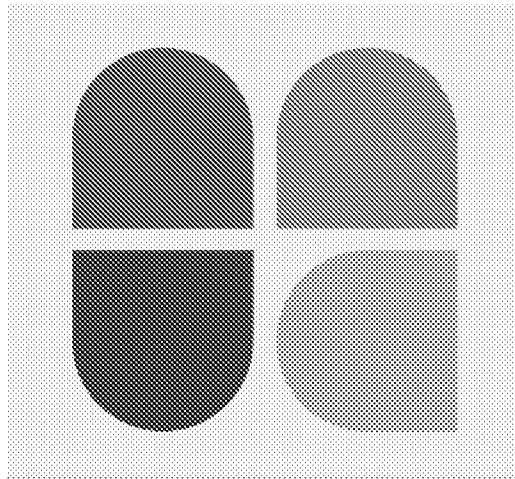




BRIGHT PLAN CIVILS

**KEYSTONE YOUTH CENTRE, ELDON
WAY, LITTLEHAMPTON BN17 7HE**

PROPOSED NEW YOUTH CENTRE

Flood Risk Assessment & Drainage Strategy
Report

Prepared on Behalf of
Littlehampton Town Council

D1985/FRA2.0

02 September 2021

DOCUMENT CONTROL

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- Appendix E** Public Sewer Records
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1 INTRODUCTION

1.1 Background

- 1.1.1 Bright Plan Civils is instructed by Littlehampton Town Council to prepare a Flood Risk Assessment & Preliminary Drainage Strategy Report to support a planning application for a Proposed New Youth Centre at the Keystone Youth Centre, Eldon Way, Littlehampton BN17 7HE.
- 1.1.2 This report has been undertaken in accordance with National Planning Policy Framework (NPPF) and The Planning Practice Guidance on the use of SuDS for achieving sustainable development.
- 1.1.3 The proposed development will involve the construction of a new youth centre building with parking and a MUGA, as demonstrated within the preliminary site layout, contained within **Appendix A** of this report.
- 1.1.4 In preparing this report, Bright Plan Civils has referred to the following documents and information:
- Environment Agency Flood Maps for Planning
 - Long Term Flood Risk Information; Flood Risk Maps
 - Southern Water and Local Authority Drainage Records
 - British Geological Survey & Records
- 1.1.5 This document has been prepared to assess drainage constraints and propose a drainage strategy that is appropriate for the design life of the development.
- 1.1.6 This report has been prepared for the benefit of the named Client only.

1.2 Site Location and Description

- 1.2.1 The site is an existing playing field located in the north west of Littlehampton. It is bordered by Eldon Way to the north, residential properties to the east, industrial buildings to the west and further playing fields to the south.
- 1.2.2 A topographical survey of the site has been undertaken and provided by the client. It is included in **Appendix B** of this report.
- 1.2.3 The topographical survey shows that the site falls approximately from 6.40mAOD in the northeast corner to 5.59mAOD in the southwest corner (of the proposed development area surveyed within the topographic survey), as detailed in Drawing **PL002**.
- 1.2.4 The site is predominantly greenfield with no formal drainage..
- 1.2.5 The nearest watercourse is the River Arun (Tidal Main River), 350 metres to the west of the site.
- 1.2.6 The existing site has a total area of 6,220m² (0.350 Ha), with 168m² of impermeable areas, as seen in Drawing **PL003**.

1.3 Ground Conditions

- 1.3.1 A site-specific geotechnical investigation was undertaken by Impact Geotechnical in October 2020,

which identified topsoil to 0.80mbgl (metres below ground level), followed by Raised Beach Deposits (SAND) to between 2.95-4.00mbgl, above a bedrock of Lewes Nodular Chalk (CHALK) to borehole depths of 6.00mbgl.

- 1.3.2 Infiltration testing in accordance with BRE365, undertaken at approximately 1.5mbgl, recorded a design rate of 1.0×10^{-5} m/s after three full tests. Extracts from the geotechnical testing are in **Appendix C**.
- 1.3.3 In addition to the site-specific geotechnical investigation, reference has been made to the British Geological Survey (BGS) website.
- 1.3.4 The BGS geology viewer states that the bedrock geology is likely to consist of 'Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation And Portsdown Chalk Formation (undifferentiated) - Chalk', as seen in **Figure 1**.

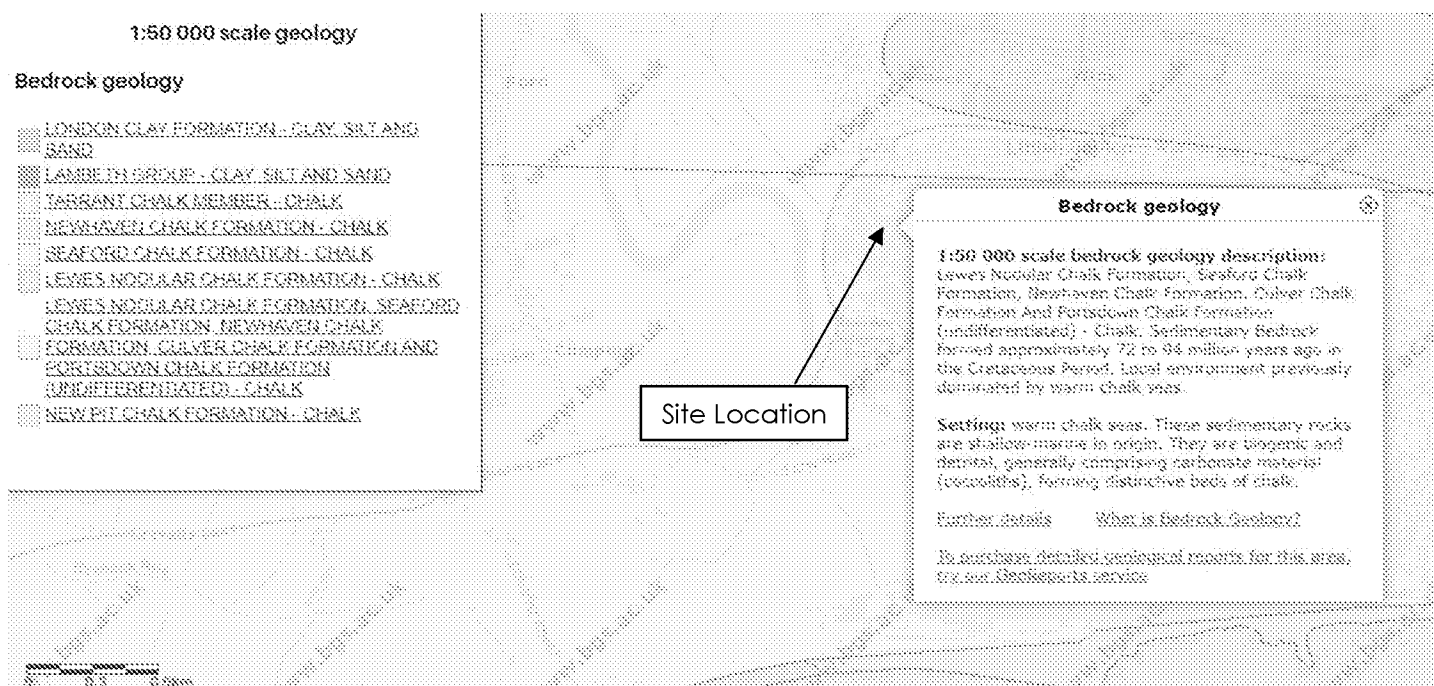


Figure 1. BGS website Bedrock geology

- 1.3.5 Superficial Deposits are recorded as 'River Terrace Deposits, 6 - Sand and Gravel', as seen in **Figure 2**.
- 1.3.6 'Raised Marine Deposits - Clay, Silt, Sand And Gravel' are also recorded south of the site, which may explain thin layers of silty clay encountered in some of the Impact Geotechnical borehole excavations. Excavations for any infiltration measures will need to ensure these are accounted for and amendments to the design to ensure drainage into permeable strata may be necessary.

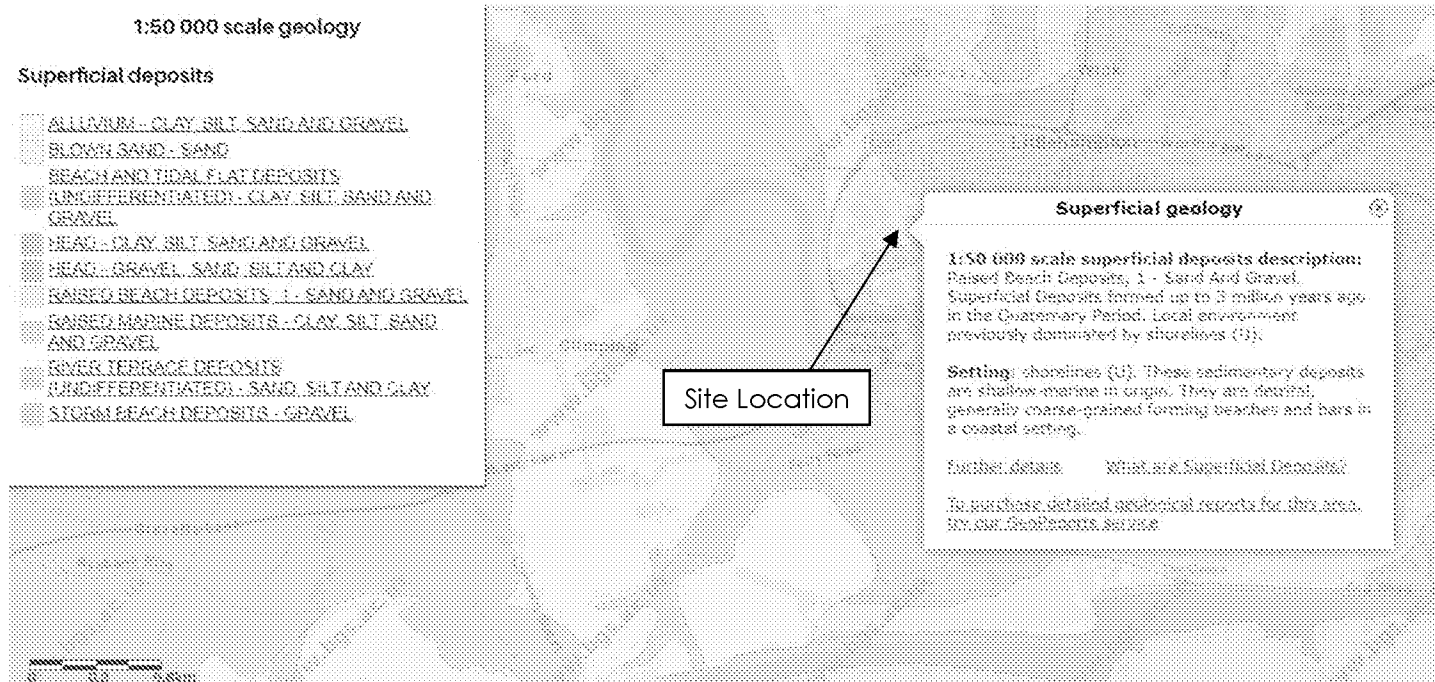


Figure 2. BGS website superficial deposits

1.4 Groundwater

- 1.4.1 Of four site boreholes excavated by Impact Geotechnical to 6.00mbgl, groundwater was only encountered in one borehole at a depth of 4.70mbgl (October 2020).
- 1.4.2 Arun District Council (ADC) stated that their mapping indicates 'low to moderate' groundwater flood risk, whilst groundwater flood risk was reported to be 'moderate' by West Sussex County Council (WSCC), with groundwater levels estimated to be between 5.0mbgl to 0.025mbgl. The ADC SFRA shows the site situated in an area with susceptibility to groundwater. SFRA Extracts and correspondence can be found within **Appendix D**.
- 1.4.3 Mapping managed by MAGIC (magic.defra.gov.uk) provides geographic information concerning the natural environment from across government. This mapping tool has been referred to in order to confirm whether the site is located within either any groundwater source protection zones or groundwater vulnerability zones.
- 1.4.4 The site is situated within a 'Principal' Aquifer for Bedrock and a 'Secondary A' Aquifer for Superficial Drift deposits, as seen in **Figure 3**. This refers to bedrock geology that exhibit generally good permeability and provide groundwater storage or supply at a local or strategic level, with drift deposits that offer variable permeability that may also provide groundwater storage.

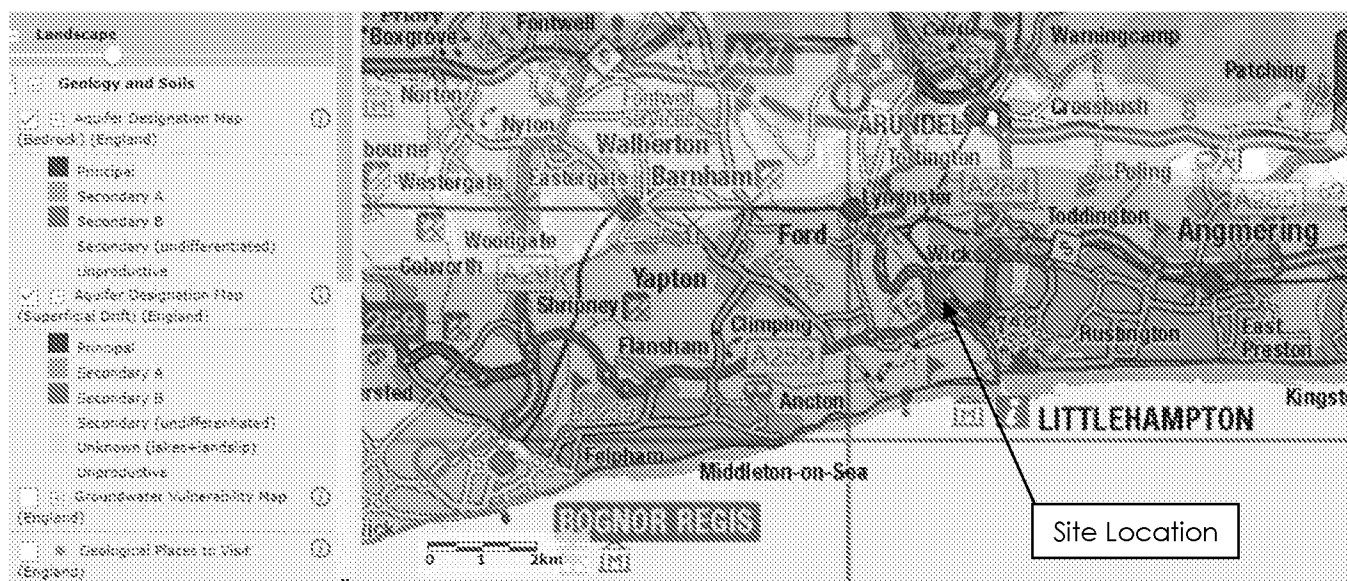


Figure 3. DEFRA Aquifer Designation Map

- 1.4.5 The Groundwater Vulnerability Map (**Figure 4**) confirms that the site falls within a 'Medium-High' groundwater vulnerability zone, with soluble rock risk.

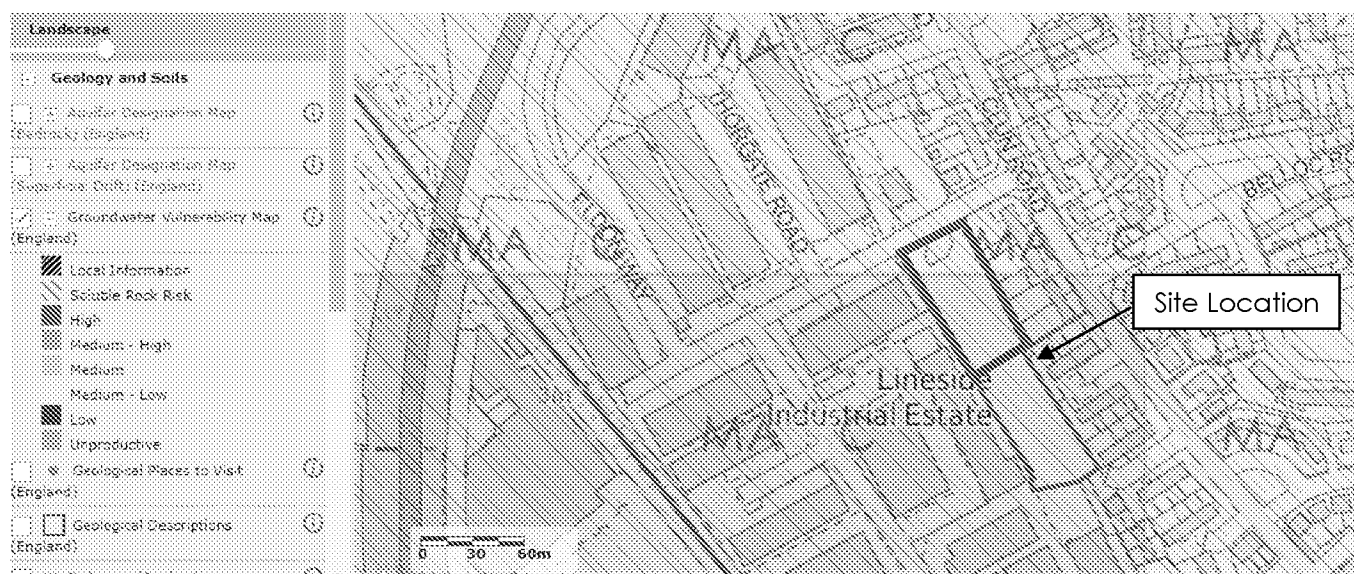


Figure 4. DEFRA Groundwater Vulnerability Map

- 1.4.6 The site is not indicated as within or in the vicinity of any Drinking Water Safeguard Zone or a Source Protection Zone.

1.5 Existing Drainage

- 1.5.1 The local sewerage authority is Southern Water, which provides sewerage services within the area. Public sewer records have been obtained from Southern Water, as contained within this report in **Appendix E**.

- 1.5.2 Surface Water:

- The Southern Water public sewer records (**Appendix E**) show a 225mm public surface water sewer running west along Eldon Way.
- An existing public surface water manhole is adjacent to the site frontage, and records a cover level of 5.67mAOD and pipe invert level of 4.88mAOD.
- The existing site does not appear to have any existing drainage infrastructure, and is assumed to drain naturally.
- The nearest surface water feature is the River Arun (Tidal Main River), 350 metres west of the site.
- Greenfield runoff rate (Qbar) has been calculated to be 1.05l/s using the HR Wallingford online tool.

1.5.3 Foul Water:

- The Southern Water public sewer records (**Appendix E**) show a public 225mm foul water sewer running south through the rear gardens of the residential properties to the east of the site.
- The nearest manhole to the southeast of the site is 9902, with a cover level of 4.77mAOD and an invert level of 3.23mAOD.
- There are no existing foul drainage connections from the existing site.

1.5.4 Highway Drainage:

- Eldon Way appears to be drained by highway gullies, which are confirmed by WSCC to drain to the Southern Water surface water sewer.

2 PROBABILITY

2.1 Sources of Information

- 2.1.1 The NPPF requires that all sources of flooding are considered being Tidal, Fluvial, Pluvial, Groundwater, Sewers and Man-made reservoirs/canals.
- 2.1.2 The likelihood of the site flooding has been established by reviewing the following information:
- Environment Agency Flood Maps for Planning
 - Long Term Flood Risk Assessment Surface Water Flood Risk Maps
 - Long Term Flood Risk Assessment Reservoir Flood Risk Maps
 - Local Authorities Strategic Flood Risk Assessment
 - Consultation with Local Authority/Lead Local Flood Authority

2.2 Flood Maps and Modelling

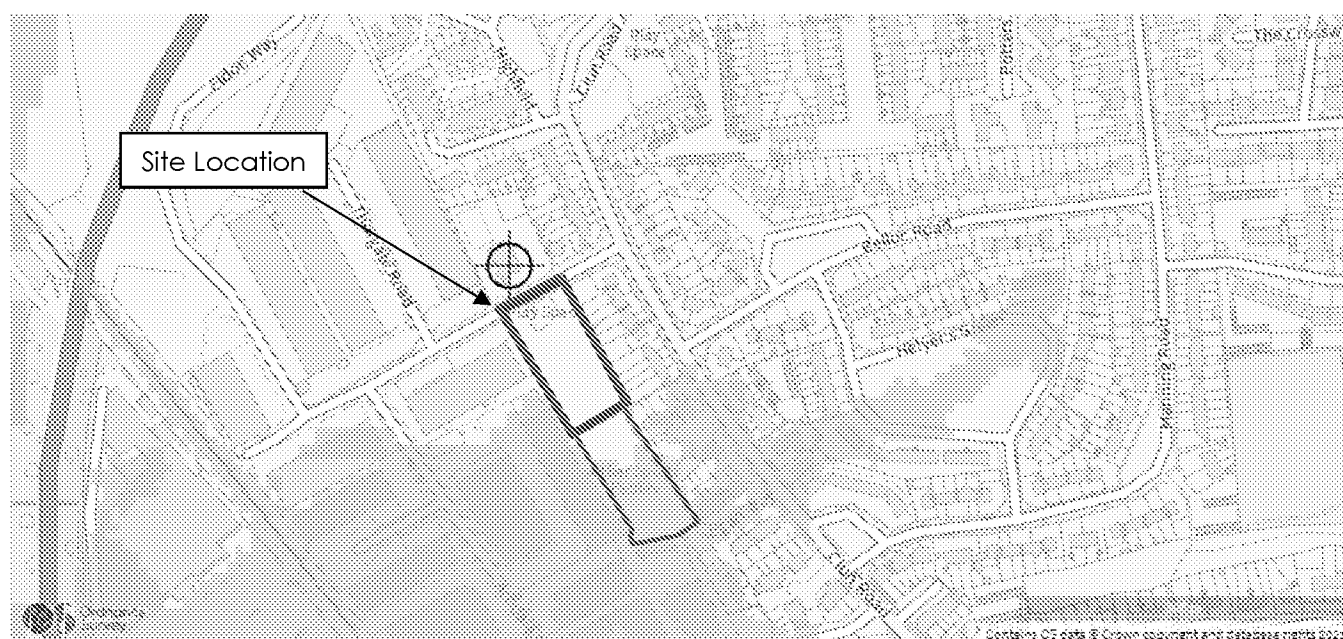
- 2.2.1 The Environment Agency's Product 4 Response provided flood maps for rivers, sea and surface water as seen in Appendix F. The Product 4 shows the site location within Flood Zone 1, with the southwest corner of the site bordering Flood Zone 3.
- 2.2.2 Flood levels for 4 No. nodes on the site have been taken from the Arun to Adur Coastal Modelling (2012) with updated defended modelling (2017) by JBA Consulting taking account of the improved flood defences recently constructed.

Node Ref			Modelled Flood Levels (m AOD)					
			Defended Annual Exceedance Probability			Undefended Annual Exceedance Probability		
	Eastings	Northings	0.5%	0.5% + CC	0.1%	0.5%	0.5% + CC	0.1%
1	501885	103001	Nil return	Nil return	Nil return	Nil return	Nil return	Nil return
2	591919	102977	Nil return	Nil return	Nil return	Nil return	Nil return	Nil return
3	501886	102962	Nil return	Nil return	Nil return	Nil return	4.88	Nil return
4	501912	102953	Nil return	Nil return	Nil return	Nil return	4.88	Nil return

- 2.2.3 The modelled flood depths and outlines show the site protected by flood defences - in the form of a wall and raised embankment along the eastern bank of the River Arun - for all modelled design events.
- 2.2.4 The modelling indicated undefended flood levels of 4.88m AOD for an undefended scenario for a 0.5% plus climate change event, resulting in flooding of up to 300mm in the southwest corner of the site when compared against the topographic survey levels of the site.
- 2.2.5 The Environment Agency's on-line Flood Maps for Planning (rivers and sea) also show that the site is located within Flood Zone 1. The flood zones are also confirmed by information and mapping obtained from The Environment Agency following consultation, which is consistent within other flood risk mapping reviewed.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

2.2.6 **Figure 5** also shows that the site is at very low risk of flooding from rivers or sea, from the Environment Agency's online long term flood risk mapping tool.



Extent of flooding from rivers or the sea

● High ● Medium ● Low ● Very low ● Location you selected

Figure 5. Long Term Flood Risk Map; Flood risk from rivers or the sea

2.2.7 **Figure 6** shows that the site at 'very low' risk of surface water flooding, and the adjacent highway to the north is at 'very low' to 'low' risk of surface water flooding. There is not expected to be any surface water flooding within the site, and low risk scenario flood depths are indicated by the flood mapping to be no more than 300mm depth within the adjacent highway, to the west of the proposed access with no surface water flood risk in the highway to the east.

2.2.8 The Environment Agency's Product 4 response also indicated that the site is at very low risk of surface water flooding.



Figure 6. Long Term Flood Risk Map; Flood risk from surface water

2.2.9 **Figure 7** shows that the site is not at risk of flooding from reservoirs.



Figure 7. Long Term Flood Risk Map; Flood risk from reservoirs

2.3 Local Authority Correspondence

- 2.3.1 Arun District Council (ADC) responded that although no part of the site is located within Flood Zone 2 or 3 flooding may encroach – as confirmed by the undefended flood outlines.
- 2.3.2 The site is not located within an area of surface water flooding, and ADC have no knowledge of any historic flooding. ADC mapping also indicates 'low to moderate' groundwater flood risk.
- 2.3.3 West Sussex County Council (WSCC) responded that the site is in Flood Zone 1 and is adjacent to but not within Flood Zones 2 or 3. WSCC stated the site does not appear to be at risk of surface water flooding, with no flooding shown at the site or in the adjacent highway in a 1 in 30 or 1 in 100 year storm event.
- 2.3.4 Groundwater flood risk was reported to be 'moderate' by WSCC, with groundwater levels estimated to be between 5.0mbgl to 0.025mbgl.
- 2.3.5 WSCC also confirmed existing highway gullies along either side of Eldon Way for highway drainage are connected to the Southern Water surface water sewer, and the presence of flood defences along the River Arun providing protection to the site, but no other drainage or flood defence infrastructure to be aware of. WSCC reported no knowledge of historic flooding.

2.4 Strategic Flood Risk Assessment

- 2.4.1 The Arun District Council SFRA (2016) identified that the existing flood defences along the River Arun at Littlehampton are not captured in the Flood Zone extents, and that it is therefore important to assess the benefits these provide. It was noted that large areas are at risk as a result of a breach scenario and assessment of residual risk was also necessary, however the flood extents from the breach modelling did not extend to the site area.
- 2.4.2 The ADC SFRA does not show any historic flood events within the vicinity of the site. It confirms that the east bank defences of the River Arun were constructed by the Environment Agency, who have permissive powers to maintain the defences to a standard of protection of 1 in 300 years, and last improved defences in May 2013.
- 2.4.3 The site is not located within an ADC flood warning area, and future flood extents are in accordance with the Environment Agency Product 4 Response.

2.5 Historic Flooding

- 2.5.1 Arun District Council, West Sussex County Council and the Environment Agency were consulted regarding historic flooding at the site and did not indicate any historic flood events at the site or in the vicinity.

2.6 Summary of Flood Risk

2.6.1 The potential sources of flooding are:

Source of Flooding	Level of Risk
Rivers and Coastal	Very Low (Residual Risk: Medium) The site is within Flood Zone 1 as is the surrounding area. The site area is protected from extreme and climate change induced flood events by the presence of flood defences along the River Arun (Tidal Main River). In an undefended scenario, the southwest corner of the site is at risk of flooding of up to 300mm as a result of climate change.
Surface Water	Very Low The long-term flood risk for surface water is classified as 'very low' across the site location. Surface water flooding within the adjacent highway is also 'very low' to 'low' with depths indicated to be a maximum of 300mm, which not impact access or egress.
Groundwater	Medium Ground investigation did not find any presence of shallow groundwater, with one measure of groundwater recorded at 4.70mbgl. Further groundwater monitoring will be required to inform detailed design. ADC and WSCC indicated low to moderate risk of groundwater flooding, with levels between 0.025-5.0mbgl.
Sewers	Low There are no reports of sewer flooding found and the risk surface water flooding is very low at the site (and low to very low in the vicinity), with highway drainage therefore at at minimal risk of being surcharged. In view of this information the risk of flooding from this source is deemed to be 'Low'.
Artificial Sources	None The site is not shown to be at risk of flooding due to artificial sources.

2.6.2 Mitigation measures should consider the residual risk of flooding, and the proposed drainage system for the proposed development should be designed in order to provide capacity up to the design event and provide consideration of potential exceedance routes, so as to not increase the risk of surface water flooding on or off the site.

3 PROPOSED DEVELOPMENT

3.1 Description of Development

- 3.1.1 The proposed development will involve the construction of a new youth centre building, with associated landscaping as demonstrated within **Appendix A**.
- 3.1.2 The type of development falls within the 'Less Vulnerable' classification (Flood Risk and Coastal Change Table 2) and is appropriate in Flood Zone 1 (Flood Risk and Coastal Change Table 3).

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	Exception Test Required	✓	✓	✓
Flood Zone 3a†	Exception Test Required †	✗	Exception Test Required	✓	✓
Flood Zone 3b*	Exceptions Test Required *	✗	✗	✗	✓
✓ = Development is appropriate ✗ = Development should not be permitted					

- 3.1.3 The proposed development will increase the hardstanding area of the site; however SuDS measures will be used where possible in order to prevent any increase in the rate of run-off generated by the site.
- 3.1.4 The post-development impermeable/hardstanding area has been determined to be 1,933m² (0.193Ha).
- 3.1.5 The use of Sustainable Drainage System (SuDS) methods and techniques (where site conditions and constraints allow) within the bounds of the site (whilst adhering to the SuDS hierarchy as stated within Building Regulations (Part H) and The CIRIA SuDS Manual C753) will be used to provide a betterment of surface water run-off compared to the existing site.
- 3.1.6 The specific Surface Water and Foul Water drainage proposals are detailed in **Section 4** of this report.

4 SEQUENTIAL AND EXCEPTION TESTS

4.1 Sequential Test

- 4.1.1 The area of proposed development is in Flood Zone 1. therefore the application of the sequential test is not required.

4.2 Exeption Test

- 4.2.1 The Exception Test is not required.

5 PROPOSED DRAINAGE STRATEGY

5.1 Surface Water

5.1.1 The SUDS manual and Building Regulations set out a hierarchy of drainage methods to ensure that developments maximise the use of sustainable drainage techniques. The hierarchy favours infiltration methods of disposal over other methods such as watercourse and sewers, as detailed below;

- i. Utilise infiltration techniques
- ii. Attenuate rainwater in ponds or open water features for gradual release
- iii. Attenuate rainwater by storing in tanks or sealed water features for gradual release
- iv. Discharge rainwater direct to a watercourse
- v. Discharge rainwater to a surface water sewer/drain
- vi. Discharge rainwater to a combined sewer

SUDS Technique	Suitable	Comments
Living Roof	No	Pitched roof proposed - not consistent with architects proposals.
Basins and Ponds (such as Wetlands, Balancing Ponds, Detention Basins, Retention Ponds)	Yes	Viable, however would need to establish proposals of open land to the east of the site.
Filter strips and swales	Yes	Viable, however would need to establish proposals of open land to the east of the site.
Infiltration Devices - Soakaways - Infiltration trenches and basins	Yes	Preliminary infiltration testing indicates that soakage methods are viable.
Permeable surfaces and filter drains (such as gravelled areas and porous block paving)	Yes	As above, and permeable surfaces would also provide a source of treatment and shallow attenuation.
Tanked systems (such as oversized pipes or cellular tanks)	Yes	No initial constraints, would provide considerable attenuation volume.

- 5.1.2 Preliminary geotechnical investigation confirmed infiltration methods are viable, with a design soakage rate of 1.0×10^{-5} m/s confirmed and groundwater levels at no less than 4.7mAOD at the time of investigation.
- 5.1.3 It is proposed to construct the car parking and paths using permeable surfacing. This will capture, attenuate and treat runoff from this areas prior to it infiltrating in to yhe underlying soil.. The proposed drainage system will have 178m² of permeable block paving within the parking spaces with a minimum sub-base thickness of 475mm (storage volume 25.36m³), as detailed on Drawing **004**. Freedraining surfaces are proposed for the walkways and MUGA pitch, with a minimum subbase of 300mm to ensure sufficient storage capacity prior to infiltration.
- 5.1.4 It is proposed that the runoff from the roof of the proposed building and the rear hardstanding areas is captured by gully and pipe drainage and conveyed to a geocellular soakaway, of 36.5m³ storage capacity – dimensions of 16.0m x 3.0m x 0.8m deep – at the rear of the site.
- 5.1.5 It is proposed that the surface water drainage system is designed to accommodate a 1 in 100 year critical design storm event including 40% climate change, without exceedance.
- 5.1.6 The strategy above will ensure that there is no increase in the rate of run-off leaving the site, therefore no increase in the risk of flooding from this source.

5.2 Treatment

- 5.2.1 The use of permeable paving will ensure that run-off from the site receives a level of treatment required by the SuDS manual, with hydrocarbons being filtered by the aggregate and geotextile layers.
- 5.2.2 In accordance with the CIRIA SuDS Manual C753 regarding methods for managing pollution risks, the risk posed by surface water runoff to the receiving environment depends on the pollution hazard at the site (the source), SuDS treatment techniques (the pathway), and the sensitivity of the environment (the receptor).
- 5.2.3 The simple index approach considers whether SuDS techniques are appropriate for the site. The states that for SuDS components to deliver adequate treatment, the total pollution mitigation index for each contaminant type should equal or exceed the pollution hazard index.
- 5.2.4 The SuDS Manual outlines three categories of pollution hazard identification, which vary depending on proposed land use, which are as follows:
- Total Suspended Solids (TSS).
 - Metals (M).
 - Hydrocarbons (H).
- 5.2.5 In accordance with C753 Table 26.2, the proposed land uses at the site are categorised as follows:
- Roofs and non-trafficked areas – very low/TSS=0.2/M=0.2/H=0.05
 - Parking area – low/ TSS=0.5/M=0.4/H=0.4

5.2.6 In accordance with C753 Table 26.3, the values of SuDS Mitigation indices are provided for permeable paving:

- Permeable Pavement – TSS=0.7/M=0.6/H=0.7

5.2.7 As the pollution hazard index does not exceed any pollution mitigation index for any contaminant type, the proposed SuDS methods will provide sufficient treatment for the proposed development.

5.3 Foul Water Drainage

5.3.1 An existing foul water sewer manhole is located to the southeast of the site, and a gravity connection is viable for the proposed development.

5.3.2 Recent changes to infrastructure and connection charges (OFWAT Charging Rules) place the onus on the sewerage undertaker to reinforce their network should there no longer be sufficient capacity to serve the new development. Funding for this is provided by revised charging arrangements for infrastructure and connection charges for each dwelling constructed comprising a Network Reinforcement Charge and Site-Specific Charges. The revised charging arrangement (funded by the developer) covers alterations to the Existing Sewer Network and the sewerage undertaker remains responsible for the cost of reinforcing their Strategic Assets. The developer is responsible for connecting the development to the public sewer network.

5.4 Climate Change

5.4.1 In July 2020 the Environment Agency updates the latest climate change allowances (available online at <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>), which supports the NPPF in making an allowance for climate change within flood risk assessment. The allowances provide predictions of anticipated change for peak river flow by river basin district and peak rainfall intensity.

5.4.2 The table below shows the anticipated changes in extreme rainfall intensity. For flood risk assessments, both the central and upper end allowances should be assessed to understand the range of impact.

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper End	10%	20%	40%
Central	5%	10%	20%

5.4.3 Based on the latest allowances, an increase of 20% should be applied to peak rainfall to this development, with a review undertaken to determine the impact of a 40% increase. The calculations within this report are based on an allowance of 40%.

6 RESIDUAL RISK AND MITIGATION

6.1 Residual Risk

6.1.1 Whilst the flood risk to the site is assessed to be low, some residual risk remains which is related to breach scenarios in a climate change induced event. The following mitigation therefore follows a robust event to ensure the site is safe for the lifetime of the development irrespective of flood defences, which were constructed along the River Arun in 2016-2017.

6.1.2 The following residual risks have been identified in relation to the proposed development:

- i. Extreme flood event as a result of a River Arun flood defences breach scenario and impacted by climate change causing flooding to the south west corner of the site.
- ii. Extreme rainfall events that exceed the design criteria used for the drainage system causing surface water flooding.
- iii. Blockage/failure of the proposed drainage system causing flooding to the site.
- iv. Groundwater flooding to the site caused by groundwater levels exceeding the ground surface level.

6.2 Mitigation

6.2.1 The residual risks above are unlikely to occur but the following mitigation is proposed to provide robust protection should it occur::

- i. The Environment Agency Product 4 response indicates that there is a residual risk of flooding in an undefended event (e.g. due to exceedance or breach of flood defences) as a result of climate change, with a maximum modelled flood level of 4.88mAOD resulting in up to 300mm flooding, to the southwest of the site where the MUGA pitch is proposed;
 - (a) Access to higher ground is established via the pathway to the north of the site, and no internal areas or buildings are proposed in the area of residual flood risk
 - (b) Where viable, the design of the fencing and boundaries should allow flows of flood waters either through or below the materials used.
 - (c) Where viable, design of site levels to minimise any impact to the site in any residual flood event.
- ii. The drainage strategy has been developed to capture runoff up to a 1 in 100-year critical rainfall event, with 40% allowance for climate change. However, should a more extreme rainfall event occur, there is the potential for the drainage system to be exceeded. The existing topography of the site has been reviewed and the existing overland flow routes assessed. Flows currently following the existing topography – falling to the south towards the open land

area. Existing and proposed drainage infrastructure should also be considered which can intercept run-off in an exceedance event, including gullies and channel drains.

- iii. The proposed drainage system will attenuate and store runoff up to the design event. Blockage of the drainage system has the potential to cause flooding on the site. Surcharged flows will likely travel overland to the neighbouring open land, however maintenance measures proposed in Chapter 8 will reduce the risk of the system becoming blocked.
- iv. Due to the underlying ground conditions of the site and the possible presence of groundwater in the upper layers pending further groundwater monitoring, there is a risk of groundwater exceeding the surface level and emerging on the site. There are no records of previous groundwater flooding, however. If groundwater flooding were to occur, it would flow away from the proposed building,. Additionally, the proposed finished floor level has been set 150mm above existing ground level.

7 FLOOD RISK MANAGEMENT

7.1 Safe Access and Egress

- 7.1.1 The site is not at risk of fluvial and tidal flooding. The site is at very low risk of surface water flooding.
- 7.1.2 The adjacent highway to the north is at very low risk of flooding adjacent to the proposed vehicular access and to the east, with low risk of surface water flooding up to 300mm depth to the west. This would not impact access and egress for the site.
- 7.1.3 Therefore, safe access and egress for the site is available.

7.2 Flood Warning

- 7.2.1 The site is not at risk of fluvial and surface water flooding therefore there is no need for a Flood Evacuation Plan (FEP).

8 MAINTENANCE

8.1 Proposed Maintenance Regime

- 8.1.1 Maintenance is required to ensure the long-term operational performance of the proposed surface water drainage system.
- 8.1.2 The drainage system has been designed to minimise maintenance requirements; however a number of key tasks will need to be undertaken so that the system remains in optimal condition. These operations are summarised in the table below, along with the required frequency of works.

Drainage System feature	Proposed maintenance / remedial works	Required frequency of works
Permeable Paving	Surface sweeping to reduce silt and debris accumulation.	Every 8 to 12 weeks
	Removal / management of weed growth	At least once a year
	Silt removal from permeable surfaces, possibly involving raking out of joints, redressing, removal and remedial works.	As required / to be specified by manufacturer
Diffuser units & catch pits, gully sumps and drains	Inspection and additional cleansing as required.	Annual
	Desilting	Year 1, Year 3, then every 5 years
Pipework	Jetting to clear blockages	As required

- 8.1.3 The responsibility of maintenance regime will be determined by the Developer, by agreed appointment.

Permeable Paving / Diffuser Units

- 8.1.4 The areas of permeable paving are designed to allow infiltration of surface water run-off through the joints in the block paving surface course and into the subbase below. The water is then collected and discharged into the positive drainage system.
- 8.1.5 As part of the permeable paving system, diffuser units are used to discharge surface water run-off from roof areas into the sub-base, as well as forming links between areas of permeable paving. These diffuser units are small heavy-duty cellular units which allow more efficient discharge of surface water into the sub-base base of the permeable paved areas.
- 8.1.6 The areas of permeable paving will require additional maintenance measures to ensure they operate as designed. Failure in carrying out this maintenance, could increase the risk of flooding. The additional measures are as follow:

- Periodic surface sweeping to reduce silt and debris accumulation. The permeable surfaces should be swept at least every 8 to 12 weeks with additional sweeps in the autumn to clear fallen leaves
- Removal / management of weed growth, as required. Typically, once or twice a year for regularly used areas
- Periodic silt removal from permeable surfaces as described by the manufacturer. If any areas are showing signs of ponding, they shall be dealt with by raking out the joints and redressing. The entire surface shall be monitored and when there are signs of excessive siltation resulting in poor drainage over the whole area, the blocks shall be taken up and a replacement of bedding layer and geotextile shall be undertaken
- Redressing of joints on the block paving as required
- Catchpits upstream of diffuser units, should be emptied and inspected on the same regime as all catchpits specified previously set out in this document

Remedial/Repair Actions

- 8.1.7 Significant storm events may cause considerable damage to SuDS and their associated components. As such, it may be necessary to inspect and carry out essential recovery works to return the feature to full working order.
- 8.1.8 Resetting of uneven blocks by lifting block area, removing bedding material and relaying to match original design are all actions which may need to be undertaken.

Accidental Spillages

- 8.1.9 It is not envisaged that any materials are to be stored onsite once the development has been completed, which could cause major spills and potential pollution issues within the drainage system. If this situation alters in the future consultation with a specialist will be required in order to confirm if any upgrades to the existing system are necessary.
- 8.1.10 Minor spillages of fuels and oils will be dealt with by the permeable paving and deep trapped gullies, by bio-degrading and collecting the hydrocarbons respectively.

Future Alterations to the Development

- 8.1.11 Any future alterations to the permeable paving should be confirmed by a specialist. Where possible any future services are to avoid being located through areas of permeable paving. If new services are required to run through areas of permeable paving, services should be installed below the depth of permeable paving with the permeable system reinstalled above.

9 OFFSITE IMPACTS

- 9.1.1 The proposed development will not result in any increase in runoff leaving the site, and therefore will not cause an increase in flood risk offsite.
- 9.1.2 Post development foul water flows will contribute an increase to the sewer network compared to the previous use – proposed foul flows are to be confirmed.
- 9.1.3 The effects of climate change have been considered in the design of the proposed surface water drainage system, to ensure there is no off-site impact.

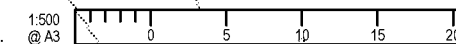
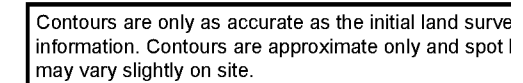
10 SUMMARY

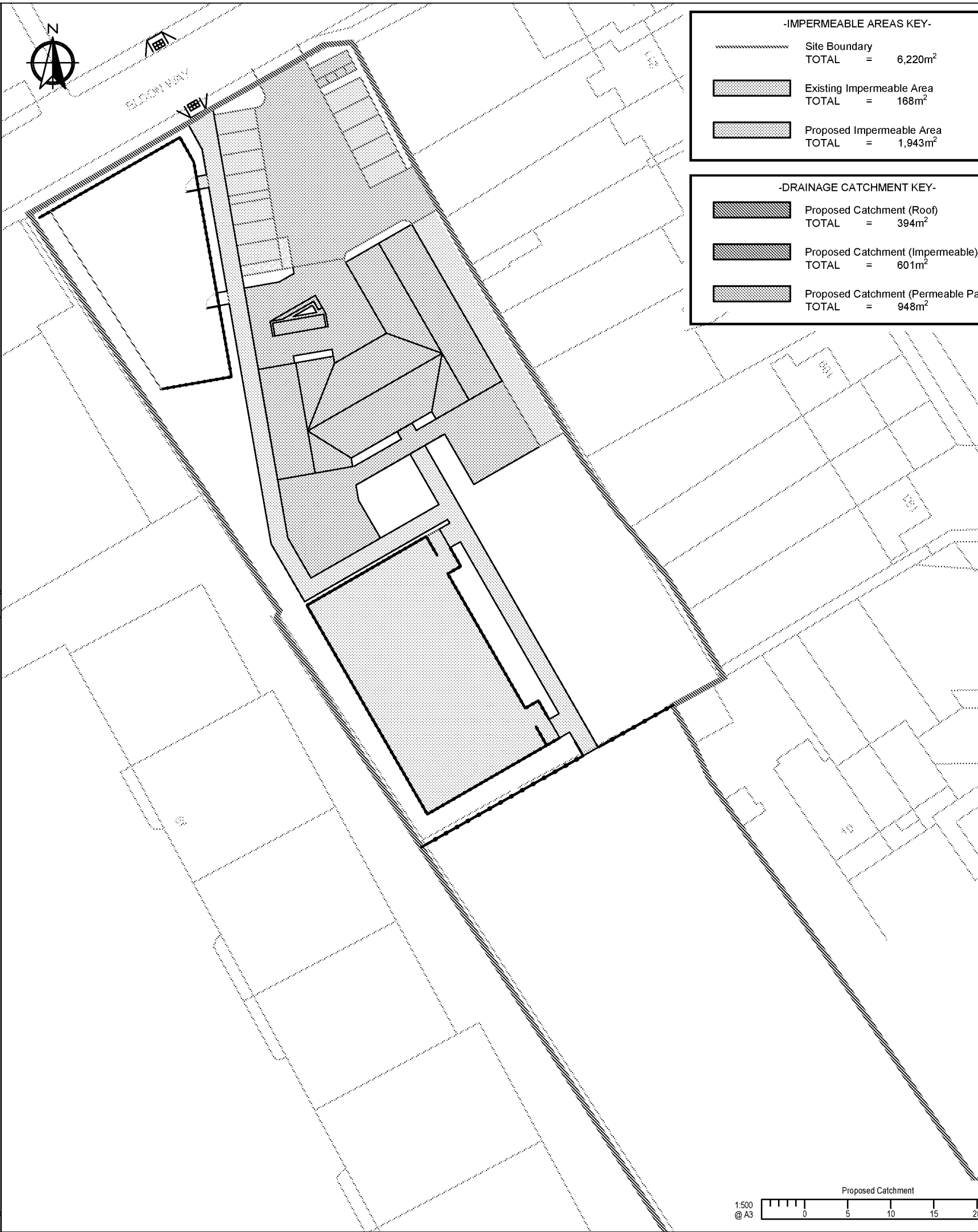
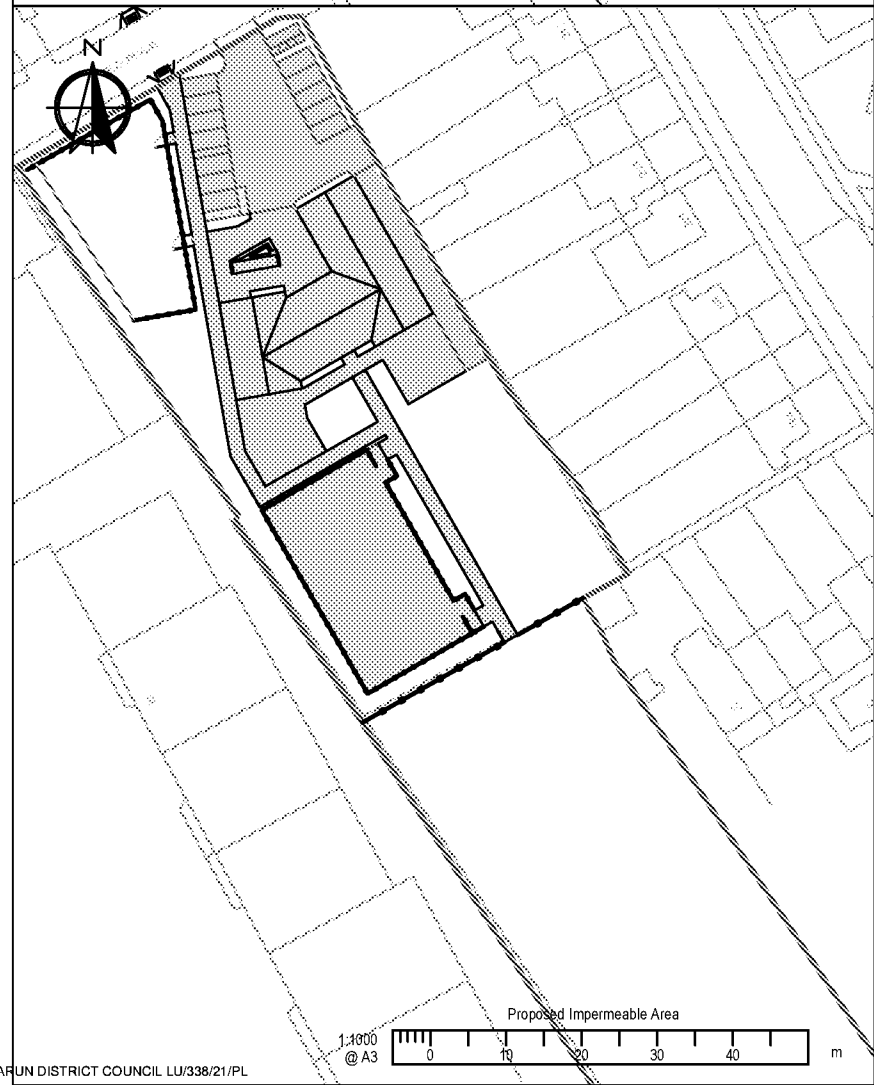
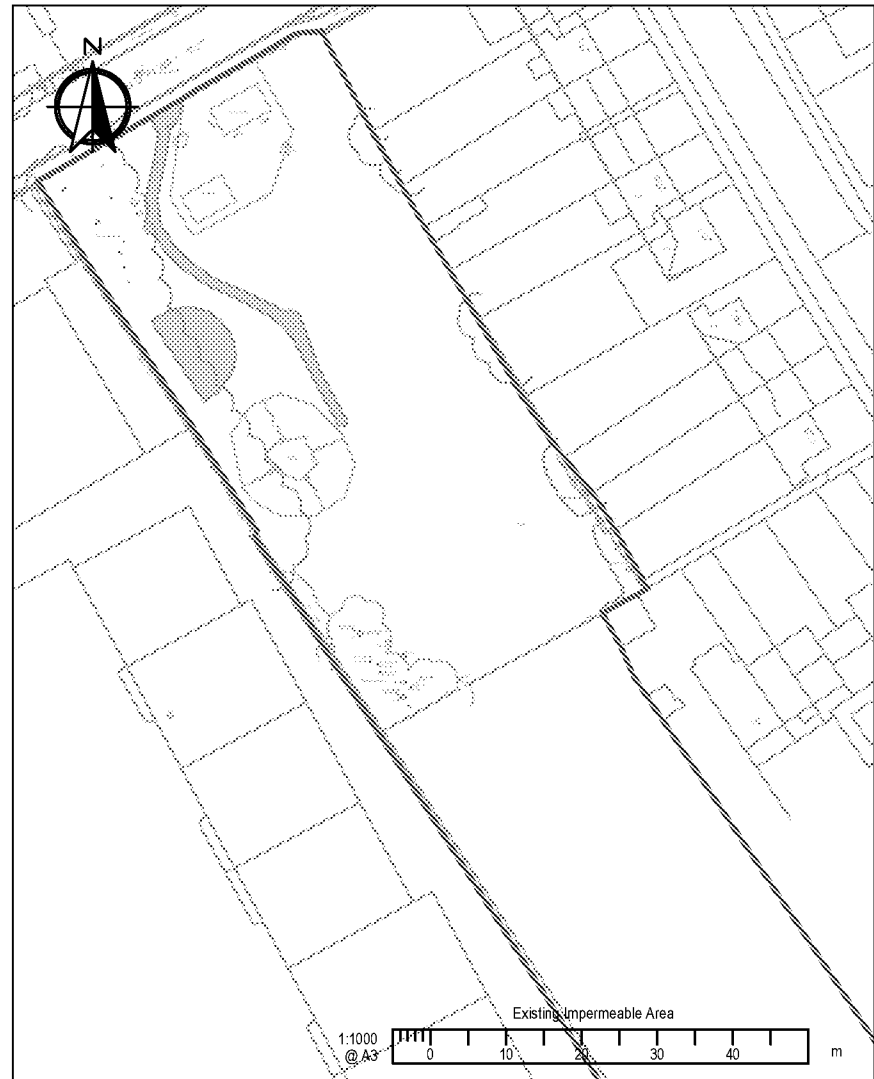
- 10.1.1 This site-specific drainage strategy report is based on Flood Maps, Public Sewer Records, BGS records, site-specific geotechnical information, and consultation with the Lead Local Flood Authority.
- 10.1.2 The existing site consists of an existing playing field south of Eldon Way.
- 10.1.3 The site slopes downwards from 6.40mAOD in the northeast corner to 4.59mAOD in the southwest corner.
- 10.1.4 The site area is 0.350Ha and has an impermeable area of 0.017Ha, which will increase to 0.193Ha as a result of the development.
- 10.1.5 The proposed development comprises the construction of a new youth centre building and associated external amenity areas.
- 10.1.6 The development lies within Flood Zone 1, and is at very low risk of surface water flooding. The existing run-off from the site is assumed to drain via a combination of infiltration and overland flow in the absence of confirmed existing drainage infrastructure.
- 10.1.7 Environment Agency flood information indicates that the southwest corner of the site is at residual risk of flooding as a result of climate change, however the proposed building is located Sequentially outside of an area of flood risk, and expected flooding in a future residual event to the proposed MUGA pitch in the southwest is less than 300mm.
- 10.1.8 Post-development surface water run-off will be managed through sustainable drainage measures, with the installation of permeable surfacing, freedraining surfacing and a geocellular soakaway, without causing surface water flooding on site.
- 10.1.9 The wastewater from the proposed development will discharge to the public foul sewer network, with connection arrangement to be confirmed subject to site investigation.
- 10.1.10 The completion of the development will not increase flood risk on or off the site.
- 10.1.11 In conclusion, this development is suitable with regards to flood risk and surface water drainage.

DRAWINGS

- 001** Site Location Plan
- 002** Topographical Survey & Overland Flows
- 003** Impermeable Areas Plan
- 004** Preliminary Levels & Drainage Strategy

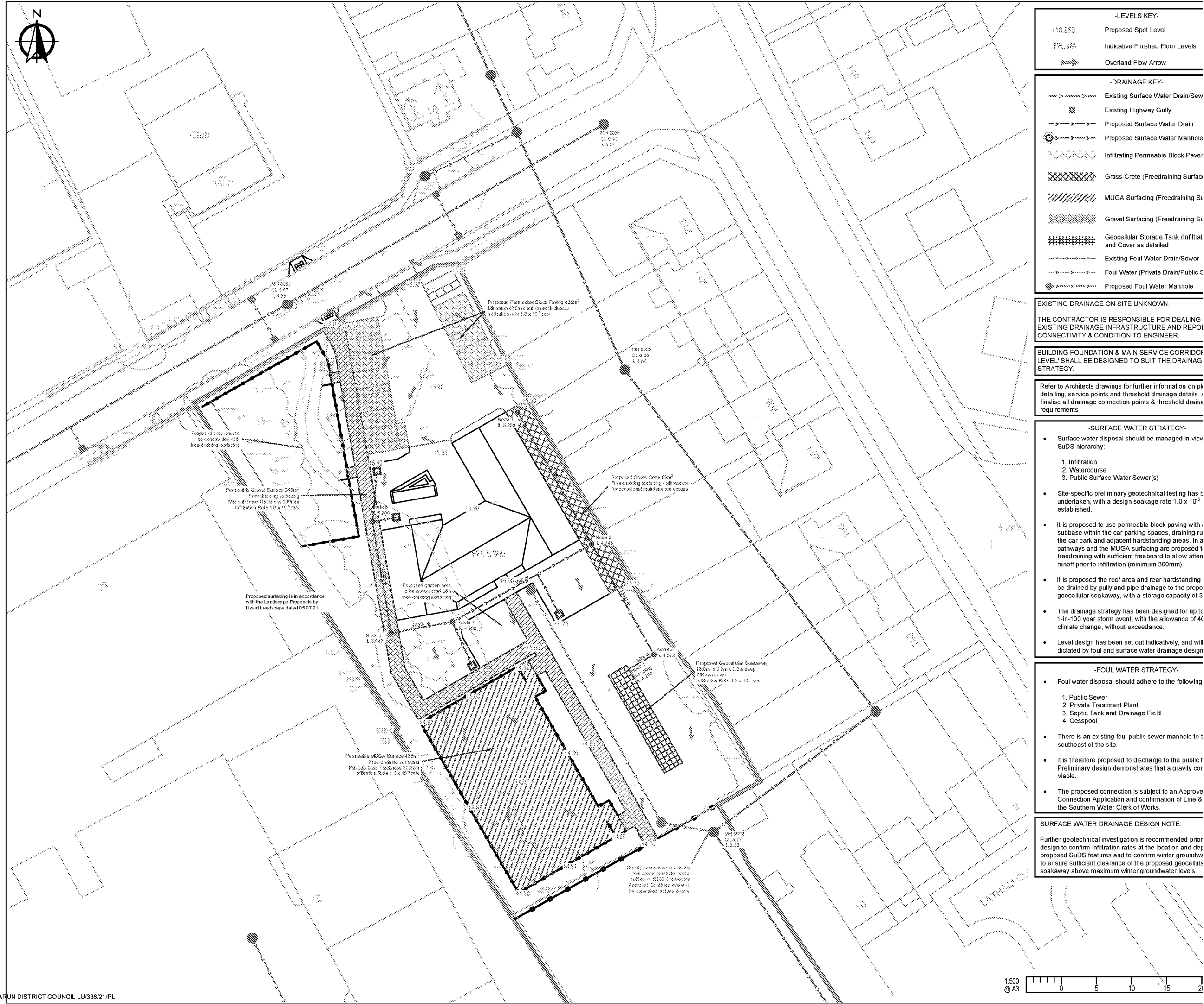






-IMPERMEABLE AREAS KEY-		
	Site Boundary	
	TOTAL	= 6,220m ²
	Existing Impermeable Area	
	TOTAL	= 168m ²
	Proposed Impermeable Area	
	TOTAL	= 1,943m ²

-DRAINAGE CATCHMENT KEY-		
	Proposed Catchment (Roof)	
	TOTAL	= 394m ²
	Proposed Catchment (Impermeable)	
	TOTAL	= 601m ²
	Proposed Catchment (Permeable Pa)	
	TOTAL	= 948m ²



-LEVELS KEY-	
±10.850	Proposed Spot Level
±10.888	Indicative Finished Floor Levels
	Overland Flow Arrow

-DRAINAGE KEY-	
	Existing Surface Water Drain/Sewer
	Existing Highway Gully
	Proposed Surface Water Drain
	Proposed Surface Water Manhole
	Infiltrating Permeable Block Paver
	Grass-Crete (Freedraining Surface)
	MUGA Surfacing (Freedraining Surface)
	Gravel Surfacing (Freedraining Surface)
	Geocellular Storage Tank (Infiltration and Cover as detailed)
	Existing Foul Water Drain/Sewer
	Foul Water (Private Drain/Public Sewer)
	Proposed Foul Water Manhole

EXISTING DRAINAGE ON SITE UNKNOWN.

THE CONTRACTOR IS RESPONSIBLE FOR DEALING WITH EXISTING DRAINAGE INFRASTRUCTURE AND REPAIRING CONNECTIVITY & CONDITION TO ENGINEER.

BUILDING FOUNDATION & MAIN SERVICE CORRIDOR LEVELS SHALL BE DESIGNED TO SUIT THE DRAINAGE STRATEGY.

Refer to Architects drawings for further information on pipe detailing, service points and threshold drainage details. Finalise all drainage connection points & threshold drainage requirements

- SURFACE WATER STRATEGY-**
- Surface water disposal should be managed in view of SuDS hierarchy;
 - Infiltration
 - Watercourse
 - Public Surface Water Sewer(s)
 - Site-specific preliminary geotechnical testing has been undertaken, with a design soakage rate 1.0×10^{-3} m/s established.
 - It is proposed to use permeable block paving with a subbase within the car parking spaces, draining runoff to the car park and adjacent handstanding areas. In a pathways and the MUGA surfacing are proposed to be freedraining with sufficient freeboard to allow attenuate runoff prior to infiltration (minimum 300mm).
 - It is proposed the roof area and rear handstanding be drained by gully and pipe drainage to the proposed geocellular soakaway, with a storage capacity of 3 m³.
 - The drainage strategy has been designed for up to 1-in-100 year storm event, with the allowance of 4°C climate change, without exceedance.
 - Level design has been set out indicatively, and will be dictated by foul and surface water drainage design

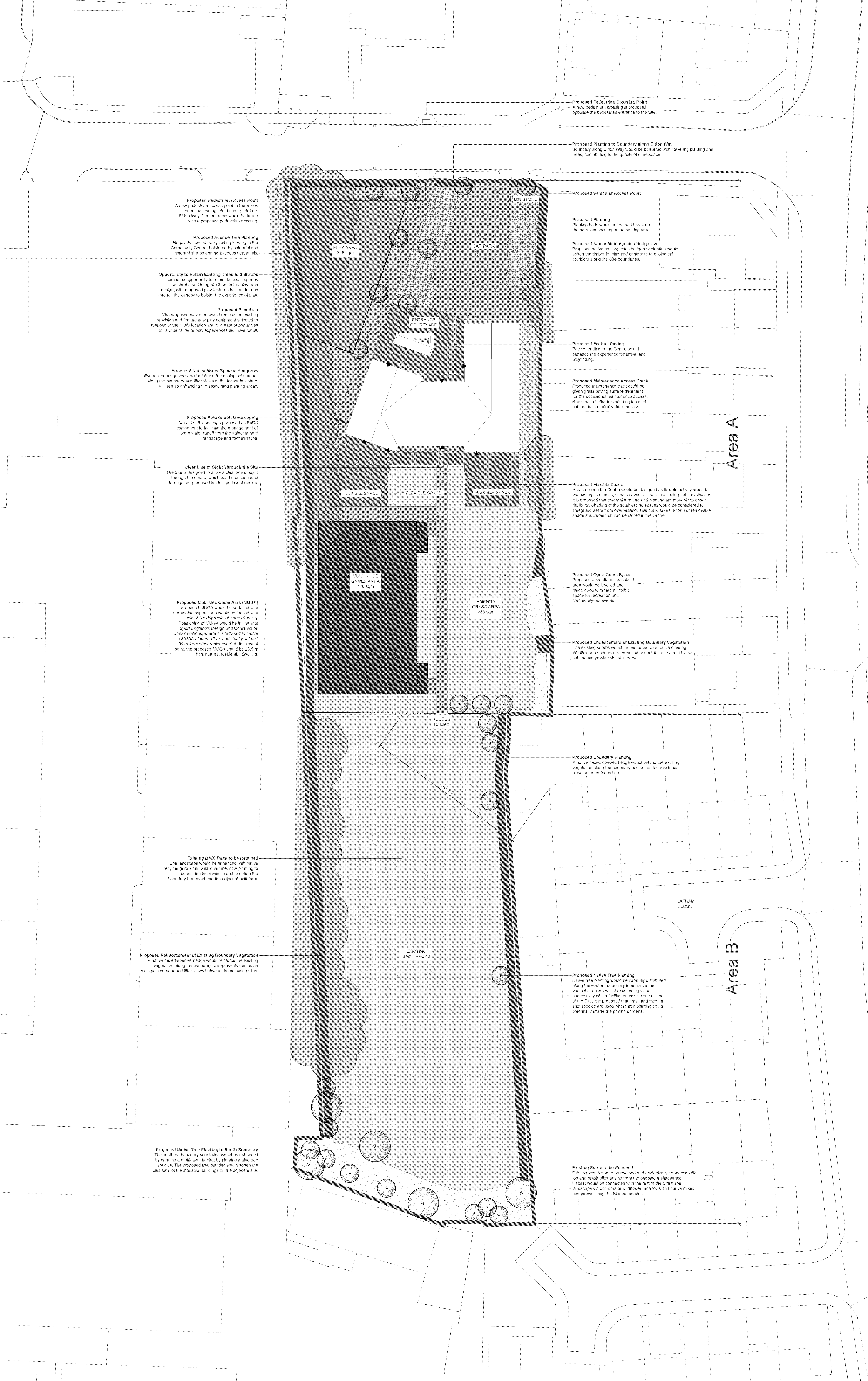
- FOUL WATER STRATEGY-**
- Foul water disposal should adhere to the following
 - Public Sewer
 - Private Treatment Plant
 - Septic Tank and Drainage Field
 - Cesspool
 - There is an existing foul public sewer manhole to the southeast of the site.
 - It is therefore proposed to discharge to the public foul sewer. Preliminary design demonstrates that a gravity connection is viable.
 - The proposed connection is subject to an Approve Connection Application and confirmation of Line & the Southern Water Clerk of Works.

SURFACE WATER DRAINAGE DESIGN NOTE:

Further geotechnical investigation is recommended prior to design to confirm infiltration rates at the location and depth of proposed SuDS features and to confirm winter groundwater levels to ensure sufficient clearance of the proposed geocellular soakaway above maximum winter groundwater levels.

APPENDICES

Appendix A Preliminary Site Layout



- Legend**
- Site Boundary
 - Existing - BMX Track
 - Existing - Vegetation
Existing vegetation to be retained where possible and enhanced.
 - Existing - Retained Tree Canopy
 - Proposed - Trees
 - Proposed - Hedgerows
 - Proposed - Planting Areas
 - Proposed - Native Shrub Planting Areas
 - Proposed - Flowering Grassland Areas
 - Proposed - Amenity Lawn
 - Proposed - Fences
 - Proposed - Resin Bound Gravel Surface
Colour varies
 - Proposed - Self-binding Aggregate Surface
to Community Garden
 - Proposed - Play Area
 - Proposed - Feature Paving
 - Proposed - Permeable Paving to Car Park
 - Proposed - Macadam to MUGA/ Playing Pitch
 - Proposed - Asphalt to Car Park
 - Proposed - Grass Paving to Maintenance Access
 - Proposed - Indicative Location of Rain Water Harvesting Tanks
 - Proposed - Rainwater Access and Direction

Notes:

1. Drawing to be viewed in colour.
2. For description of the landscape design intent refer to LLD2345-LAN-REP-001 - Landscape Design Strategy report.

PLANNING ISSUE

Rev	Description	Date	Initials
03	Planning Issue	24.08.21	GL
02	Planning Issue	20.08.21	GL
01	Planning Issue	20.08.21	GL
00	Draft Issue	06.08.21	GL



Client
Littlehampton Town Council
Project Title and Location
Keystone Youth Centre
Eldon Way, Littlehampton, West Sussex

Drawing Title
Landscape Strategy Masterplan

Scale	Drawn	Approved	Date
1:200@AO	GL	MZ	06.08.21
Drawing No	LLD2345-LAN-DWG-010	Revision	03

Landscape Strategy Masterplan Keystone Youth Centre - Littlehampton Town Council

Appendix B Topographic Survey

