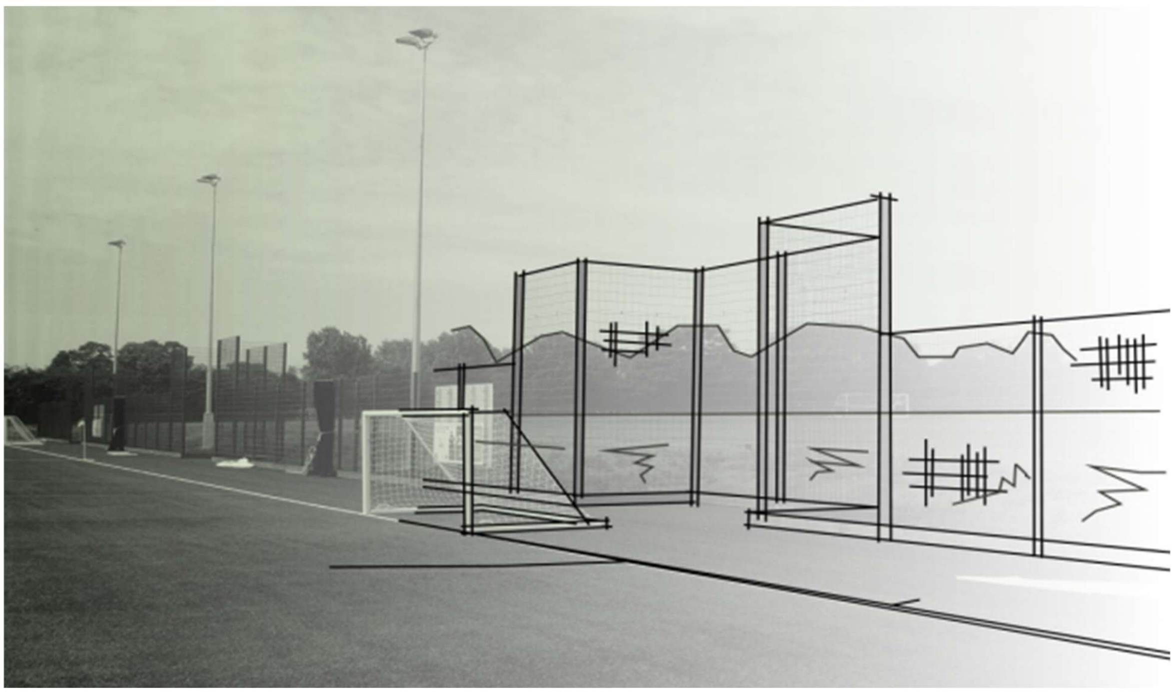
Ryburn Valley High School

Creation of a 3G Artificial Grass Pitch (AGP) with perimeter fencing, hardstanding areas, storage container, floodlights and access pathway

Drainage Strategy



Client	Ryburn Valley High School St Peter's Avenue Sowerby Bridge West Yorkshire HX6 1DG		
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SPORTS PITCH CONSULTANTS

Contents

1. Introduction

Surfacing Standards Limited has been appointed to consider and develop an application for full planning permission for the creation of a 3G Artificial Grass Pitch (AGP) with perimeter fencing, hardstanding areas, storage container, floodlights and access pathway.

The assessment has been carried out in accordance with the guidance set out in the National Planning Policy Framework (NPPF).

2. Site Details

The Proposal

The proposed development will include the creation of an Artificial Grass Pitch (AGP) with new fencing and hard standing as shown within table 1.

Table 1 – Area of pitch and associated development

Aspect	**Area**
3G artificial grass pitch area	6,393m2
Porous Asphalt surfaced areas	115m2
Total Development Area	**6,508m2**

Subject Area

The proposed development is situated at Ryburn Valley High School, St Peter's Avenue, Sowerby Bridge, West Yorkshire, HX6 1DG:

Figure 1 – Site Location

Site Description

The site comprises existing grassed playing fields associated with the high school. The area of the playing field serves a football pitch that is already fully drained and connects into the site wide drainage system with an unrestricted outfall. The main school buildings and car park are located to the west of the playing field. To the north is St Peters Avenue which is the main access to the site with residential properties located on the other side of this road. To the south and east of the playing field are more residential properties with open fields to the south west.

Site History

An attempt to trace the history of the site has been carried out by reviewing readily available Ordnance Survey maps. The earliest maps date back to the late 19th century, indicating that the site was recorded as open fields across most of its extent. An old school building is recorded towards the northeast of the site during this time. The wider site was bordered to the west by a forested area known as 'Rawson's Wood'. By the mid-20th century the school buildings present to the north east appear to have been extended across the northwest of the wider site. Terraced playing fields are recorded to the west and south of school encompassing the development area as shown below:

Site Topography

Topography of the area is relatively flat with land rising slightly towards the north west. For further information on existing levels see 'SC105 01- Topographical Survey'.

Local Watercourses

The nearest surface water feature is the River Ryburn approximately 450 metres to the south of the development.

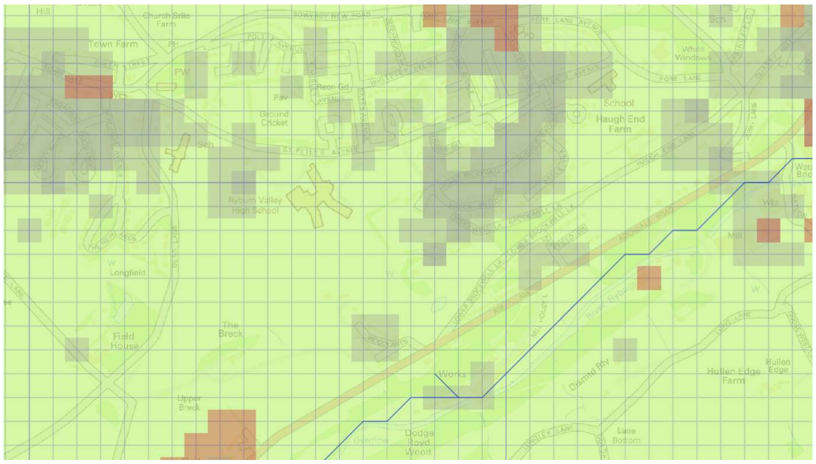

Figure 2 – River networks

Existing Drainage

There is currently no formal drainage for the grass pitches.

Source protection zone

The site is not located within a Source Protection Zone.

Coal Mining

Coal Authority mapping data shows the site does not lie within a Coal Mining Reporting Area. Therefore, there is considered to be a negligible instability risk from historical coal workings.

Ground Conditions Encountered

Geological mapping for the area shows there to be no natural superficial deposits within the site boundary. The underlying bedrock across the wider site and proposed pitch location is recorded as the Midgley Grit, comprising coarse to fine grained sandstone. A fault is present east of the site, trending north-south.

Groundwater

Groundwater was not encountered in any of the borehole testing locations.

Infiltration Potential

Based on the assessment of the ground conditions, the near surface natural soils do have some infiltration to the levels of 2.65x10-6. The drainage through areas of the natural virgin ground have some capacity but sadly are not efficient enough to allow for a drainage scheme entirely based on natural soakage through the ground. Some areas of the footprint were found to be "made ground" that was re-worked clay subsoil from the relocation of the school building to build up and form the natural turf pitch level. Therefore, some areas of the footprint were impermeable.

SSL have developed the drainage scheme and design stated below to a worst-case scenario with no inclusion of natural infiltration through the permeable pitch base and soakaway. The entire development footprint and soakaway is permeable and will be formed on permeable subsoil that has natural infiltration up to 2.65x10-6. In reality the drainage calcs and design stated within this report would incur far less surface water runoff and storage within the soakaway chamber and through the pitch sub base acting as additional attenuation due to water soaking through the natural soils.

This is backed up by the research paper undertaken by Loughborough university that tested 7 AGP pitch sites when installed to ascertain how much surface water ran through the piped system and into the outfall. Note that some of these sites such as ATP 5 were built on clay subsoil and show a maximum yield of surface water going through the piped system and outfall of 34.9%.

Rainfall Event	ATP1	ATP2	ATP3	ATP4	ATP5	ATP6	ATP7
	Dec 2011	Dec 2012	Jan 2012	Jan 2012	Jan 2012	July2013	Apr 2014
Antecedent Precipitation (5 Days) – AP5 (mm)	0.4	15	7	6	8	5.4	6
Total Rainfall (mm)	8.0	4.8	4.2	3.9	4.5	19.6	7.4
Total Rainfall Volume (L)	60,208	36,125	31,609	29,351	33,867	69,600	26,300
Rainfall Duration (h)	~110	~9	5	3	3	3	4
Peak Rainfall Intensity mm/h	1.6	1.6	1.2	1.2	2.4	5.8	2.2
Total Volume Discharged from Pitch Drain (L)	11,669	483	4,040	2,086	11,823	8133	113
Peak Flow Rate (L/s)	0.130	0.007	0.082	0.170	0.127	0.1	0.01
% Yield	19.4	1.3	12.8	7.1	34.9	12	0.5
Time of Concentration (h)	1.7	62.4	17.55	0.7	0.18	1	6
Lag Time (h)	13.3	65.0	3.9	7.0	2.8	12	38
Discharge Duration (h)	131.1	138.4	45.0	34.6	76.2	41	25
Time to Base Flow (h)	23.8	134.6	34.0	30.6	62.3	60	23
Antecedent dry period (h):	21.5	40.4	48.5	40.5	1.0	25	25
Attenuation of Peak Flow (%):	96	99	97	93	97	98	99

Figure 2 – Drainage behaviour of sport pitches - findings from a research study

<u>Assessment Context</u>

The proposed pitch development area is approximately 0.6ha.

<u>Flood Map</u>

The Government websites confirm the proposed development area is located within a flood zone 1, indicating a low risk from flooding.

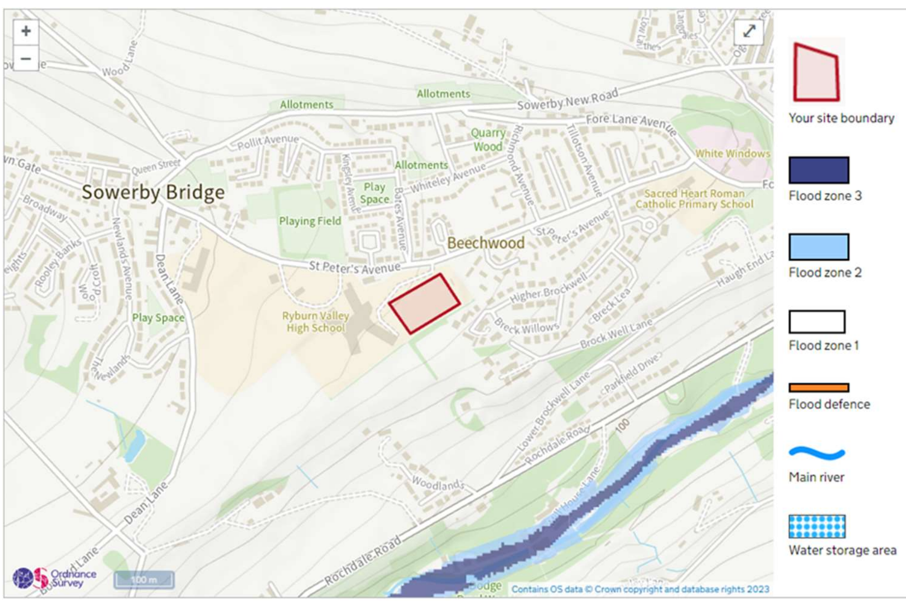

Figure 3 – Flood map

Risk of Flooding from Rivers and Sea

The Government website confirms the proposed development area is at a very low risk of flooding from rivers or sea, which happens when there are high tides and stormy conditions.

Risk of Flooding from Surface Water

The Government website confirms the proposed development area is at high risk of flooding from surface water, which happens when rainwater does not drain away through the normal drainage systems.

3. Framework & Flood Risk Policy

National Planning Policy Framework (2023)
Section 14 – Meeting the Challenge of Climate Change, Flooding and Coastal Change

Policy extract:

Paragraph 167:
When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment55. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:
a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;
c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;
d) any residual risk can be safely managed; and
e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

Department for Environment, Food and Rural Affairs
Sustainable Drainage Systems
Non-statutory technical standards for sustainable drainage systems
March 2015

The surface water drainage scheme must be in accordance with the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) or any subsequent replacement national standards and unless otherwise agreed in writing by the Local Planning Authority, no surface water shall discharge to the public sewerage system either directly or indirectly.

To assist the application for full planning permission and to facilitate the satisfactory implementation and delivery of the project; an assessment of flood risk and a sustainable drainage proposal is required in accordance with national policies.

With reference to Table 2 of Planning Practice Guidance, the proposed development for an outdoor sports facility would be classified as Water Compatible Development.

Table 2 - Extract from Table 2 of the PPG for Flood Risk and Coastal Change is replicated below in Table 2.

Flood Risk Vulnerability Classification	
Vulnerability	**Development types**
Water Compatible Development	Flood control infrastructure Water transmission infrastructure and pumping stations Sewage transmission infrastructure and pumping stations Sand and gravel working Docks, marinas and wharves Navigation facilities Ministry of Defence defence installations Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location Water-based recreation (excluding sleeping accommodation) Lifeguard and coastguard stations Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan
Source: Planning Practice Guidance - 2014	

Flood Risk Vulnerability and Flood Zone Compatibility

Based on the above assessment of the site being located within a flood zone 1 and classified as a 'water compatible development' and with reference to Planning Practice Guidance for 'Flood Risk and Coastal Change' (Table 3), the proposed development of this site would be considered "appropriate".

A copy of Table 3 is presented below to confirm the assessment above.

Table 3 - No exception test

Flood risk vulnerability and flood zone compatibility					
Flood risk vulnerability classification	**Essential infrastructure**	**Water compatible**	**Highly vulnerable**	**More vulnerable**	**Less vulnerable**
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception Test required	✓	✓
Zone 3A	Exception Test required	✓	✗	Exception Test required	✓
Zone 3B	Exception Test required	✓	✗	✗	✗

Key:

✓Development is appropriate
✗Development should not be permitted

Sequential Test

As the site is located within a flood zone 1, a sequential test is not required, and it is worth noting the site is used (and historically designated) as a sports complex (active playing field) the development can be deemed to have passed the sequential test.

Current Conditions

The proposed development will replace part of an existing playing field.

Surface Water Disposal Requirements

In accordance with the National Planning Policy Framework (NPPF) and the National Planning Practice Guidance (NPPG), the site should be drained in the most sustainable way. No foul sewage will be created as part of this development.

The NPPG clearly outlines the hierarchy to be investigated by the developer when considering a surface water drainage strategy. As such, the developer must consider the following drainage options in the following order of priority:

A. Into the ground (infiltration).

B. To a surface water body.

C. To a surface water sewer, highway drain, or another drainage system.

D. To a combined sewer.

This is necessary to promote sustainable development, secure proper drainage and to manage the risk of flooding and pollution. This condition is imposed considering policies within the NPPF and NPPG.

Flood Compensation

Flood compensation measures will not be required as finished (floor) levels will not affect current flood plain storage onsite.

Overland Flows

There is a risk of the critical storm event being exceeded, albeit this risk is considered very low.

In such an event the proposed drainage systems will become overwhelmed and overland flows could occur.

4. Surface Water Drainage Strategy

Surface Water Disposal Solution

In accordance with the National Planning Policy Framework (NPPF) and the National Planning Practice Guidance (NPPG), the site should be drained on a separate system with foul water draining to the public sewer and surface water draining in the most sustainable way.

The NPPG clearly outlines the hierarchy to be investigated by the developer when considering a surface water drainage strategy in the following order of priority:

A. Into the ground (infiltration);

B. To a surface water body;

C. To a surface water sewer, highway drain, or another drainage system;

D. To a combined sewer.

Surface Water Disposal Options

A. Soak away

Based on the assessment of the ground conditions, the near surface natural soils do have some infiltration to the levels of 2.65x10-6. The drainage through areas of the natural virgin ground have some capacity but sadly are not efficient enough to allow for a drainage scheme entirely based on natural soakage through the ground. Some areas of the footprint were found to be "made ground" that was re-worked clay subsoil from the relocation of the school building to build up and form the natural turf pitch level. Therefore, some areas of the footprint were impermeable.

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This is backed up by the research paper undertaken by Loughborough university (figure 2) that tested 7 AGP pitch sites when installed to ascertain how much surface water ran through the piped system and into the outfall. Note that some of these sites such as ATP 5 were built on clay subsoil and show a maximum yield of surface water going through the piped system and outfall of 34.9%.

B. Surface Water Body

In order to meet the local SUDS requirements to a rainfall event of 1 in 30 year storm event the above mentioned drainage strategy is completed with an positive outlet connecting into the schools existing drainage system that the existing natural turf pitch already connects into with an unrestricted outfall. The new connection will become restricted to greenfield run off rates of 3.52l/s. This is a significant reduction to the current surface water running through the existing system and shows a betterment without consideration of the natural drainage through the pitch and soakaway noted above.

C. Surface Water Sewer

Not required due to option B being possible.

D. Combined Sewer

Not required due to option B being possible.

Surface Water Drainage Strategy

FIFA's Quality Concept for Football Turf (Handbook of Requirements January 2015 Edition) requires a 3G artificial turf to provide water permeability (for outdoor uses) >180mm/hr and advises that to ensure adequate drainage of a field, all individual elements of the football turf should satisfy this requirement.

A positive drainage scheme (land drainage); shall be installed beneath the Artificial Grass Pitch (AGP) area comprising UPVC perforated carrier and lateral pipe drains.

The granular pitch substrate (typically consisting of Type 3 unbound (SHW 800 Series) to comply with BSEN 13285) is intended to provide onsite containment and attenuation within the granular sub-base, before surface water enters the proposed surface water connection.

The designed surface water drainage solution should be based upon the following criteria, to maintain satisfactory system performance:

- Provide adequate functionality over a period of twenty years.
- Prevent the risk of uncontrolled flooding elsewhere (to land adjacent to the development).
- Comply with all applicable Sustainable Urban Drainage System (SUDS) requirements with attenuated flows (containment within the granular pitch sub-base) incorporated wherever necessary, without affecting the performance of the pitch.

As shown below the calculated volume for storage within the soakaway system itself meets a 1 in 30 year storm event is 213m3. Then there is additional storage above such a storm event through intentionally backing up into the pitch drainage system and utilising the drainage network itself along with the wedge of stone sub base within the pitch that holds 32% void space through the open graded type 3 aggregate material.

This is achieved through the surface water being attenuated / stored within the construction make up of the artificial turf pitch that has 32% void space acting as the surface water drainage and the drainage system acting as attenuation when required.

The proposed development and associated surface drainage strategy from this site is such that the surface water will be managed and disposed of within the existing surface water drainage, thus complying with the Technical Guidance to the National Planning Policy Framework.

Surface water management and disposal performance will be achieved by the following physical implications to the development (the Artificial Grass Pitches):

1. Adequate attenuation (water storage) within pitch bases (comprising a permeable granular sub-base) to ensure that excess volumes, which would be experienced during a critical storm event, does not bypass the control system;

2. Restricted flow rate to 3.52 l/s before discharging into the existing site drainage system.

The drainage solution is designed to ensure no above ground flooding occurs up to and including the 1 in 30 year event.

Minimum Storage Required: **213 m^3** **incl cc allowance**

FACTOR	VALUE	SOURCE	FACTOR	VALUE
Return Period (yrs):	30	Environment Agency, Water Authority, etc.	Additional Inflow (l/s):	0
Limiting Discharge (l/s):	3.52	Environment Agency, Water Authority, etc.	Calculate/Specify PR:	Calculate
Contributing Area (ha):	0.649	Site plans	Specify PR:	100
Impervious, PIMP (%):	100	Site plans		
M5-60min (mm):	17	Volume 3 maps and site location	Climate Change Allowance	0
SAAR (mm/yr):	1102	Volume 3 maps and site location		
Ratio, r:	0.2	Volume 3 maps and site location		
Soil Type:	3	Volume 3 maps and site location		
SOIL:	0.4	Soil Type and Volume 1, Section 7.4		
UCWI:	120	SAAR and Volume 1, Figure 9.7		
Calculated PR	81.54			
Percentage Runoff =	81.54			

Duration, D (min)	M5-60 (mm)	Z1 for r=0.20	M5-D (mm)	Z2 for M30	M30-D (mm)	incl climate change	Area C (ha)	PR (%)	Runoff (m3)	Add. Runoff (m3)	Total Runoff (m3)	Limiting Discharge (m3/min)	Limiting Runoff (m3)	Storage Required (m3)
5	17	0.29	4.9	1.43	7.0	7.0	0.65	82	37.2	0.0	37.2	0.21	1.1	36.2
10	17	0.43	7.3	1.45	10.6	10.6	0.65	82	56.2	0.0	56.2	0.21	2.1	54.1
15	17	0.53	9.0	1.48	13.3	13.3	0.65	82	70.4	0.0	70.4	0.21	3.2	67.3
30	17	0.71	12.1	1.50	18.2	18.2	0.65	82	96.1	0.0	96.1	0.21	6.3	89.8
60	17	1.00	17.0	1.53	26.1	26.1	0.65	82	137.9	0.0	137.9	0.21	12.7	125.3
120	17	1.32	22.4	1.54	34.5	34.5	0.65	82	182.8	0.0	182.8	0.21	25.3	157.4
240	17	1.78	30.3	1.51	45.8	45.8	0.65	82	242.3	0.0	242.3	0.21	50.7	191.6
360	17	2.12	36.0	1.49	53.5	53.5	0.65	82	283.3	0.0	283.3	0.21	76.0	207.2
480	17	2.32	39.4	1.47	58.0	58.0	0.65	82	307.1	0.0	307.1	0.21	101.4	205.7
600	17	2.61	44.4	1.45	64.2	64.2	0.65	82	340.0	0.0	340.0	0.21	126.7	213.3
720	17	2.72	46.2	1.44	66.5	66.5	0.65	82	352.0	0.0	352.0	0.21	152.1	200.0
840	17	2.85	48.5	1.43	69.3	69.3	0.65	82	366.5	0.0	366.5	0.21	177.4	189.1
1440	17	3.85	65.5	1.37	89.9	89.9	0.65	82	475.9	0.0	475.9	0.21	304.1	171.8
2880	17	5.15	87.6	1.32	115.6	115.6	0.65	82	611.9	0.0	611.9	0.21	608.3	3.7

Figure 4 – 1 in 30 year to 3.52 l/s

A hydraulic model has not been developed to simulate the flows within and flooding from the piped drainage network. It is not possible to simulate the pitch drainage within the hydraulic modelling software to accurately simulate the flow within a perforated pipe network which uses the pitch sub-base as attenuation and storage, as is the case with this particular drainage network.

The design of the pitch sub-base and the associated drainage network is such that additional surface water flows that cannot be accommodated within the piped drainage network will enter the pitch sub-base via the perforated pipe network, and will be attenuated in the sub-base until such a time and the flows within the piped network have subsided to a level which will allow the surface water to re-enter the piped network and discharge downstream into the drainage ditch.

As such, in the case of surface water networks for pitches, which use the sub-base as a storage area, it is accepted that confirming that there is adequate storage within the pitch to accommodate any flooding, is an acceptable work-around for the shortfall.

Further information on the design and attenuation volumes within such events can be seen within:

SC105 07 - Drainage Layout

Foul Water Drainage Strategy

There will be no foul water produced as part of the site development.

Surface Drainage Maintenance

The drainage system will be designed to minimise maintenance requirements; however, a full maintenance scheme will be established for those elements not being offered for adoption.

Maintenance operations will be carried out by Birmingham FA in perpetuity post development and the 5. Drainage Management & Maintenance is displayed below within ***section 5***.

Site Drainage Proposals Conclusions

- The proposed development includes the creation of a new external artificial grass pitch with perimeter ball-stop fencing, and clean accesses.
- The proposed development area will occupy land and replace an existing sports area.
- Surface water is to be disposed of into a surface water drain;
- Adequate attenuation within pitch base and upper surface (comprising a permeable granular sub-base) to ensure that excess volumes, which would be experienced during a critical storm event, does not bypass the control system.
- This drainage strategy is designed to ensure no above ground flooding occurs up to and including the 1 in 100 year event + 40% allowance for climate change.
- The surface water drainage from this site, post development, is such that the surface water will be managed and disposed of within the site boundary, thus complying with the Planning Practice Guidance for 'Flood Risk and Climate Change' to the National Planning Policy Framework.
- Based on the above and providing the above strategies are adopted; the developed site will not contribute further to flood risk thus satisfying the principles of the National Planning Policy Framework.

5. Drainage Management & Maintenance

GULLIES, PIPEWORK, INSPECTION CHAMBERS AND CONTROLS	
Required Action	**Frequency**
Regular Maintenance	
Remove cover and inspect chambers and pipework ensuring water is flowing freely and that the exit route for water is unobstructed.	Annually
Undertake inspection after leaf fall in autumn, remove leaves from gullies, chambers and pipes	Every autumn
Inspect silt traps and clear of silt	Every 6 months or as required
Inspect catchpits and clear of silt	Every 6 months or as required
Remedial work	
Remove debris, silt and leaves from inspection chambers and flow control chambers.	As required
Remove debris and silt from pipework through high pressure jet washing.	As required
Repair physical damage if necessary	As required
Monitoring	
CCTV survey to establish condition of pipe runs. Cleansing or repair of physical damage to be conducted if necessary	Every 5 years or as required

PERMEABLE AND POROUS SURFACES	
Required Action	**Frequency**
Regular Maintenance	
Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional Tasks	
Stabilise and mow contributing and adjacent areas	As required
Removal of weeds or management using glyphospate applied directly into the weeds by an applicator rather than spraying	As required and in accordance with manufacturer's recommendations
Remedial Work	
Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost material.	As required

Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
If efficiency of water percolating to the sub-base drops, jet washing and suction cleaning could substantially reinstate paving to 90% efficiency (as per recent experience).	As required
Monitoring	
Initial inspection	Monthly for three months after installation
Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48h after large storms in first six months
Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
Monitor inspection chambers	Annually