Appendix 4: TGMS Feasibility Study Report

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HALLAM LAND MANAGEMENT

A feasibility study and equivalent quality assessment for the relocation of pitches at Woollams Playing Fields, St Albans.

23rd September 2024

TGMS1284.2

Rev 1

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Please note, important: The aim of this report is to appraise the current conditions at the site specified in 'Physical Site Survey' below only. This is not a design document and does not include detailed design or design information and should not be used for this purpose. As such, TGMS accepts no design liability or responsibility for subsequent works based on the information contained within this report.

REVISION RECORD					
Rev	**Date**	**Description**	**Prepared**	**Checked**	**Approved**
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1	18/09/2024	Revision to content	MY	RE	RE
2	23/09/2024	Revision to content	MY	CP	RE

1 EXECUTIVE SUMMARY WOOLLAMS PLAYING FIELDS

KEY: **No action required** **Action may be required** **Action required**

1.1 Site information

	1	**Objective:** To conduct a feasibility study and equivalent quality assessment for the relocation of pitches at Woollams Playing Fields, St Albans.
	2	**Site visit:** A detailed site investigation was conducted on the 16th of April 2024.
	3	**Site location:** The playing fields comprise two main areas – at the northern end are the St Albans School playing fields including the school pavilion. The central and southern areas are used by Old Albanians Sports Association, a community open access club charity, including past school attendees. The existing Woollams Playing fields earmarked for residential development are known as OA's 2, OA's 3 and OA's 4.
	4	**Hydrology:** No watercourses pass through the site. The drainage strategy for the site encompasses deep bored soakaways given the permeable site geology. The standard-period average annual rainfall for 1961 to 1990 (SAAR6190) for this catchment is 682 mm which is below the national average of 855 mm/year.
	5	**Land drainage flow rates:** The predicted drainage rates for the site for both a 6-hour and a 24-hour rainfall event are greater than the greenfield runoff rates, and so the installation of a land drainage system will result in greater flow rates than the greenfield condition.
	6	**Land drainage outfall:** The outfall for the current drained pitches utilises deep bored soakaways given the site is underlain by the Lewes Nodular Chalk Formation. This approach is viable given the various soakaways have been operational since the initial construction. Given the location of the development area is within Zone III (Groundwater Source Protection Zone), a suitable drainage strategy has been developed.
	7	**Flood risk from rivers and seas:** Based on information obtained from the Environment Agency (EA) via gov.uk, the site is in an area of very low risk of flooding from rivers and seas (<0.1%, (<1 in 1000 years)).
	8	**Flood risk from surface water:** Based on information obtained from the Environment Agency (EA) via gov.uk, the site generally has a low risk of surface water flooding (between 0.1% and 1% each year)..
	9	**Landfill:** Based on information obtained from data.gov.uk, the site is not located over a historic or permitted landfill site which could have affected the nature of any remodelling earthworks.
	10	**Groundwater Source Protection Zones:** Based on information obtained from magic.defra.gov.uk, the site is located within Zone III (Total Catchment) of a Groundwater Source Protection Zone Defined as 'This is the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point'. This may restrict the construction of a deep bored soakaway (depending upon geology) as a means of achieving drainage outfall from the site should a more convenient means of water disposal not be available.
	11	**Existing and proposed pitch dimensions and gradients:** The existing pitches have gradients compliant with NGB guidance. For the proposed pitches, cut and fill earthworks operations will be required to bring maximum slopes in line with Sport England guidance. Dimensions of the proposed pitches are equivalent or greater than existing pitch dimensions and the overall useable playing field space has increased by 0.76 ha.
	12	**Pitch orientation:** Sport England (SE) has published guidance on optimum pitch orientation for a range of sports. Both the existing and proposed pitches are within orientation guidance.
	13	**Soil maps:** According to Sheet 1 of the Soil Survey of England and Wales 1:250,000 soil map (1983), the indigenous soil in this area may comprise the 'BATCOMBE' association, described as '*Fine silty over clayey and fine loamy over clayey soils with slowly permeable subsoils and slight seasonal water logging. Some well drained clayey soils over chalk. Variably flinty*'.
	14	**Geology:** Data from the British Geological Survey (BGS) indicate that the majority of both sites has a superficial cover of the Clay-with-flints Formation comprising clay, silt, sand and gravel weathering products formed in the Quaternary and Neogene periods. These overlie the Lewis Nodular Chalk Formation and Seaford Chalk Formation, sedimentary carbonate rock formed in the Cretaceous Period.
	15	**Soil profile pit description:** In summary, the proposed site is characterised by 300 mm of very stoney CLAY LOAM topsoil overlying moderately stoney CLAY subsoil. These soils are associated with poor drainage status which is likely to persist over the winter months when the rate of precipitation exceeds the rate at which water is removed through water infiltration through the pitch surface, or evapotranspiration. Following re-grading earthworks to create the desired pitch gradients, the installation of a land drainage scheme that is designed to intercept rain water at the surface before it has had an opportunity to soak in to the soil profile is recommended.
	16	**Agronomic condition (existing pitches):** Agronomic condition of the existing pitches was generally very good, characterised by excellent ground cover and sward composition with low-level weed content.

		Sward composition was predominantly Perennial Ryegrass (*Lolium perenne spp*.) with some Annual Meadow grass (*Poa annua)* ingress. Levels were excellent with all pitches exhibiting no undulations greater than 20 mm as per Sport England Performance Quality Standards.
	17	**Site usage:** Following pitch construction and the installation of a land drainage system, the proposed natural turf pitch may be able to support 3 to 6 hours of usage per week in the winter (4.5 to 9 hours per week for players 15 years of age and under).
	18	**Performance Quality Standards:** With reference to the PQS assessments, all the natural turf facilities/surfaces comfortably pass all of Sport England's Performance Quality Standards. The cricket square passes guidance as per the ECB TS4 Documents, Recommended Guidelines for the construction, preparation and maintenance of cricket pitches and outfields at all levels of the game.
	19	**Equivalent Quality Assessment:** The proposed quality of the replacement pitches is high and equivalent to the existing provision. Whilst, objectively, the proposed development is audited as equivalent to the existing facilities, the benefit of new pitch construction, most pertinently a new drainage scheme, as is proposed, would be seen as an improvement over the existing drainage scheme give the age of the current system (circa 23 years old). In terms of Exception 4, the following observations can be made in line with policy: 'The area of playing field to be lost as a result of the proposed development will be replaced, prior to the commencement of development, by a new area of playing field': • of equivalent or better quality, and - The proposed development will be of an equivalent quality. • of equivalent or greater quantity, and - The proposed development will be of an equivalent quantity (in terms of pitches, larger in terms of usable area) • in a suitable location, and - The location of the new sports facilities would be considered to be in a suitable location (in close proximity to the maintenance facilities) • subject to equivalent or better accessibility and management arrangements. The client confirms that the management of the pitches will remain with the OASA and to the same or higher standard as the existing pitches.

1.2 Recommendations

Based on the findings from the site assessment, recommended pitch construction works are set out in Section 5 of this report.

1.3 Indicative costs for the development proposals

Indicative cost estimates for the recommended pitch construction works have been shared with the client.

Matt Young – September 2024

2 INTRODUCTION AND OBJECTIVES

TGMS Sports Surface Consultants have been commissioned by Hallam Land Management to investigate the feasibility of developing a natural turf playing field extension to the existing Woollams Playing Fields to accommodate the relocation of pitches from an area identified for potential housing development. The extension will be on arable farmland owned by the The St Albans School Woollam Trust but currently managed by a tenant farmer.

The existing Woollams Playing fields identified by the council in its Reg 19 Local Plan Consultation for residential development were constructed 23 years ago by White Horse Contractors from the same farmland. The construction method was to remove the topsoil, screen to remove stones and then stockpile, cut and fill remodelling to provide gradients in line with NGB guidance, return of stones onto the subsoil formation, return of stockpiled topsoil, installation of a piped drainage scheme, soil amelioration (with sand) and establishment of turfgrass from seed.

In consultation with the client, an indicative layout has been produced by TGMS for the pitch relocation works including indicative development options for the site remodelling, pitch drainage strategy, establishment of turfgrass from seed and maintenance period.

In consultation with Sport England, the development is likely to align with Sport England's Exception 4 policy, which states:

'The area of playing field to be lost as a result of the proposed development will be replaced, prior to the commencement of development, by a new area of playing field':

- of equivalent or better quality, and
- of equivalent or greater quantity, and
- in a suitable location, and
- subject to equivalent or better accessibility and management arrangements.

Therefore, one outline proposal is to be considered for the extension area and compared to the existing provision in the form of an Equivalent Quality Assessment (EQA), necessary for planning purposes.

The objectives of the feasibility study are as follows:

- To review existing topographic and site investigation information to assess existing playing field gradients, levels and dimensions.
- To provide confirmation of the 'usable playing field area' both of the existing playing field and the replacement playing field
- To carry out a 'Performance Quality Assessment' of the existing pitches to ensure replacement pitches are of an equivalent quality or better.
- To conduct a detailed site visit to include assessment of current soil types, agronomic condition and outfall opportunities for the proposed site.
- To provide an indicative development option for comment and consultation. This is to include indicative cut and fill modelling and potential pitch layouts, drainage strategy, establishment of turf grass and maintenance operations.
- To derive indicative construction costs for budgetary purposes.
- To provide an indicative work programme of the proposed construction works

3 PHYSICAL SITE SURVEY

Matt Young and Darren Symonds of TGMS conducted a Performance Quality Standards assessment of the existing natural turf pitches and cricket square on the 16th April 2024. Information relating to the proposed development area has been taken form the initial feasibility report conducted in September 2019. It is pertinent to note that soils characteristics would not have changed from the initial report although pitch construction methodology has changed and therefore more up to date development options will be included.

3.1 Site location

The playing fields comprise two main areas – at the northern end are the St Albans School playing fields including the school pavilion. The central and southern areas are used by Old Albanians. An overview of the site is shown in Figure 2 which also shows the area of playing fields earmarked for redevelopment (Area A) and the arable farmland proposed for development of replacement playing fields (Area B).

Woollams Playing Fields
Harpenden Road
St ALbans
AL3 6BZ

Grid reference (centre of the field).
OS X (Eastings) 515050
OS Y (Northings) 210223

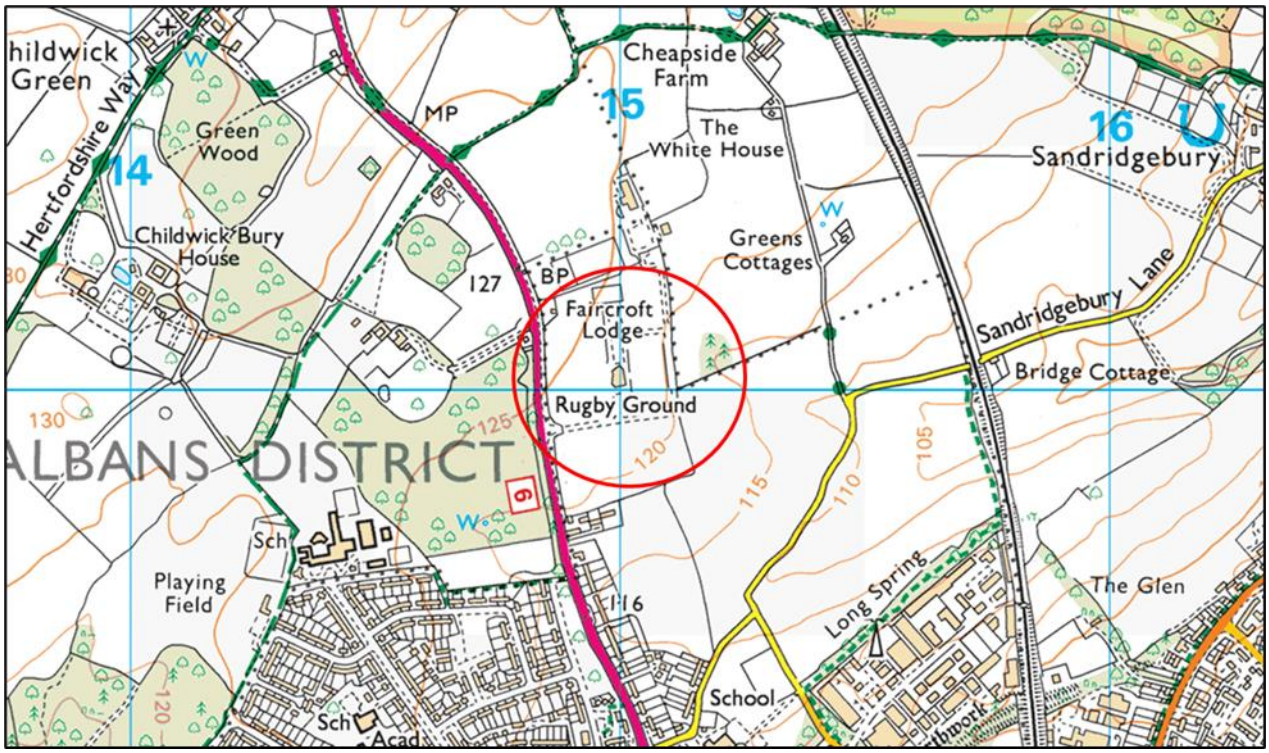

Figure 1 Site location (red circle). Location indicative only and not to scale

The proposed site is bounded by agricultural land to the north and proposed residential developments to the south.

Figure 2 Site locations (indicative; do not scale). The red area is existing playing field that has been identified for potential housing development (Area A). The blue area (Area B) is arable land to be converted to sports use to replace lost playing fields from Area A, referred to in the planning application as Area X. TP1 to TP4 mark the location of the trial pits (Aerial photograph courtesy of Google Earth Pro).

For the purpose of this report and to inform the Equivalent Quality Assessment section, the pitches locations and attributed names can be seen in Figure 3.

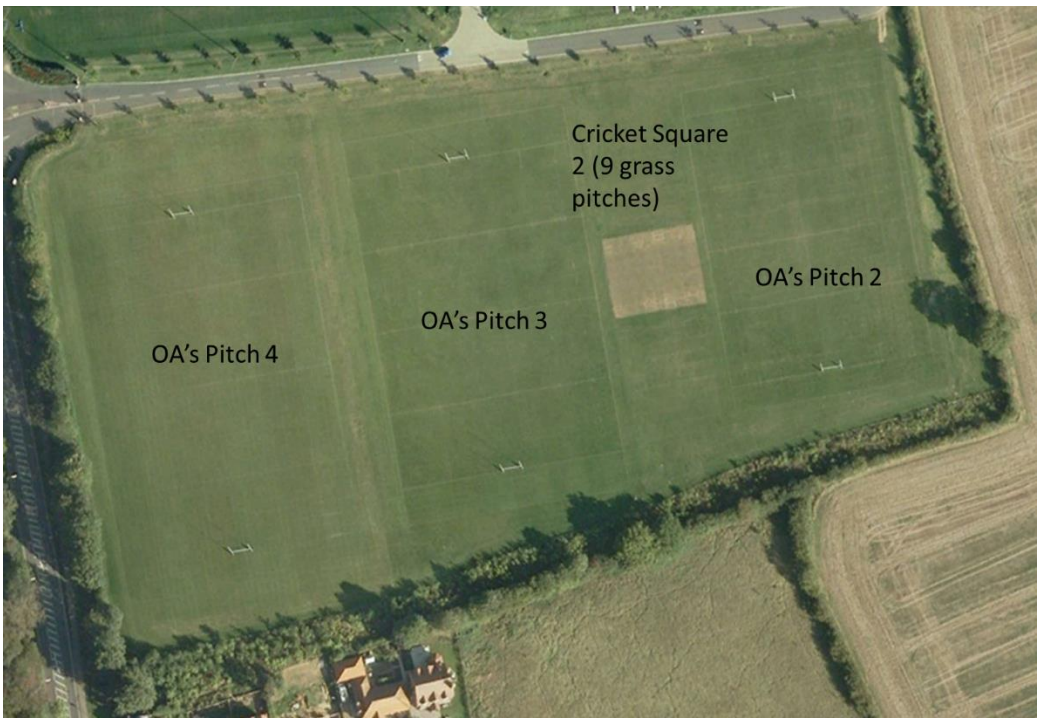

Figure 3 Pitches and cricket square assessed using Sport England's and ECB's Performance Quality Assessments.

Photographs from a walkover survey are presented in Figures 5 to 8.

Figure 4 OA's Pitch 4 looking north

Figure 5 OA's Pitch 3 looking south east

Figure 6 Cricket square overview looking east

Figure 7 OA's Pitch 2 looking south east

Figure 8 Batter slope down from the access road on to Area A illustrating that cut and fill earthworks have taken place

Figure 9 Area B looking north across arable land

Figure 10 Area B looking Northeast

Figure 11 Area B looking Southwestl

3.2 Geomorphology and climate

3.2.1 Hydrology

No watercourses pass through the site. The drainage strategy for the site encompasses deep bored soakaways given the permeable site geology.

Standard period annual rainfall

Climate data obtained from the Flood Estimation Handbook (FEH) indicate that the standard-period average annual rainfall (SAAR) for the catchment is 682 mm which is below the national average of 855 mm/year (Figure 12) and within the second lowest category for the whole of the UK.

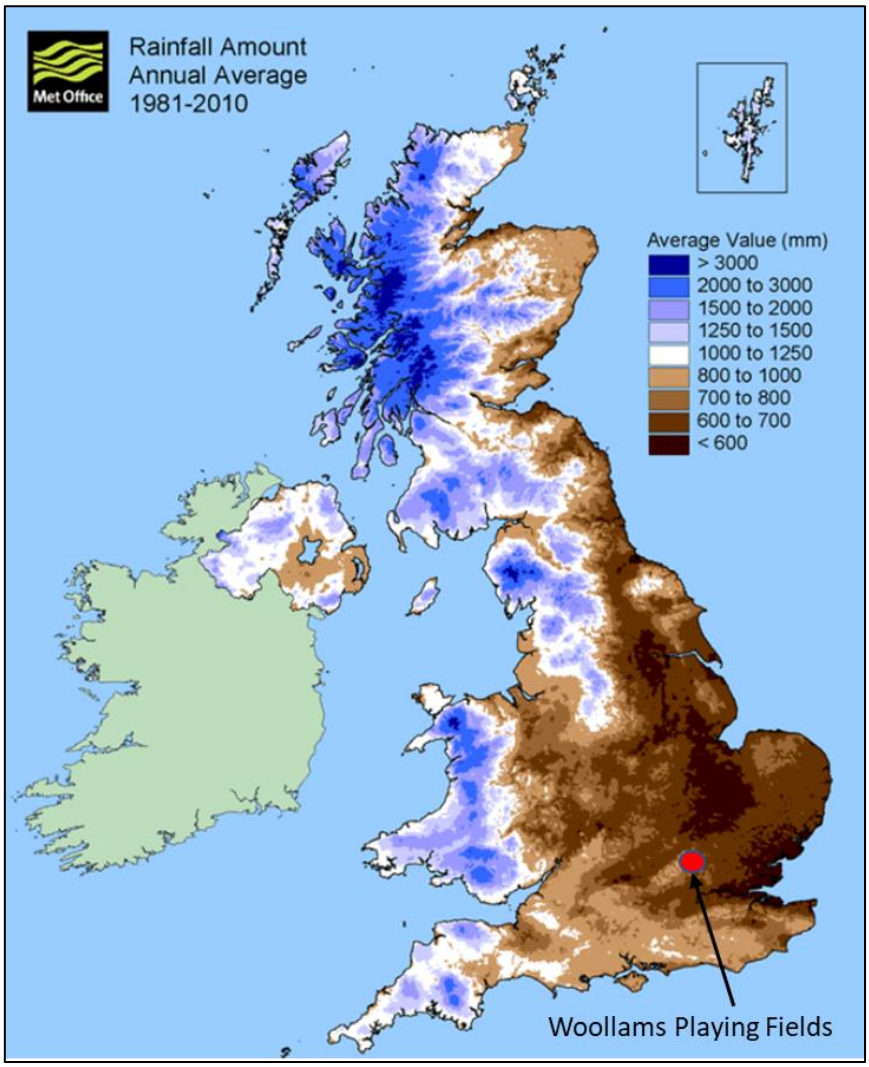

Figure 12 MET office rainfall statistics (1981-2010). Red circle indicates the location of the development area.

Predicted drainage outfall rates.

Drainage outfall rates have been calculated using the ADAS 345 method (Table 1).

Greenfield runoff rates for the site have been calculated using the Flood Estimation Handbook method and are also presented in Table 1. It is important to note that both rates are based on one hectare.

The predicted drainage rates for the site for both a 6-hour and a 24-hour rainfall event are greater than the greenfield runoff rates, and so the installation of a land drainage system will result in greater flow rates than the greenfield condition. It is therefore concluded that additional attenuation maybe required depending on discharge rates and permeability of any deep bored soakaways which is assumed to be the methodology for outfall. Drainage design should account for at least the 1:30 return period outfall rate of 6.8 l/s/ha for the site over a 24-hour period. Further drainage modelling may be required during the design stage depending on any discharge conditions (LLA) or restricted flow rates.

Table 1 Greenfield run off rate (FEH method) and drainage outfall rates (ADAS 345 Method) for the proposed site for 6 hr and 24 hr duration events for the return periods shown.

Return period	Greenfield Runoff Rate (FEH method) (l/s/ha)	Drainage Outfall Rate (6 hr FEH rainfall event) l/s/ha)	Drainage Outfall Rate (24 hr FEH rainfall event) (l/s/ha)
1:1	1.6	2.3	3.1
1:30	4.4	5.5	6.8
1:100	6.1	7.2	8.6

3.2.2 Risk of flooding from rivers and seas

Based on information obtained from the Environment Agency (EA) via gov.uk, the site is in an area of very low risk of flooding from rivers and seas (<0.1%, (<1 in 1000 years)).

3.2.3 Risk of flooding from surface water

Based on information obtained from the Environment Agency (EA) via gov.uk, the site generally has a low risk of surface water flooding (between 0.1% and 1% each year).

Given this information, it should be possible to undertake site remodelling works to address adverse levels and gradient if required.

3.2.4 Landfill

Based on information obtained from environment.data.gov.uk, neither the existing playing fields or proposed development area are located over registered former landfill sites which could affect surface levels or the nature of any earthworks

3.2.5 Groundwater source protection

Based on information obtained from magic.defra.gov.uk, the site is located within Zone III (Total Catchment) of a Groundwater Source Protection Zone (Figure 14). Defined as 'This is the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point'. This may restrict the construction of a deep bored soakaway (depending upon geology) as a means of achieving drainage outfall from the site should a more convenient means of water disposal not be available.

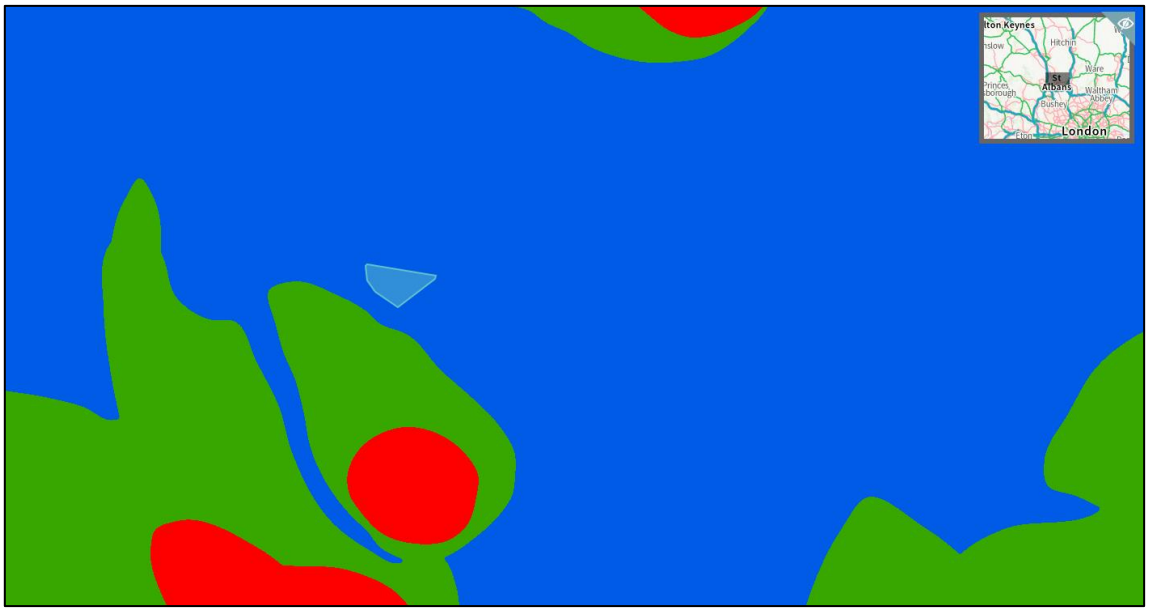

Figure 13 Groundwater source protection zone (Inner Protection Zone)

3.3 Topography (levels)

3.3.1 Existing playing field

Area A has a playing field area of approximately 38,160 m^2 as per Whitehorse Contractors drawing S6-091-P002; in 2001, however the amounts of usable space have decreased due to the planting of trees along the northern edge thus realistically reducing the amount of usable space to approx.. 35,000 m^2, based on aerial imagery.

In the winter layout there are three rugby pitches (Pitch OA's 2, Pitch OA's 3 and Pitch OA's 4) orientated N-S and in the summer a single cricket square and outfield (Cricket 2) with a 9-pitch fine turf square. There is a NW-SE diagonal cross fall of 1.67%, which varies slightly across the plateau but results in a fall of 1.1% in the direction of play and 0.6% across play. Site investigation

determined that micro levels were very good on site and there is evidence of frequent topdressing to maintain levels and surface conditions.

Sport England recommends that the maximum slope along the direction of play should not exceed 1.25% and that the maximum cross-fall should not exceed 2.00%. It is not desirable for both the longitudinal and cross-falls to be at these maximum values. It is evident from the table below that the existing gradients fall within recommended guidance and earthworks remodelling to achieve compliant playing gradients would be considered necessary.

Table 2 Pitch gradients on existing levels.

Pitch	Direction of play (%)	Across play (%)	Orientation
OA's Pitch 2	-1.1%	0.6%	350º
OA's Pitch 3	-1.1%	0.6%	350º
OA's Pitch 4	-1.1%	0.6%	350º
Cricket 2	-1.1%	0.6%	350º

*Green denotes compliance with Sport England's recommended sloped for sports of pitches. Red denotes non-compliance.

3.3.2 Proposed playing field area

Topographic data for existing levels were provided by St Albans School and are shown in Interlocks Surveys Ltd drawing 190296. The field 'Long Croft Spring' comprises an area of approximately 11.61 ha. From the northern end of the field, the land falls from 226.3 m AOD (above Ordnance Datum) approximately NW-SE to 123.0 m AOD at 0.6% and then steepens with a N-S fall of 3.1% to 114.72 m AOD on the southern boundary. Cut and fill earthworks operations will be required to bring maximum slopes in the direction of play to 1.25% as recommended by Sport England. If pitches are orientated N-S as recommended for rugby and cricket (Figure 15), then falls across the pitches are expected to be similar to those in Area A.

3.4 Dimensions (existing and proposed)

3.4.1 Existing dimensions

Dimensions for the existing sports pitches have been taken from aerial imagery, The following pitch dimensions have been observed and presented in Table 3.

Table 3 Pitch dimensions based on Aerial imagery

Pitch	Direction of play (Length m.)	Across play (Length m)	Dead ball area (m)	Safety Margins (m)	Area (m^2, exclude. Safety margin)
OA's Pitch 2	80	60	7	5 (east), 3 (west)	5,640
OA's Pitch 3	92	65	10	5	7,930
OA's Pitch 4	100	70	7	5	7,980
Cricket 2	9 Pitch Cricket Square				

3.4.2 Proposed replacement pitches dimensions, gradients and orientation

TGMS have produced an indicative layout for the replacement pitches in Area B which can be seen in Figure 14. The proposed replacement pitches have been modelled with gradients of 1.0% in the direction of play and 1.25% across play, both gradients of which are compliant with National Governing Body guidance.

Table 4 provides a breakdown of the proposed pitch dimensions which can be compared to existing pitch dimensions contained within Table 3.

Table 4 Proposed pitch dimensions, in goal areas, safety margins and total m^2 of the proposed replacement pitches

Pitch	Direction of play (Length m.)	Across play (Length m)	Dead ball area (m)	Safety Margins (m)	Area (m^2, exclude Safety margin)
Rugby Pitch A	82	60	10	5	6,120
Rugby Pitch B	100	70	10	5	8,400
Rugby Pitch C	95	70	10	5	8,050
Cricket 2	9 Pitch Cricket Square				

*Green denotes compliance with Sport England's recommended sloped for sports of pitches. Red denotes non-compliance

Based on Tables 3 and 4, it is clear that the replacement pitches provide a greater quantity of usable playing surfaces, in the region of 0.76 hectares. The proposed playing field plateau also includes a like for like 9-pitch cricket square plus installation of a non-turf match pitch.

Figure 14 Proposed indicative layout by TGMS providing 3 Nr. replacement rugby pitches and a 9-pitch cricket square plus non-turf match pitch

3.5 Pitch layout and grading

Sport England (SE) has published guidance on optimum pitch orientation for a range of sports (Figure 15). For rugby pitches, this ranges from 285° to 20° in order to mitigate against the effects of low winter sunshine projection. With reference to Figure 14, the proposed pitches are orientated as per Sport England guidance:

The orientation of both the existing and proposed pitches can be seen in the tables below..

Existing Pitches	Orientation (285° to 20°
OA's 2	350°
OA's 3	350°
OA's 4	350°
Cricket Square	350°

Proposed Pitches	Orientation (285° to 20°
Pitch A	345°
Pitch B	345°
Pitch C	345°
Cricket Square	345°

*Green denotes compliance with Sport England/ECB recommended orientation. Red denotes non-compliance

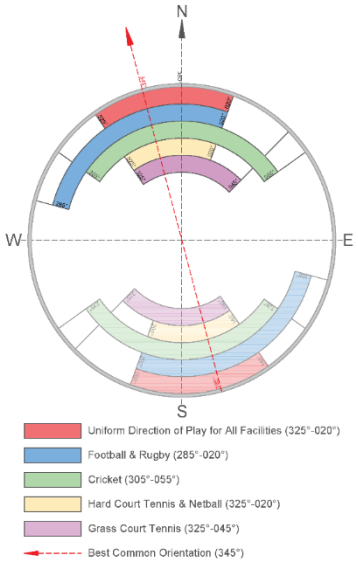

Figure 15 Optimum pitch orientations (Sport England).

3.6 Mapped soils and geology (for the proposed replacement area)

The soil on site was mapped by the Soil Survey of England and Wales and is classified as the BATCOMBE' association, described as '*Fine silty over clayey and fine loamy over clayey soils with slowly permeable subsoils and slight seasonal water logging. Some well drained clayey soils over chalk. Variably flinty'*.

Data from the British Geological Survey (BGS) indicate that the majority of both sites has a superficial cover of the Clay-with-flints Formation comprising clay, silt, sand and gravel weathering products formed in the Quaternary and Neogene periods. These overlie the Lewis Nodular Chalk Formation and Seaford Chalk Formation, sedimentary carbonate rock formed in the Cretaceous Period.

The exception to this is the dell area which comprises sands and gravels of the Kesgrave Catchment Subgroup (Quaternary) overlying the same bedrock.

The bedrock is classified as Principal Aquifer and Area B, but not Area A, is within the Zone III (Total catchment) of a Ground Water Source Protection Zone around a drinking water source to the NE of the site. This means that a direct discharge of drainage water to groundwater via a deep bored soakaway is unlikely to be approved by the Environment Agency and care should be taken to avoid nutrient and pesticide contamination of the groundwater.

3.6.1 Soil sampling

Four soil trial pits (TP1 to TP4, Figure 2) were excavated by hand to characterise the underlying soil profile and to determine water table depth. Soil samples were removed for laboratory analysis to determine soil texture and basic nutrient status. TP1, TP2 and TP3 were excavated in Area B. TP4 was excavated in Area A.

		
Topsoil depth	300 mm	320 mm
Topsoil texture	Clay Loam	Clay Loam (heavily compacted)
Subsoil texture	Stiff Clay becoming mottled indicating a changing water table	Stiff Clay becoming mottled indicating a changing water table
Stones	Very stoney comprising flints and sub-rounded to angular gravel	Very stoney comprising flints and sub-rounded to angular gravel
Thatch content	~ 10 mm	~ 10 mm
Groundwater	None	None
Ground cover	Arable stubble and organic matter	Arable stubble and organic matter
Surface level uniformity	Poor with the site requiring cut and fill remodelling	Poor with the site requiring cut and fill remodelling
Surface gradients	Significant undulation across the site typical of agricultural fields	Significant undulation across the site typical of agricultural fields

	TP3	TP4
		
Topsoil depth	310 mm	200 mm (screened)
Topsoil texture	Clay Loam	Clay Loam converted to Loamy Sand (slightly compacted)
Subsoil texture	Stiff Clay becoming mottled indicating a changing water table	Stiff Clay to a depth of 400 mm
Stones	Very stoney comprising flints and sub-rounded to angular gravel	Stoneless until 500 mm bgl (further excavation was not possible)
Thatch content	~ 10 mm	~ 5 mm
Groundwater	None	None
Ground cover	Arable stubble and organic matter	100% (*Lolium perenne*)
Surface level uniformity	Poor with the site requiring cut and fill remodelling	Excellent
Surface gradients	Significant undulation across the site typical of agricultural fields	Complaint with SE guidance

3.6.2 Soil textural analysis

The results from a soil textural analysis of samples sent to the laboratory are presented in Table 5. The results concur with observations made during the site investigation.

Table 5. Soil texture results (Sand 2.00–0.063 mm; Silt 0.063 mm–0.002 mm; Clay <0.002 mm).

Location	Horizon	Sand (%)	Silt (%)	Clay (%)	Classification	Ph
TP1	Topsoil 0.00 m-0.30 m	20.2	55.7	24.1	CLAY LOAM	6.54
TP4	Topsoil 0.00 m-0.20 m	79.6	14.0	6.4	LOAMY SAND	7.11

3.6.3 Soils summary

In summary, the proposed site is characterised by 300 mm of very stoney CLAY LOAM topsoil overlying moderately stoney CLAY subsoil.

These soils are associated with poor drainage status, which is likely to persist over the winter months when the rate of precipitation exceeds the rate at which water is removed through water infiltration through the pitch surface, or evapotranspiration. Given the presence of stiff Clay, it is likely that these soils will affect the rate at which water can percolate through the profile (i.e., characterised by low hydraulic conductivity). This will tend to encourage the development of saturated conditions

towards the surface following significant rainfall. In extreme situations, this may manifest as surface water ponding which will tend to migrate from higher elevation to lower elevation, accumulating in surface depressions. However, more typically, the soil will become soft and susceptible to structural damage thereby causing excessive wear and tear, and the grass sward will suffer due to poor aeration status (i.e., the soil pores that are normally air-filled become filled with water leading to anaerobic conditions; for grass to thrive, at least 10% of the soil volume should comprise air-filled pores).

It should be noted that the topsoil comprises a high silt content (55.7%). Silt particles have a propensity to migrate through the soil matrix and block larger soil pores that are associated with drainage and aeration unlike sand particles which are too large, or clay particles which, although very small, are electrically bonded to each other thereby creating much larger, stable aggregates. This relatively high silt content will gradually reduce the effective life of any land drainage scheme that is installed, but this can be mitigated to some extent by routine maintenance involving regular (annual) clearing of silt traps.

Following re-grading earthworks to create the desired pitch gradients, the installation of a land drainage scheme that is designed to intercept rainwater at the surface before it has had an opportunity to soak into the soil profile is recommended.

These systems work by using a primary drainage system comprising closely spaced, deep lateral drains combined with a secondary drainage system of closely spaced sand grooves or sand bands that are cut through the surface such that they connect with the primary system below.

A typical arrangement is presented in Figure 16.

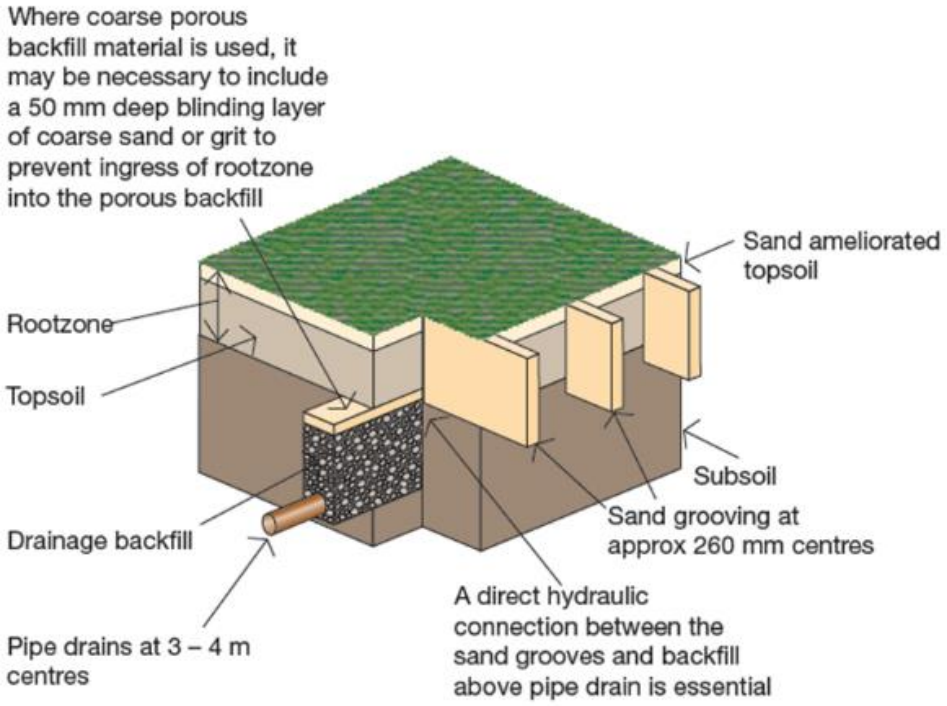

Figure 16 Typical sand groove-based surface by-pass drainage system (Ref: Sport England Design Guidance Note "Natural Turf for Sport", 2011).

3.6.4 Stone Content

Observations made during the initial site visit identified a very high stone content on the surface and within the upper topsoil layer of the development area, as a result of the constant agricultural workings of the site bringing stones to the surface. Stone content comprised primarily sharp-edged

flints and cobbles/pebbles and pose a significant injury risk to users of the facilities if not dealt with properly during the construction phase.

Methods to deal with stones include stone burial, stone removal and topsoil screening, each method has limitations and complete stone removal is neither possible nor practical. As a result, TGMS cannot guarantee within the specification and during construction that sharp edges stones can be removed in their entirety, due to the limited methodology and desire within the industry to achieve stoneless soils with little or no structure.

Significant de-structuring of the soil can occur through intensive stone removal/screening operations, which can inadvertently decrease infiltration rates of the indigenous soil without significant de-compaction works. Due to the methodology for stone buying/picking/screening, only stones over certain dimensions can be effectively buried/removed, often leaving smaller sharp-edged flints on the surface, it is these stones that can cause significant injury in the form of cuts and abrasions.

The only method that will potentially mitigate the risk of stones is the importation of screened topsoil or rootzone (to act as a buffer) to be spread across the entirety of the pitch works once a stone removal operation has taken place (screening), this is an expensive process and costs associated with this operation can be seen in the indicative costs section. Industry standard specifications tend to achieve a stone/sharps free upper 75 mm profile, realistically this could only be achieved with the importation of 50 mm Rootzone carpet plus sand topdressing necessary for secondary drainage protection.

Alternatively, the specification can rely on best endeavours of the contractors to bury or remove stones/sharps outside specification, it cannot be guaranteed however that the upper soil profile will meet specification in terms of stone content

3.7 Existing Drainage infrastructure and outfall

The outfall for the current drained pitches utilises deep bored soakaways given the site is underlain by the Lewes Nodular Chalk Formation.

This approach is viable given the various soakaways have been operational since the initial construction. Given the location of the development area is within Zone III (Groundwater Source Protection Zone), the client must provide clarification as to whether installation of deep bored soakaways is permitted. Any drainage and attenuation design would be reliant on obtaining soakaways infiltration rates to inform the design process.

3.8 Irrigation

Rugby Union is predominantly played in the winter months when precipitation is generally higher and evapotranspiration is at its lowest, however there may be instances during the summer months when supplementary irrigation is required to promote grass plant development in preparation for the beginning of the season. Irrigation would also be considered essential within the 12 months maintenance period if the pitches are to be handed over in time for the beginning of the season.

If the recipient wishes to use the pitches during the winter months, the installation of the suggested drainage schemes would be recommended. However, an intensive drainage system which allows all year-round usage will inevitably lead to droughting off in summer, given little moisture will be retained. Irrigation is therefore considered a pre-requisite to good pitch maintenance in sustaining a healthy sward and mitigating the risk of drainage aggregate settlement (which occurs when clay soils dry out and shrink leading to aggregate settlement within the trenches and consequential disruption to surface levels).

It is strongly recommended that the new playing fields are irrigated. Provision should be made for a pressurised irrigation main supply with hydrant points for travelling irrigators as a minimum. If a permanent system is not included, temporary irrigation will be required during the grow-in process of any new facility.

Evapotranspiration (the combined removal of water from the soil through evaporation and plant transpiration) is likely to peak at around 5 mm/day which, over an 8,000 m^2 playing area (typical rugby pitch), equates to 40 m^3 of water. As a minimum, an irrigation system should be designed to have sufficient water storage or capacity to deliver 70% of this volume in an overnight period of 8 hours (applying water overnight significantly improves water use efficiency because of reduced evapotranspiration, allowing water to soak further into the ground where it can be used more efficiently). This would require 28,000 litres to be applied to return moisture which has been lost from a single pitch.

Any system needs to be capable of delivering the 30 m^3 in an 8-hour window (i.e., ~4 m^3/h) which requires sufficient pump capacity. Note that direct connection of automatic irrigation systems to the mains water supply is illegal and is unlikely to deliver sufficient performance (irrigation systems require 3-5 bar pressure however the pressure of a typical mains water supply is in the range of 1-3 bar).

It is with these points in mind that irrigation has been included for consideration within the feasibility and the client should liaise with a suitably qualified irrigation engineer to identify any appropriate irrigation solutions.

3.8.1 Water sourcing and cost

As an indication, at a water supply cost of £1.91/m^3 (accurate as of April 2024, Thames Water), the cost of 30 m^3 of water would be ~£57.00, therefore in the height of summer, thrice weekly irrigation applications may cost ~£170 per week. If three pitches were to be irrigated, then costs could exceed £500 per week. It is important to note that typically irrigation will only be required during a period of extreme drought and generally from June through August.

3.9 Agronomic condition – Existing pitches

Agronomic condition of the pitches was generally very good, characterised by excellent ground cover and sward composition with low-level weed content. Sward composition was predominantly Perennial Ryegrass (*Lolium perenne spp*.) with some Annual Meadow grass (*Poa annua)* ingress.

Micro-levels were excellent with all pitches exhibiting no undulations greater than 20 mm as per Sport England Performance Quality Standards.

Infiltration testing was carried out using a double ringed infiltrometer, the results of which can be seen in the table below:

Table 5 Infiltration rates of the existing pitches

Pitch	Infiltration rates (mm/hr) using a double ringed infiltrometer
OA's Pitch 2	64
OA's Pitch 3	48
OA's Pitch 4	45

Given the nature of the Loamy Sand topsoil (following sand amelioration at construction) and the presence of a piped drainage scheme supplemented with secondary drainage, infiltration rates would be considered very good, particularly for soil-based pitches. Infiltration rates were a mean of 52 mm/hr, comfortably exceeding Sport England's infiltration benchmark of 5 mm/hr.

More information relating to performance Quality Standards can be found in section 3.11.

Figure 17 Example of infiltration testing using a double ringed infiltrometer (OA's Pitch 4)

3.10 Site usage

The current pitches (AO's 1-3) would be classified as Pipe-drained with slit drains and characteristic of a Type 5 pitch as per Sport England's Design Guidance Notes, Natural Turf for Sport. Type 5 pitches generally provide approximately 3-6 hours of use per week before pitch conditions deteriorate.. Given the age of the primary and secondary system and the fact piped drainage schemes have a longevity of approx. 25-30 years, and secondary sand slits approximately 7-10 years, it is likely that the pitch drainage scheme is nearing end of life (The primary system is approx. 23 years old).

Given the soil characteristics of the development area and the quality of the current pitches (good), any new construction would also benefit from the installation of a Type 5 scheme, such that drainage performance remains optimal and provides the necessary carrying capacity the recipient requires.

Table 6 Sport England estimated usage levels

Drainage status	Adult weekly use* (hours)
Undrained	Under 2
Pipe-drained	2 - 3
Pipe-drained with mole drains	2 - 4
Pipe-drained with sand grooves	3 - 6
Pipe-drained with slit drains	3 - 6
Pipe-drained with topsoil and drainage layer	3 - 6
Pipe and slit drained	3 - 6
Pipe-drained with suspended water table	4 - 6

*The usage levels shown will increase by ~50 % for players 15 years of age and under.

It is therefore concluded that, following pitch construction and the installation of a land drainage system, the proposed natural turf pitches would be able to support 3 to 6 hours of usage per week in the winter (4.5 to 9 hours per week for players 15 years of age and under).

3.11 Performance Quality Standards (PQS)

To inform the design process and to adhere to planning (Exception E4, to ensure replacement pitches are of an equivalent quality or better), it was necessary to audit the condition of the existing pitches and cricket square in line with sport England and ECB Performance Quality Standards (Grounds Management Framework).

Performance Quality Standards (PQS) provide a recommended minimum quality standard for the construction and maintenance of natural turf pitches. PQS were originally developed via a voluntary technical consortium and have now been adopted by Sport England and Governing Bodies of Sport (Ref: Appendix 4 of Natural Turf for Sport, 2000, ISBN 1 86078 103 9 – 2nd Edition, 2011).

Sport England and The ECB has produced a pro forma for summarising the condition of natural turf sports pitches and cricket squares by conducting a Performance Quality Standard assessment and comparing the results for a given site against minimum standards. The results of this assessment are presented in the following tables.

Table 7 Summary of Performance Quality Assessments.

Summary of Performance Quality Standards presented in Appendix I

Client:	Hallam Land Management	Physical Site Survey date:	16th April 2024
Project Title:	A feasibility study for the Construction of natural turf rugby pitches at Woollams Playing Fields		OA's Pitch 2

ELEMENT	LIMITS	METHOD OF TEST	Visit 1
Ground cover %	>70 for SH 25-30 >80 for SH 30-35	BS 7370: P3 A6	✓
Broad-leaved weeds %	<10	BS 7370: P3 A6	✓
Sward height mm	20-60 PS 20-75 SM	BS 7370: P3 A3	✓
Thatch depth mm	<5	BS 7370: P3 A7	✓
Hardness in g	35-200	STRI method of test using a 0.5 kg Clegg Impact Hammer from a drop height of 0.55 m	✓
*Water infiltration rate mm h^{-1}	5	BS 7370: P3 A8	✓
Evenness (2 metre straight edge)	<20 mm	BS 7370: P3 A6	✓
Slope: Direction of play Across play	<1.25% <2.00%	BS 7370: P3 A5	✓
pH value	5.5 – 7.5	ISO 10390	✓
GUIDANCE FOR ROOTZONE LAYER			
Maximum diameter (stones)	<32 mm	Particle Size Distribution	✓

Table 8 Summary of Performance Quality Assessments

Summary of Performance Quality Standards presented in Appendix I

Client:	Hallam Land Management	Physical Site Survey date:	16th April 2024
Project Title:	A feasibility study for the Construction of natural turf rugby pitches at Woollams Playing Fields		OA's Pitch 3

ELEMENT	LIMITS	METHOD OF TEST	Visit 1
Ground cover %	>70 for SH 25-30 >80 for SH 30-35	BS 7370: P3 A6	✓
Broad-leaved weeds %	<10	BS 7370: P3 A6	✓
Sward height mm	20-60 PS 20-75 SM	BS 7370: P3 A3	✓
Thatch depth mm	<5	BS 7370: P3 A7	✓
Hardness in g	35-200	STRI method of test using a 0.5 kg Clegg Impact Hammer from a drop height of 0.55 m	✓

*Water infiltration rate mm h^{-1}	5	BS 7370: P3 A8	✓
Evenness (2 metre straight edge)	<20 mm	BS 7370: P3 A6	✓
Slope: Direction of play Across play	<1.25% <2.00%	BS 7370: P3 A5	✓
pH value	5.5 – 7.5	ISO 10390	✓
GUIDANCE FOR ROOTZONE LAYER			
Maximum diameter (stones)	<32 mm	Particle Size Distribution	✓

Table 9 Summary of Performance Quality Assessments.

Summary of Performance Quality Standards presented in Appendix I

Client:	Hallam land Management	Physical Site Survey date:	16th April 2024
Project Title:	A feasibility study for the Construction of natural turf rugby pitches at Woollams Playing Fields		OA's Pitch 4

ELEMENT	LIMITS	METHOD OF TEST	Visit 1
Ground cover %	>70 for SH 25-30 >80 for SH 30-35	BS 7370: P3 A6	✓
Broad-leaved weeds %	<10	BS 7370: P3 A6	✓
Sward height mm	20-60 PS 20-75 SM	BS 7370: P3 A3	✓
Thatch depth mm	<5	BS 7370: P3 A7	✓
Hardness in g	35-200	STRI method of test using a 0.5 kg Clegg Impact Hammer from a drop height of 0.55 m	✓
*Water infiltration rate mm h^{-1}	5	BS 7370: P3 A8	✓
Evenness (2 metre straight edge)	<20 mm	BS 7370: P3 A6	✓
Slope: Direction of play Across play	<1.25% <2.00%	BS 7370: P3 A5	✓
pH value	5.5 – 7.5	ISO 10390	✓
GUIDANCE FOR ROOTZONE LAYER			
Maximum diameter (stones)	<32 mm	Particle Size Distribution	✓

Table 10 Summary of Performance Quality Assessments (Based on the Grounds Management Framework)

	Summary of Performance Quality Standards			
Client:	Hallam land Management	Physical Site Survey date:		16th April 2024
Project Title:	PQS Assessment of an existing cricket square			
Performance Standard	Method of Test		Quality Standard	
		Standard	**Mark**	**Compliance (Standard or basic or unsuitable)**
A. Herbage				
i) Length of herbage: (a) during the growing season	1	(a) 8 to 12 mm (b) 13 to 18 mm	26 mm	BASIC
ii) Bare area, (at the start of the season) (a) total area	3	(a) Max. 10%	0%	HIGH

(b) diameter of any individual bare area	3	(b) Max. 25 mm	0%	STANDARD
iii) Total ground cover	3	Min. 90%	96%	HIGH
iv) Desirable grass species	3	Min. 80%	90%	HIGH
v) *Poa annua*	3	Max. 15%	10%	HIGH
vi) Other undesirable grass species	3	Nil		HIGH
vii) Weeds - Large-leaved	3	Nil		HIGH
viii) Weeds - Small-leaved	3	Max. 2%	0%	HIGH
ix) Moss	3	Nil	0%	HIGH
x) Algae and Lichen	3	Nil	0%	HIGH
B. Pests and Diseases				
i) Diseases	3	Nil	Red Thread	BASIC
ii) Earthworms	3	Max. 2%	5	BASIC
iii) Pests	3	Nil	Nil	HIGH
C. Profile				
i) Root depth	4	Min. 100mm	75 mm	BASIC
ii) Root Break	4	<75 mm	No	HIGH
ii) Thatch depth	4	Max. Nil	TRACE	HIGH
iii) Rootzone medium	4	Min. 100mm	150 mm	HIGH
iv) Rootzone particles (clay content)	14	Min. 28%	Not tested	Not tested
v) Evenness: 2m straight edge, or 0.5m straight edge	2	Max. variation 8 mm 4mm	5 mm	STANDARD
vi) Gradient: (Fall to be away from the cricket square)	16	1:70 - 1:90	1:110	BASIC

Figure 18 Soil profile from cricket square

Figure 19 Overview of cricket square.

With reference to the PQS assessments, all the natural turf facilities/surfaces comfortably pass all of Sport England's Performance Quality Standards. The cricket square passes guidance as per the ECB TS4 Documents, Recommended Guidelines for the construction, preparation and maintenance of cricket pitches and outfields at all levels of the game.

3.12 4.6 Equivalent Quality Assessment

The Equivalent Quality Assessment is required by Sport England in their consultation on new sports facilities where new playing surface provision is proposed to replace existing provision lost to other developments. An Equivalent Quality Assessment has been conducted for the existing pitches to be lost and the proposed pitch layout as outlined in Figure 14 (Option A).

Parameter	Existing Layout	Proposed Layout	Impact
Dimensions	Usable natural turf area: 35,160 m^2 Formal pitches: 1 x Rugby (100 m x 70 m plus 7 m in goal) 1 x Rugby (92 m x 65 m plus 10 m in goal) 1 x Rugby (80 m x 60 m plus 7 m in goal) 1 x 9-pitch cricket square with minimum 45.72 m boundaries and 2.64 m runoffs	Usable natural turf area: 42,755 m^2 Formal pitches: 1 x Rugby (100 m x 70 m plus 10 m in goal) 1 x Rugby (95 m x 70 m plus 10 m in goal) 1 x Rugby (82 m x 60 m plus 10 m in goal) All pitches to have RFU compliant 5 m runoffs 1 x 9-pitch cricket square with minimum 45.72 m boundaries and 2.64 m runoffs plus non-turf match pitch	
Orientation	N-S	N-S	
Principal Slopes	1.1% in direction of play	1.00% in direction of play	

	0.6% across play (SE compliant)	1.25% across play (SE compliant)	
Minor levels	Excellent	Excellent	
Drainage	Piped drainage scheme	SE Type 5 sand bypass system	
Soil quality	Stone-screened, sand ameliorated clay loam	Stone-screened, sand ameliorated clay loam with a rootzone carpet	
Sward quality	Predominantly desirable perennial ryegrass.	Predominantly desirable perennial ryegrass.	
Maintenance	Maintained to a high standard.	Maintained to a high standard.	
Susceptibility to flooding	Very Low risk of flooding from rivers (Flood Zone 1). Very Low risk of surface water flooding.	Very Low risk of flooding from rivers (Flood Zone 1). Very Low risk of surface water flooding.	

	New is improvement on existing		New is equivalent to existing		New is detrimental cf. existing

Equivalent Quality: The proposed quality of the replacement pitches is high and equivalent to the existing provision

Whilst, objectively, the proposed development is audited as equivalent to the existing facilities, the benefit of new pitch construction, most pertinently a new drainage scheme would be seen as an improvement over the existing drainage scheme give the age of the current system (circa 23 years old).

In terms of Exception 4, the following observations can be made in line with policy:

'The area of playing field to be lost as a result of the proposed development will be replaced, prior to the commencement of development, by a new area of playing field':

- of equivalent or better quality, and - The proposed development will be of an equivalent quality.
- of equivalent or greater quantity, and - The proposed development will be of an equivalent quantity (in terms of pitches, larger in terms of usable area)
- in a suitable location, and - The location of the new sports facilities would be considered to be in a suitable location (in close proximity to the maintenance facilities)
- subject to equivalent or better accessibility and management arrangements. The client confirms that the management of the pitches will remain with the OASA and to the same or higher standard as the existing pitches.

3.13 Other items

Issues which can arise from natural grass pitch construction can be summarised as follows:

- **Services** – It is recommended that the client obtains up to date service plans of the site prior to any development works. Please note that the presence of services may inhibit the scope of works. This is particularly pertinent for site re-modelling and land drainage works.
- **Planning permission** – Where cut and fill remodelling earthworks and the installation of a land drainage scheme are required, it may be prudent to obtain guidance from the local planning department as to whether planning permission is necessary.
- **Irrigation** – The construction of natural grass pitches relies on optimal weather conditions to aid germination and grass plant establishment. In some cases, when construction is carried out in summer and during droughty conditions, supplementary irrigation may be required, the costs of which should be factored into the budget. It is the responsibility of the Client to provide sufficient irrigation during the duration of project construction phase and subsequent initial maintenance phase.
- **Irrigation (following handover)** – It is important that the recipient of the pitch understands that in the absence of irrigation, pitch conditions will deteriorate with a potential loss of ground cover and an increase in hardness (more so in summer). Pitch drain runs may also settle as the surrounding clay soils shrink. Invariably, the grass will return following sufficient precipitation however supplementary irrigation may be required should drought conditions persist.
- **Outfall** – When discharging into existing drainage infrastructure, natural water courses/ditches or through deep bored soakaways, it may be necessary to obtain the relevant permissions including discharge consents and/or land drainage consent from the Environment Agency, landowner or lead local flood authority. These procedures can significantly delay proceedings and prior investigation may be necessary at feasibility stage. It is the responsibility of the Client to obtain the appropriate consents.
- **Cut and fill earthworks** – Cut and fill involves significant earthmoving using large plant machinery e.g. dozers, excavators and dumper trucks. The nature of the works inevitably destroys the natural soil structure (cracks, fissures, worm holes and root holes) that has built up over many years resulting in a significant reduction in drainage rates. Differential settlement is also not uncommon. Following cut and fill remodelling earthworks, the installation of a drainage scheme will be necessary in order to mitigate the effect of the earthworks on natural drainage rates.
- **Maintenance scheme** – For any natural turf pitch development, it is essential that a well-structured, intensive maintenance programme is implemented to maintain the pitch(es) following construction. Failure to implement the recommended maintenance schedule will result in a deterioration of pitch condition and subsequent reduction in availability for use. A generic agronomic maintenance programme is presented in Appendices I.
- **Settlement of drain lines** – Land drains can be prone to settlement as the soil surrounding the drainpipe dries out and shrinks (perfectly normal in new constructions). Whilst topping up drain lines is usually covered by the Contractor during the first 12-months following construction, it is possible that drains may continue to sink to some extent after this time. Therefore, there should be some allowance within the maintenance programme to ensure that drain lines are kept topped up and overseeded.

4 SUMMARY AND RECOMMENDATIONS

1. **Objective:** To conduct a feasibility study and equivalent quality assessment for the relocation of pitches at Woollams Playing Fields, St Albans.

2. **Site visit:** A detailed site investigation was conducted on the 16th of April 2024.

3. **Site location:** The playing fields comprise two main areas – at the northern end are the St Albans School playing fields including the school pavilion. The central and southern areas are used by Old Albanians Sports Association, a community open access club charity, including past school attendees. The existing Woollams Playing fields earmarked for residential development are known as OA's 2, OA's 3 and OA's 4.

4. **Hydrology:** No watercourses pass through the site. The drainage strategy for the site encompasses deep bored soakaways given the permeable site geology. The standard-period average annual rainfall for 1961 to 1990 (SAAR6190) for this catchment is 682 mm which is below the national average of 855 mm/year.

5. **Land drainage flow rates:** The predicted drainage rates for the site for both a 6-hour and a 24-hour rainfall event are greater than the greenfield runoff rates, and so the installation of a land drainage system will result in greater flow rates than the greenfield condition.

6. **Land drainage outfall:** The outfall for the current drained pitches utilises deep bored soakaways given the site is underlain by the Lewes Nodular Chalk Formation. This approach is viable given the various soakaways have been operational since the initial construction. Given the location of the development area is within Zone III (Groundwater Source Protection Zone), a suitable drainage strategy has been developed.

7. **Flood risk from rivers and seas:** Based on information obtained from the Environment Agency (EA) via gov.uk, the site is in an area of very low risk of flooding from rivers and seas (<0.1%, (<1 in 1000 years)).

8. **Flood risk from surface water:** Based on information obtained from the Environment Agency (EA) via gov.uk, the site generally has a low risk of surface water flooding (between 0.1% and 1% each year).

9. **Landfill:** Based on information obtained from data.gov.uk, the site is not located over a historic or permitted landfill site which could have affected the nature of any remodelling earthworks.

10. **Groundwater Source Protection Zones:** Based on information obtained from magic.defra.gov.uk, the site is located within Zone III (Total Catchment) of a Groundwater Source Protection Zone (Figure 14). Defined as 'This is the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point'. This may restrict the construction of a deep bored soakaway (depending upon geology) as a means of achieving drainage outfall from the site should a more convenient means of water disposal not be available.

11. **Existing and proposed pitch dimensions and gradients:** The existing pitches have gradients compliant with NGB guidance. For the proposed pitches, cut and fill earthworks operations will be required to bring maximum slopes in line with Sport England guidance. Dimensions of the proposed pitches are equivalent or greater than existing pitch dimensions.

12. **Pitch orientation:** Sport England (SE) has published guidance on optimum pitch orientation for a range of sports. Both the existing and proposed pitches are within orientation guidance.

13. **Soil maps:** According to Sheet 1 of the Soil Survey of England and Wales 1:250,000 soil map (1983), the indigenous soil in this area may comprise the 'BATCOMBE' association, described as '*Fine silty over clayey and fine loamy over clayey soils with slowly permeable subsoils and slight seasonal water logging. Some well drained clayey soils over chalk. Variably flinty*'.

14. **Geology:** Data from the British Geological Survey (BGS) indicate that the majority of both sites has a superficial cover of the Clay-with-flints Formation comprising clay, silt, sand and gravel weathering products formed in the Quaternary and Neogene periods. These overlie the Lewis Nodular Chalk Formation and Seaford Chalk Formation, sedimentary carbonate rock formed in the Cretaceous Period.

15. **Soil profile pit description:** In summary, the proposed site is characterised by 300 mm of very stoney CLAY LOAM topsoil overlying moderately stoney CLAY subsoil. These soils are associated with poor drainage status which is likely to persist over the winter months when the rate of precipitation exceeds the rate at which water is removed through water infiltration through the pitch surface, or evapotranspiration. Following re-grading earthworks to create the desired pitch gradients, the installation of a land drainage scheme that is designed to intercept rain water at the surface before it has had an opportunity to soak in to the soil profile is recommended.

16. **Agronomic condition (existing pitches):** Agronomic condition of the existing pitches was generally very good, characterised by excellent ground cover and sward composition with low-level weed content. Sward composition was predominantly Perennial Ryegrass (*Lolium perenne spp*.) with some Annual Meadow grass (*Poa annua)* ingress. Micro-levels were excellent with all pitches exhibiting no undulations greater than 20 mm as per Sport England Performance Quality Standards.

17. **Site usage:** Following pitch construction and the installation of a land drainage system, the proposed natural turf pitch may be able to support 3 to 6 hours of usage per week in the winter (4.5 to 9 hours per week for players 15 years of age and under).

18. **Performance Quality Standards:** With reference to the PQS assessments, all the natural turf facilities/surfaces comfortably pass all of Sport England's Performance Quality Standards. The cricket square passes guidance as per the ECB TS4 Documents, Recommended Guidelines for the construction, preparation and maintenance of cricket pitches and outfields at all levels of the game.

19. **Equivalent Quality Assessment**: The proposed quality of the replacement pitches is high and equivalent to the existing provision

    Whilst, objectively, the proposed development is audited as equivalent to the existing facilities, the benefit of new pitch construction, most pertinently a new drainage scheme would be seen as an improvement over the existing drainage scheme give the age of the current system (circa 23 years old).

    In terms of Exception 4, the following observations can be made in line with policy:

    'The area of playing field to be lost as a result of the proposed development will be replaced, prior to the commencement of development, by a new area of playing field':

- of equivalent or better quality, and - <u>The proposed development will be of an equivalent quality</u>.
- of equivalent or greater quantity, and - <u>The proposed development will be of an equivalent quantity (in terms of pitches, larger in terms of usable area)</u>
- in a suitable location, and - <u>The location of the new sports facilities would be considered to be in a suitable location (in close proximity to the maintenance facilities)</u>
  subject to equivalent or better accessibility and management arrangements. <u>The client confirms that the management of the pitches will remain with the OASA and to the same or higher standard as the existing pitches.</u>

5 DEVELOPMENT OPTIONS

The objective of the feasibility study was to assess the site's current conditions and provide recommendations for the development of natural turf rugby pitches for The Woollams Trust.

The indicative layout comprises three natural turf rugby pitches of assorted sizes and a 9-pitch natural turf square plus non-turf match pitch.

The development options focus on providing natural turf sports pitches which can perform in winter (e.g., rugby) during inclement weather conditions and provide the necessary carrying capacity for the rugby club.

Based on the topographical nature of the development area, cut and fill remodelling earthworks will be required to provide pitch gradients in line with Sport England/RFU and ECB recommended slopes for sports pitches guidance. Cut and fill earthworks, and in particular the movement of plant machinery, impacts negatively on soil structure through construction compaction, imparting stress on the soil which causes densification and displacement of air from the pores between the soil particles which would normally be associated with air and water movement. When soils are compacted, the water infiltration rate is reduced which can result in saturated surface conditions, increased wear and tear and a large decrease in carrying capacity and usability of the pitches. To alleviate the effect of these issues, it is industry practice to install a primary and supplementary secondary drainage scheme (as a minimum in the footprint of winter sports pitches) to intercept surface water as efficiently as possible and convey it to a piped system below the surface and away to a point of outfall.

TGMS has monitored pitch installations which have been constructed through cut and fill earthworks in the absence of drainage. In our experience, the pitches have never performed well and have often been unplayable for large periods of time (weeks to months) particularly during winter. The likely issues to be encountered following pitch construction through cut and fill earthworks in the absence of drainage are as follows:

- Waterlogged playing conditions following spells of inclement weather. Saturated surface conditions will take far longer to return to playable surface conditions in the absence of a land drainage scheme, compared with pitches that incorporate an efficient drainage system.

- Increased susceptibility to wear and tear which is exacerbated by poor drainage status, leading to de-structured surface conditions (mud) and very poor playability.

- Potential ingress of undesirable grass species due to favourable surface conditions (wet).

- Loss of surface levels due to soil de-structuring, a reduction and shear strength, and low traction.

It is important to note that soil structure will improve over time through shrink swell of the soils creating cracks and fissures, plus faunal movement i.e., earthworms, however for pitches to re-develop sufficient soil structure in order to drain efficiently in the absence of drainage scheme may take years, if not decades.

Therefore, the following development option is recommended for the construction of the natural turf sports pitch.

Please note: the following is not a detailed design specification; these are options for consideration at the feasibility stage. TGMS will only warrant a full design specification following the production of a specification of method, materials, and performance outcomes.

5.1.1 Recommendation: Site remodelling, installation of a primary drainage system @ 5 metre centres plus the installation of a secondary bypass scheme (sand bands).

The works for the sports pitches (rugby pitches) would comprise the following**:**

1. **Vegetation clearance-** Removal of existing grass and vegetation
2. **Earthworks to provide gradients in line with NGB guidance** – Topsoil strip, associated earthworks and topsoil return.
3. **Stone removal** – in situ stone works e.g., stone burying/soil screening.
4. **Installation of a pipe drainage scheme at 5 metre centres** – Total Plateaux, outfall to be confirmed by client (land drainage consents will be required and should be obtained by the client).
5. **Installation of secondary drainage** – installation of sand bands at 0.5 metre centres (Koro Top Drain or similar), pitch areas only.
6. **Rootzone carpet** - 50 mm rootzone buffer carpet due to high stone content of Site Won topsoil (pitch areas and run offs only).
7. **Final cultivations** – to produce a suitable tilth and to restore levels**.**
8. **Establishment of a new grass sward from seed (including seeding and fertiliser)** – it is recommended that a suitable 100% Rye Grass seed is used.
9. **Application of sand topdressing** – to maintain hydraulic connectivity with the drainage scheme.

5.1.2 Recommendation: 12-months maintenance post-construction

Following construction, on-going maintenance will be required for the first 12-months to run concurrently with the Defects Liability period. This will include the following items:

- Mowing.
- Fertiliser application.
- Compaction alleviation (e.g., Verti-draining).
- Selective weed control (as required).
- Pest and disease control (as required).
- Overseeding (as required)

5.1.3 Irrigation

The proposed drainage option would be considered intensive. As a consequence, the pitches will be susceptible to periods of drought, manifest as loss of grass cover, harder pitch surfaces and drainage settlement (as the clay soils dry and shrink). The ability to irrigate the pitches would be considered extremely beneficial as alluded to in Section 3.8.

Whilst a fully automatic pop-up system is not likely to be viable given the capital cost, the club should explore the possibility of installing water points at the ends of pitches to enable connection to self-propelled travelling sprinklers. TGMS have not provided indicative costs for irrigation given the amount of alternative market options. TGMS would recommend that the client liaise with an irrigation consultant to ascertain the options available including any storage tanks required.

5.1.4 Cricket square construction

Based on the findings from the site investigation, the following works are recommended: It should be noted that the works and costs detailed below relate to the construction of a 9-pitch natural grass cricket square (approx. 686 m^2) plus non-turf match pitch.

The works for the cricket square would comprise the following:

1. **Earthworks** – Undertake earthworks to create new surface levels, consolidate sub-base for the importation of cricket loam.
2. **Drainage** – Installation of a ring drain surrounding the new cricket square linked to the pitch drainage schemes.
3. **Cricket Loam** – Importation of 150 mm approved cricket loam in layers not more than 50 mm and keyed into sub-base.
4. **Consolidate** – Consolidate levels and grade to meet final surface requirements.
5. **Prepare seed bed** – Cultivate, pre-seed fertiliser application and seed with sports specific perennial ryegrass.
6. **Installation of a water supply** – it is imperative that a working water supply is installed adjacent to the cricket square to allow for safe preparation of the cricket square for use. In the absence of water, cricket square performance can be dangerous. The water supply must be a WRAS Category 5 compliant irrigation system.

This method of construction will ensure that the new cricket square is slightly proud of the outfield facilitating the movement of excess water onto the surrounding outfield. The new cricket square will be feathered into the surrounding outfield to ensure no excessive gradients are present which can affect performance and bowler run up.

5.1.5 12-months maintenance post-construction (cricket square)

Following construction, on-going maintenance will be required for the first 12-months to run concurrently with the Defects Liability Period. This will include the following items:

- Mowing.
- Fertiliser application.
- Selective weed control (as required).
- Pest and disease control (as required).
- Verti-cutting
- Spiking
- Overseeding
- Topdressing
- Rolling
- Scarification

6 INDICATIVE WORK PROGRAMME

With respect to timescales for completing the project, it is recommended that pitch construction works are only completed under suitable ground and weather conditions to avoid excessive compaction and smear. For the natural turf areas, grass is ideally sown in spring or early autumn to maximise the balance between moisture and temperature.

The grass must be allowed to establish a healthy and deep root network and mature canopy to resist the stresses applied during play. The date for start of play for the pitch is highly dependent on weather conditions during the construction phase and growing-in period, more so in the absence of supplementary irrigation.

An indicative work programme is presented below.

Natural turf pitches	**Year 1**												**Year 2**											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Mobilisation of the specialist pitch contractor																								
Earthworks including topsoil strip and cut and fill																								
Primary drainage installation																								
Secondary drainage installation																								
Light cultivation and grading																								
Application of rootzone carpet																								
Fertiliser application and seeding																								
Reinstatement of damage																								
12 months of initial maintenance																								
Pitch ready for use																								
Cricket Square Construction																								
12 months of initial maintenance																								
Cricket Square ready for use (April Year 3)																								

7 IMPLICATIONS OF WORKS ON FUTURE MAINTENANCE, LONGEVITY AND USAGE

7.1 Maintenance issues

- Land drains can be prone to differential settlement (i.e. there can be some sinkage over the drain lines) as the soil surrounding the drain pipe dries out and shrinks; this is perfectly normal in new constructions. Whilst topping up drain lines is usually covered by the Contractor during the first 12-months following construction, it is possible that drains may continue to sink to some extent after this time. Therefore, there should be some allowance within the maintenance programme to ensure that drain runs are kept topped up.
- In general terms, a maintenance budget of ~£10 k / senior pitch is normally required to maintain the facility in good condition. This figure includes an allowance for annual sand topdressing.
- A routine maintenance schedule is appended (Appendix I)

7.2 Drainage system longevity

- Whilst only a guide, the piped drainage system should have an operational lifespan of approximately 20 years if well maintained (e.g. silt traps regularly inspected and emptied, and collector drains flushed).
- If managed well (i.e. annual sand topdressing) and not over-used (please see Item 8.3 below), sand bands beneath a rootzone carpet should have an operational lifespan of 10 years (dependent on the rate of silt ingress from the surrounding soil).

7.3 Usage

- For Option 1, provided that the site is well maintained, the type of drainage system proposed for this site should allow 3 – 6 hours of use / week / pitch (4 ½ to 9 hours for U15s) on average without causing detriment to the grass sward or soil structure. In very wet conditions, usage may be less than this.

8 OUTLINE PROJECT RISK ASSESSMENT

The following risks to the project should be considered:

1. **Weather:** Good dry weather during construction is essential for project progress. This is particularly sensitive once the vegetation has been removed and the topsoil has been stripped.
2. **Timeliness and quality of construction:** It is important that the specialist pitch contractor appointed has the scale of operation and capacity to deliver this project on time and to the requisite high quality. A premium for highly experienced, well-equipped contractors must be valued in the tender process. Cost should not be the only consideration.
3. **Drain line sinkage and establishment challenges:** Whenever piped drainage is installed there are challenges with settlement of the permeable drain back fill and getting grass to establish in the drain runs. Settlement occurs due to a combination of shrinkage of the surrounding soil on drying and natural settlement of the permeable backfill with time, and so construction method and monitoring of the contractor are essential. Grass establishment problems along the drain runs can occur because the backfill materials are freely draining (so that the drains function) and therefore do not retain much water and also readily leach nutrients. This is mitigated to an extent at the design stage by the specification of the construction method for mixing some topsoil into the tops of the drains, but this approach is dependent upon the inclusion of a secondary drainage scheme. Watering and fertiliser applications along the drain runs during establishment may be required during periods of drought.
4. **Spoil:** Spoil from the drainage installation shall be disposed of off-site unless the Client would prefer on-site disposal as a cost-cutting measure.
5. **Ongoing operational finance:** The Client should carefully consider the maintenance demand (in terms of time, skill and cost) for the proposed surfaces.

9 CONFIDENTIALITY

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11 APPENDICES

11.1 Appendix I: Outline Maintenance Recommendations

Mowing. The grass shall be maintained at a height of 30 using cylinder mowing equipment. The grass should never be allowed to exceed a height of 50 mm. If the grass does become too long, the height of cut should be reduced gradually over 3 – 4 cuts allowing some time for recovery in between. N.B. On no account should the grass height be reduced by more than 50% on any one occasion. Overall, approximately 30 mowing operations may be required each year, depending on weather and growing conditions.

Fertiliser application. Allowance should be made for a sufficient number of fertiliser applications to maintain healthy growth and colour. The fertiliser regime should be based on the results of annual soil sampling to determine nutrient concentrations, but the following programme is provided as a guide:

- April 12:6:6 at 350 kg/ha
- September 5:5:20 at 350 kg/ha

Fertiliser shall be applied with appropriate equipment that ensures a uniform distribution.

Weed control. Apply a selective herbicide in the spring (if required) to combat the weeds present. This to be applied at least two weeks after the first fertiliser treatment (April) and at a time when grass growth is strong and healthy. NB. Do not apply herbicide during periods of potential turf stress, i.e. if the weather is hot and dry or if frosts are forecast. Apply herbicide strictly according to the manufacturers label recommendations and only by suitably qualified personnel.

Pesticide/Fungicide [If required]. A pesticide/fungicide application may be required should disease be present within the grass sward. An approved fungicide should be used with activity against the pathogens present and be applied following the manufacturers label recommendations by suitably qualified personnel.

Aeration / Compaction Alleviation. Verti-drain (or other similar de-compaction treatment) the pitches on at least two occasions in the spring and autumn. Use 18 mm diameter solid tines working to a minimum depth of 200 mm below the surface set to provide some heave. Verti-draining must not be carried out if ground conditions are too soft or during frost.

Additional aeration treatments (e.g. slitting or spiking) during the playing season would also be highly beneficial to maintain surface drainage rates. These treatments should only be undertaken when ground conditions are suitable.

Sand topdressing. Supply and spread an approved medium-fine sand suitable for sports use during the renovations period at the rate of 85 t/ha. After each application, the sand should be worked into the surface with brushes or drag mats. Given the presence of the rootzone carpet, this may not be required until Year 4.

Overseeding. Overseed the pitches and safety margins as required at the application rate of approximately 200 kg/ha immediately after the end of season renovation. Use at least three cultivars of perennial ryegrass chosen form the latest Turfgrass Seed booklet with live ground cover and visual merit ratings of 6.5 or more. Make at least two passes with seeding equipment designed to place the seed approximately 5 mm below the surface.

Harrowing [Playing season as required]. To maintain surface levels, it is recommended to chain harrow / drag mat the pitches as opposed to flat rolling which tends to compact the pitch surface and exacerbate undulations. This should only be undertaken under suitable ground conditions.

Divot repair [Playing season]. After each match, divot and tread the divots back into position. This will remove any bare soil which allows weeds and weed grasses to germinate. Filling in divots with seed/soil mix will help to maintain better grass coverage.

Renovation of worn areas [Playing season]. Areas of high wear should be dressed and seeded using a divot repair mix (seed/rootzone) during the playing season as required in order to maintain good grass cover. These areas should be hand watered (if necessary) to ensure rapid grass germination and establishment.

Line Marking [Playing season]. Line marking should be undertaken on a weekly basis during the playing season.

Goal post safety. The posts should be regularly checked for damage and re-painted / re-paired as necessary following the manufacturer's guidance.