Rev	Description	By	Date

Client:

Partner Construction

Project Title:

Ribchester

Drawing Title:

EA Flood Warning Areas

Scale	Date
NTS @ A3	15.10.13

Drawing No	Revision	Status
3957_FRA03	0	Final

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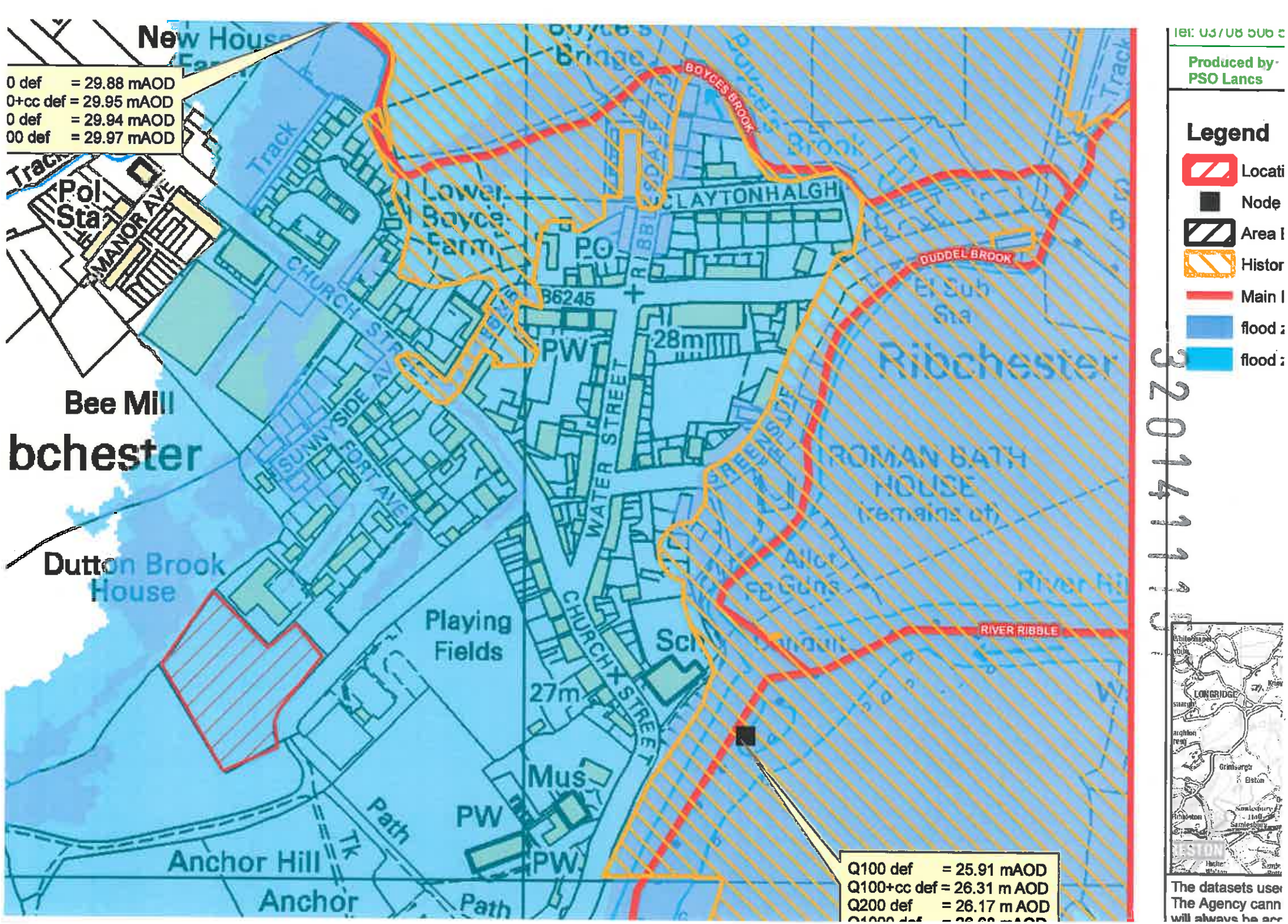
0 def = 29.88 mAOD
0+cc def = 29.95 mAOD
0 def = 29.94 mAOD
00 def = 29.97 mAOD
Bee Mill
bchester
Dutton Brook House
Playing Fields
Anchor Hill
Anchor
Path
Tk
Pol Sta
MANOR AVE
CHURCH STR
Lower Boyce Farm
BOYCES BROOK
CLAYTONHALGH
PO
B6245
PW
28m
WATER STREET
DUDDEL BROOK
Ribchester
ROMAN BATH HOUSE
(remains of)
RIVER RIBBLE
CHURCH STREET
27m
Mus
Produced by PSO Lancs
Legend
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Node
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Q200 def = 26.17 m AOD
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The Agency cann
will always be acc

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SURVEY ORIENTATED TO AXIAL TBM GPS

LEGEND

DISCLAIMER:

ONLY MANHOLES ARE INSPECTED BELOW WHERE VISIBLE AT THE TIME OF SURVEY.

ANY ENTRY TO MANHOLE WAS NOT UNDERTAKEN AND DEPTHS, PIPE SIZING ETC ARE MEASURED FROM GROUND LEVEL.

DRAINAGE INFORMATION MUST BE CHECKED AND VERIFIED PRIOR TO ANY WORK BEING UNDERTAKEN.

BOUNDARIES SHOWN ARE APPROX. AND MAY NOT REPRESENT LEGALLY DEFINED OWNERSHIP.

TREE SPREADS ARE AVERAGED ONLY AND ARE REPRESENTATIVE OF THE AVERAGE SPREAD. THE TREE CANOPY LAYER REPRESENTS THE TREES EXTREMITY.

BENCH MARK INFORMATION

DESCRIPTION	REV	DATE	DRAWN
ROAD EXPANDED UP TO CHURCH BRIDGE	A	13/08/13	SH

SurveyEng Ltd
Land Surveyors & Engineers

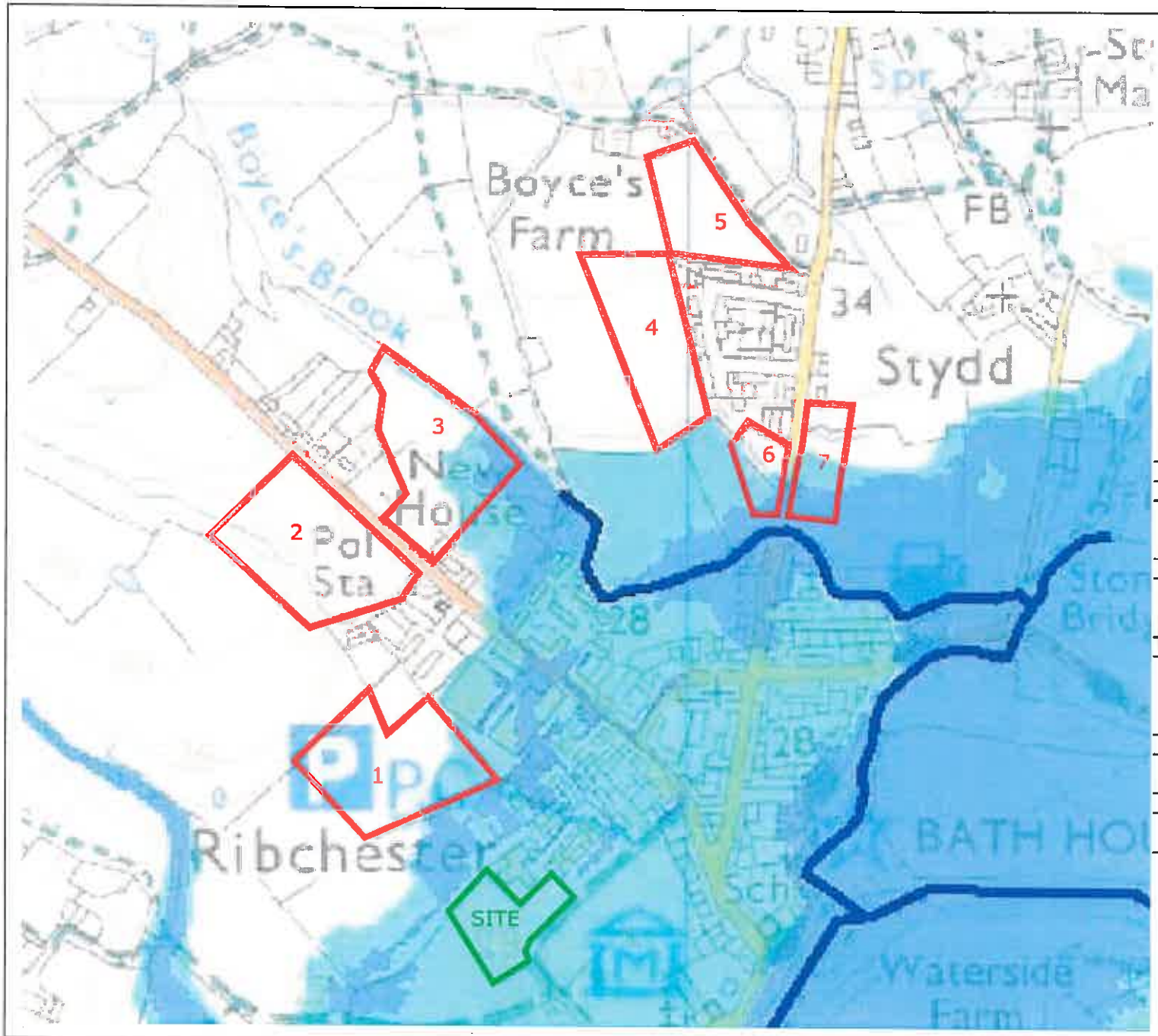
CLIENT
Partner Construction

PROJECT TITLE
Land adjacent to Ribchester Tennis Club off Church Street, Ribchester

DRAWING DETAIL
Topographical Land Survey

PROJECT ENGINEER	DATE
SH	05/08/13
DRAWN	SCALE
SH	1:500 @ A1

DRAWING NUMBER	REVISION
PC.TS.11	A



Rev	Description	By	Date

Client:

Partner Construction

Project Title:

Ribchester

Drawing Title:

Sequential Assessment
Development Possibilities

Scale	Date
NTS @ A3	15.10.13

Drawing No	Revision	Status
3957_FRA04	0	Final

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Created By:
KNAPTON
& Knapton

320141115P

Schedule

Notes:

Client:
Site:
Plan:

North

Scale:
Date:
Drg No:

Created By:
KNAPTON
& Knapton

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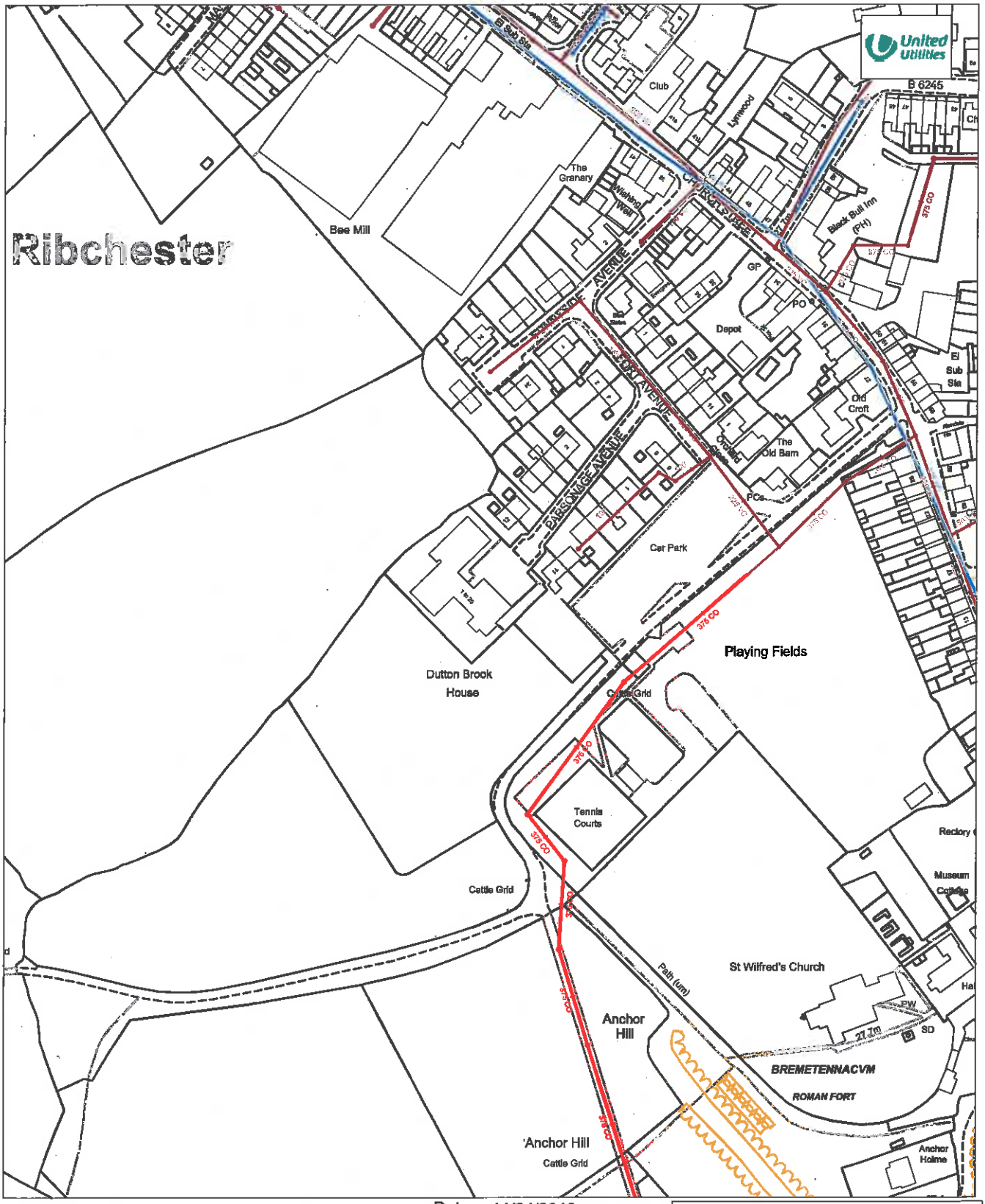


Printed By: H Kay

Date: 11/04/2013

Extract From Map of Public Sewers

Dalton Brook House Parsonage Road Ribchester

Red or Brown - Foul Sewers

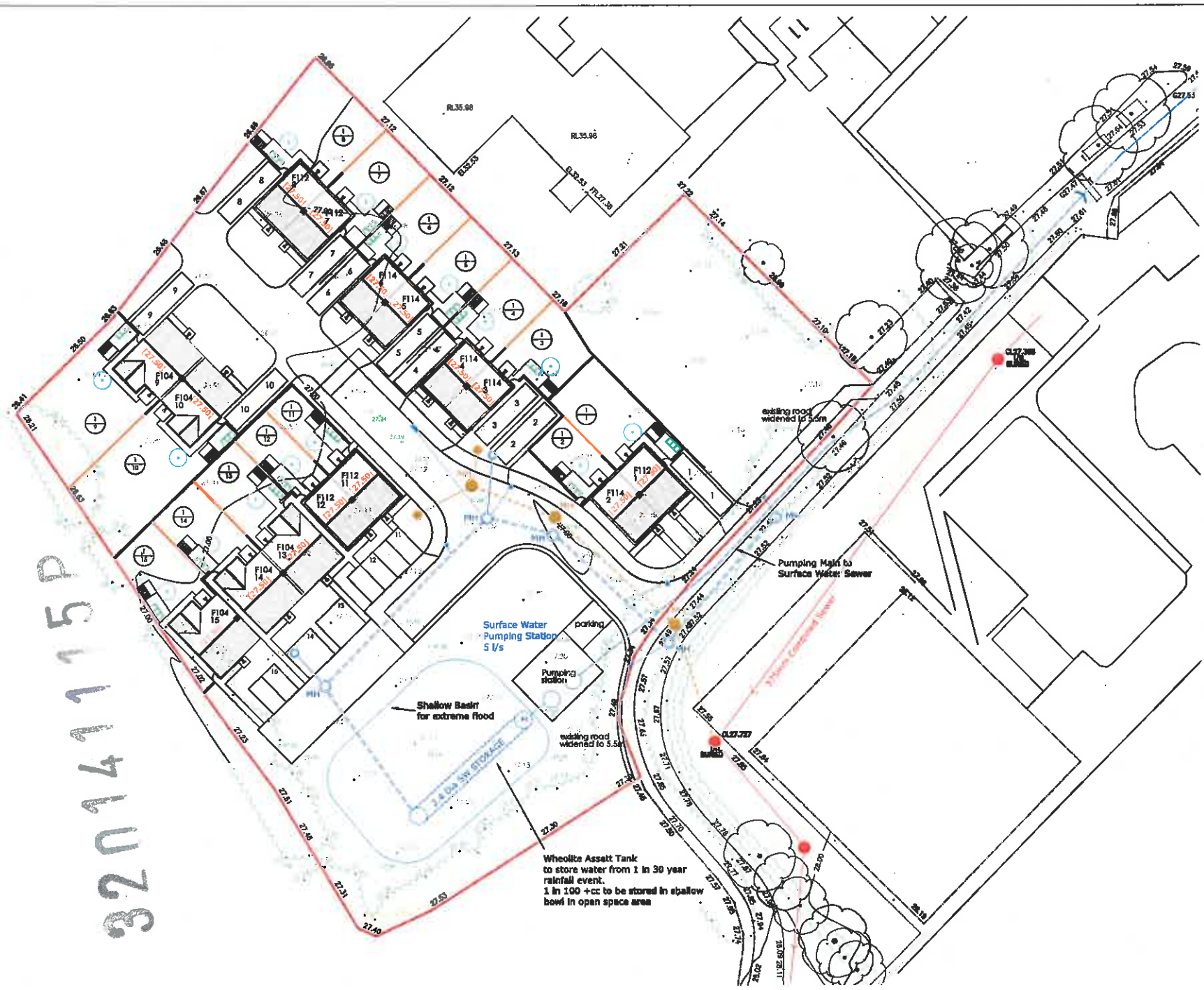
Blue - Surface Water Sewers

Legend

- Abandoned Sewer
- Public Sewer
- Highway Drain
- Private Sewer
- Pumping Main
- Section 104 Sewer

Refer to colour guide for content of pipe

The position of underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private pipes sewers or drains may not be recorded. United Utilities will not accept any liability for any damage caused by the actual positions being different from those shown.



3201411 5P

LEGEND

Rev	Description	By	Date

Client:

Partner Construction

Project Title:

Ribchester

Drawing Title:

Drainage Strategy Plan

Scale	Date
1:250 @ A1	Dec 2013

Drawing No	Revision	Status
3957-FRA03	0	Final

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