# Heyford Free School

## Proposed Sports Facilities Existing Condition Survey Report (REV.3)



GLDM
Suite 1
1 Aubrey Street
Hereford HR1 2NL
Tel: 07816 226496

**HEYFORD FREE SCHOOL**

**PROPOSED SPORTS FACILITIES**

**EXISTING CONDITION SURVEY REPORT**

**Client:** Waterman Group / Dorchester Living

**Site:** Ex. Upper Heyford Airfield
Camp Road
Upper Heyford
Oxfordshire OX25 5HD

**Project:** Proposed Sports Facilities
Heyford Free School

**Report Prepared by:** GLDM
1 Aubrey Street
Hereford HR4 0BU
Tel: 07816 226496
E-mail: info@gldm.co.uk
www.gldm.co.uk

**Authors:** H W Giddens, Partner GLDM
S. L. Giddens, Partner GLDM
J. Flannery, Associate Chartered Geologist
N. C. Moore, Associate Quantity Surveyor GLDM

**Date:** March 2015

***Disclaimer***



*Information contained within the report is based upon preliminary appraisal of the identified areas. Proposals for subsequent project development must be based upon detailed specifications and agreement with relevant statutory agencies and therefore the nature and extent of works referred to within the report may be subject to alteration.*

**Attention is drawn to the following notes which should be read in conjunction with this report, which has been prepared for the exclusive use of the Client for the specified purpose described.**

1. The comments, opinions and recommendations made in this report are based upon the information obtained during the investigation. Conditions not revealed by the investigation may exist, for example between trial hole positions, or there may be special conditions appertaining to the site caused by historical patterns of use or influence, for which no responsibility can be taken.

2. Where comments are made concerning the correlation between trial holes, recorded material types or the strata below the maximum depth of the investigation, this is for guidance only and liability is not accepted for its accuracy. Commentary is based upon visual recording and examination. No structural integrity testing was undertaken.

3. The commentary upon trial hole investigation included within this report have been prepared following visual inspection of the samples obtained, and where possible, reference to published geological information and have been modified in the light of on site and off site appraisal.

4. Unless otherwise stated, standard hand excavation techniques have been employed to examine upper margins of soil profiles. Although normally satisfactory information is obtained, some mixing of layered or interbedded soils occurs, an unavoidable loss of ''fines'' from granular soil takes place, and ''rock'' and ''construction'' or ''builders waste'' is identified usually only from small fragments.

5. Comments upon groundwater conditions and permeability rates are based upon the conditions and samples revealed by the investigation at that time. Ground water levels are subject to seasonal variations, local drainage changes, and abnormal climatic conditions, which may also affect the engineering and permeability characteristics of the ground.

6. 

**CONTENTS**

**1.0 INTRODUCTION**

**1.1** The extent of this report is to undertake the scope of assessment implied within the Condition 5 a (i) of Cherwell District Council Planning Approval Notice (Application No; 13/00343/F Date of Decision 27th June 2014), which relates to the provision of a range of external sports facilities for the Heyford Free School. The Applicant / Agent on the Planning Approval Notice declared as The Heyfordian School Trust (c/o Pegasus Group Ltd).

**1.2** The Condition 5 a (i) requires a detailed assessment of ground conditions (including drainage and topography) of the land proposed for the playing field which identifies constraints which could affect playing field quality.

**1.3** The Condition 5 contains further comment related to the consideration of the assessment provided under 5 (i) and states:-

(ii) Based upon the results of the assessment to be carried out pursuant to (i) above, a detailed scheme which ensures that the playing field will be provided to an acceptable quality. The scheme shall include a written specification of soils structure, proposed drainage, cultivation and other operations associated with grass and sports turf establishment and a programme of implementation.

**1.4** The condition 5 also includes reference to the scheme for the school playing field facilities needing to be compliant with the relevant industry technical guidance, including guidance published by Sport England, National Governing Bodies for Sport (NGB's), with particular attention being drawn to 'Natural Turf for Sport' (Sport England 2011) and Comparative Sizes of Sports Pitches and Courts.

**1.5** This report contains generic commentary on the principles to be adopted when considering the extent of work required to refurbish the facilities to the standards referred to under the definitions stated within Condition 5 (ii), and is based upon preliminary appraisal of the identified areas. Proposals for subsequent project development must be based upon detailed specifications and agreement with relevant statutory agencies and therefore the nature and extent of works referred to within the report may be subject to alteration.

**1.6** The site was originally visited on 17th February 2015 by H Giddens and S.L. Giddens, Partners from GLDM. Weather conditions were dry and sunny with a recorded air temperature of $8^0$ C ($46^0$ F).

**2.0 SITE CONTEXT AND STUDY AREAS**

**2.1** The former RAF Upper Heyford air base (known as Heyford Park) lies approximately 4.5 miles North West of Bicester and approximately 2 miles from Lower Heyford. The former airbase is on an exposed plateau above the Cherwell Valley and is served by a rural road network.

**2.2** The site lies within the Cotswold's Regional Character Area assessment. This landscape type is characterised by a high limestone plateau with a distinctive elevated and exposed character, broad skies and long-distant views. Large-scale arable fields dominate the landscape, with some medium-sized plantations partially obscuring the otherwise open views.

**2.3** The former RAF Upper Heyford air base contains a large number of previous military buildings and associated runways and hard standings within the technical area on the airfield north of Camp Road. To the south of Camp Road lies the former main residential housing area, supermarket, school, petrol station, gymnasium, and hospital and recreation facilities.

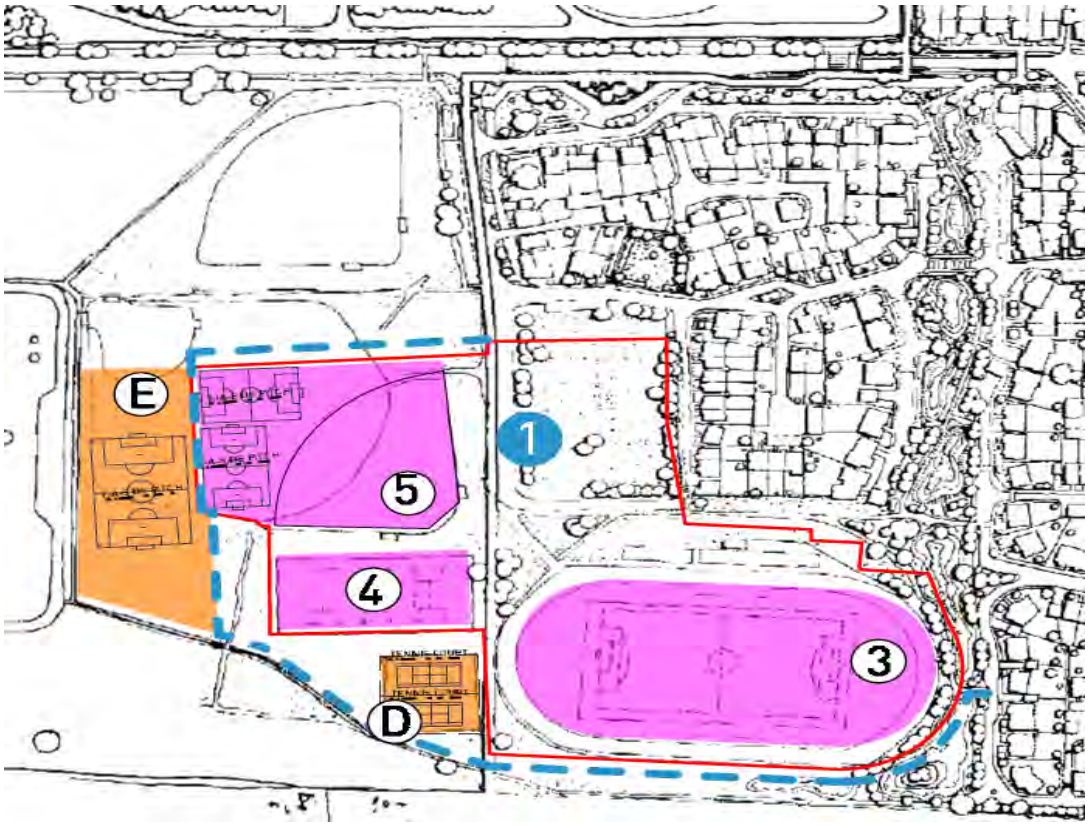
**2.4** The site study area lies within Southern margins of the former air base and is illustrated on the **Figure 1**.

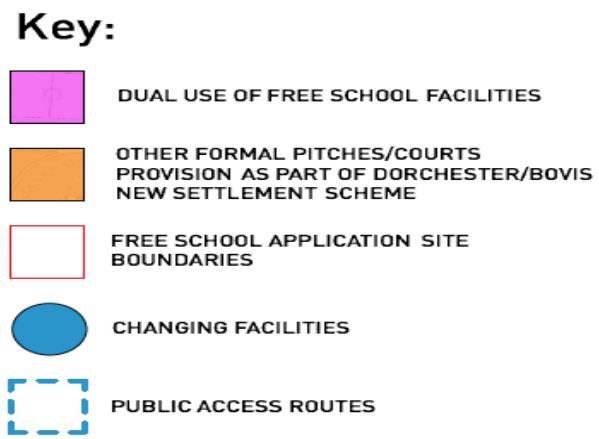
**2.5** The development of the sports areas is believed to have been undertaken in the late 1960's / early 1970's. An aerial photograph of the camp dated 1969 (**Figure 2**) illustrates some areas laid out for sport within the study area. A later aerial photograph dated 1975 (**Figure 3**) illustrates the full extent of the existing footprint of the facilities.

**2.6** It is not possible to fully determine the original construction or previous playing performance profiles for the facilities up until their cessation of regular use thought to be around 1993. It is understood that the natural turf pitch

located within the inner area of the Athletics Track identified as ③ on Figure 1, has been used for football in recent times. This area is obviously maintained to the extent that the grass is periodically cut and marked for play. All other areas illustrated on Figure 1 are in a 'redundant' state.

**Figure 1. (Extract from Drawing No. K. 0158 34-4 Dated 28th August 2013)**




③ **1.03 ha** Multi-sport pitch (incorporating football pitch to Sport England's Natural Turf for Sport guidance, touch rugby and athletics track markings).

④ **0.24 ha** Multi-purpose hard surface (incorporating 4 tennis courts (international) 3 netball courts (international) and 3 basketball courts (recreational) markings).

⑤ **0.68 ha** Multi-purpose grass pitch (incorporating softball, rounders, 5-a-side markings).

**D 0.12 ha** 2 tennis courts re-surfaced and re-marked.

**E 0.75 ha** 7-a-side football pitch.

**Figure 2. (Source http://www.raf-upper-heyford.org)**

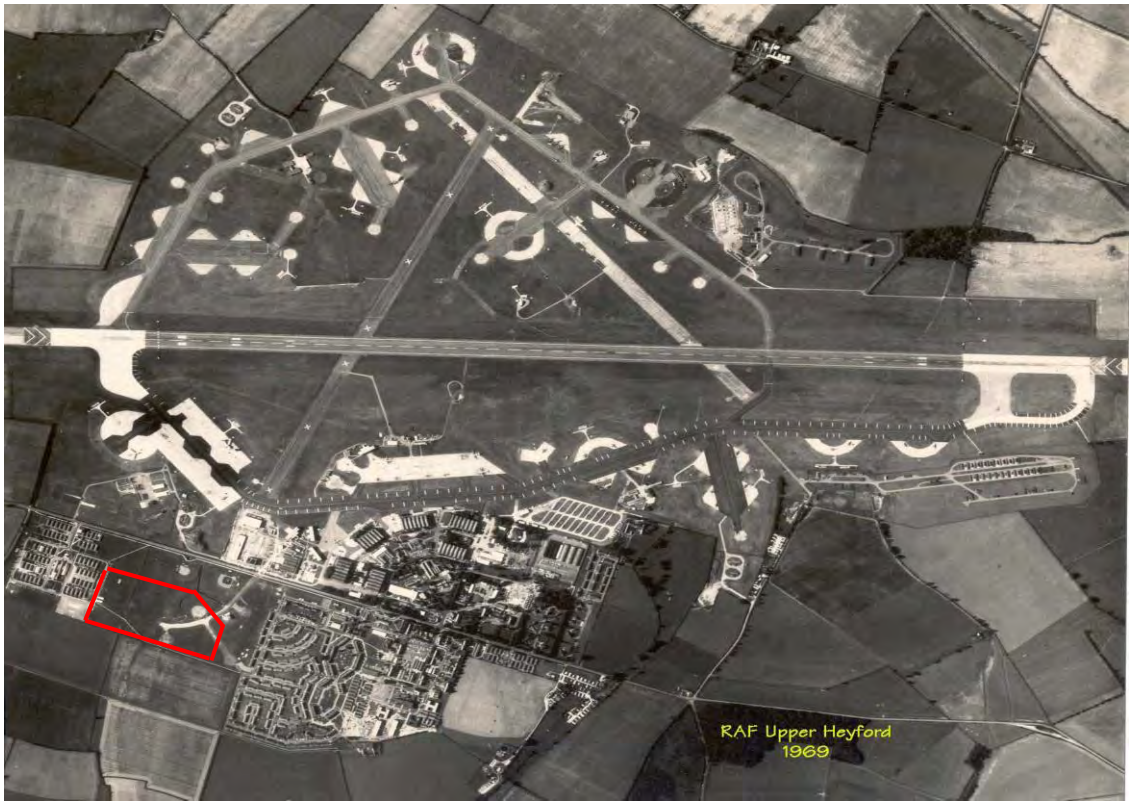



**Figure 3. (Source http://www.raf-upper-heyford.org)**

**3.0 DESIRED PERFORMANCE CRITERIA**

By reference to the range of facilities defined by the Applicant / Agent and illustrated within Figure 1 (Extract from Drawing No. K. 0158 34-4 Dated 28th August 2013) it is understood that the following provision is to be made upon the site.

③ **1.03 ha** Multi-sport pitch (incorporating football pitch to Sport England's Natural Turf for Sport guidance, touch rugby and athletics track markings).

④ **0.24 ha** Multi-purpose hard surface (incorporating 4 tennis courts (international) 3 netball courts (international) and 3 basketball courts (recreational) markings).

⑤ **0.68 ha** Multi-purpose grass pitch (incorporating softball, rounders, 5-a-side markings) to recreational community use standard.

**D 0.12 ha** 2 tennis courts re-surfaced and re-marked to recreational community use standard.

**E 0.75 ha** 7-a-side football pitch to recreational community use standard.

In order to consider the extent of refurbishment required to ensure the facilities are compliant with the requirements of the Condition 5 and the envisaged usage profile, the following design criteria have been applied to inform this report.

**3.1 Natural Turf Pitches**

**3.1.1** The range of natural turf pitches defined by the Applicant / Agent and illustrated within Figure 1 (Extract from Drawing No. K. 0158 34-4 Dated 28th August 2013 are:-

- ③ **1.03 ha** Multi-sport pitch (incorporating football pitch to Sport England's Natural Turf for Sport guidance, touch rugby and athletics track markings).
- ⑤ **0.68 ha** Multi-purpose grass pitch (incorporating softball, rounders, 5-a-side markings) to recreational community use standard.
- **E 0.75 ha** 7-a-side football pitch to recreational community use standard.

**3.1.2** Sport England and the various constituent sports governing bodies (NGB's) such as the Football Association and England Rugby, have developed a Performance Quality Standard (PQS) to identify the basic physical characteristics for natural turf pitches to be safe, sustainable and provide suitable conditions for play. The PQS provides a recommended minimum quality standard for the maintenance and construction of pitches. Specifically it sets the basic standard recommended for natural grass pitches, which may be located at a variety of locations including parks or recreation grounds.

Principally, the PQS recommends that a natural grass pitch must:-

- Have adequate grass cover
- Low level of weed coverage
- Be flat
- Have the ability to drain water
- Carrying capacity – pitches should be capable of sustaining demand for identified use.

The identified areas have been assessed on the existing condition of the turf sward, soil type and gradients by reference to relevant guidance, specifically the following publications:-

- *Sport England Design Guidance Note – Natural Turf for Sport*
- *Football Foundation Facilities Data – Natural Grass Pitches*
- *Football Association – Natural Grass Pitches Performance Quality Standard (PQS)*

**3.1.3** The assessment of the level of play and competition envisaged for each envisaged pitch, will have some influence upon the requirement to provide a playing surface of a certain quality standard; however each asset should be managed to provide the maximum quality standard achievable within the definition of the usage profile. It should be recognised that the measurement undertaken on the areas to inform this report is provided as the assessment of the playing surface (site areas) at a given date and that conditions will change throughout the year / playing season. This is particularly applicable to the assessment of ground cover, sward height, drainage and hardness.

**3.1.4** The recognised minimum quality performance criteria referred to above have been developed and adopted by the principal sports governing bodies to assist in determining the design requirements that should be included within the provision of sports facilities, which may be situated at a variety of locations such as school, club, community or recreational grounds. This advice and guidance is provided for both natural turf and artificial turf surfaces at what might be determined as 'grassroots' level as opposed to national or professional level. These criteria are also utilised by principal funding agencies such as Sport England, Football Foundation etc. to determine compliance of project design proposals if a bid for external support funding is made. Consideration of all the issues at an early stage in project development affecting the playing of sport appropriate to the planned level, type and standard to be provided will ensure that playing surfaces are physically and financially sustainable.

**3.1.5** The range of assessment criteria applied to the physical condition survey undertaken on the existing areas is illustrated within Table 1 and includes additional agronomic appraisal to assess the potential effect of turf and ground conditions upon the playing capacity of a pitch surface.

**3.1.6** Appropriate planning, design, management and maintenance are essential to ensure the success of any sports facility. Poorly considered appraisal in the early stages of the design of natural turf surfaces will result in increased costs and reduced viability of the project in the long term. Open space and playing pitch provision can only achieve the desired output requirements if structural and maintenance inputs are appropriately considered and implemented.

**Table 1** **DESIRED SURFACE PERFORMANCE CRITERIA – PHYSICAL SURVEY**

| ELEMENT | LIMITS | TEST |
|---|---|---|
| Ground Cover % | > 75 for SH 25 – 30<br>> 85 for SH 30 – 35 | BS 7370 |
| Broadleaf Weeds % | < 10 | BS 7370 |
| Sward Height mm | 25 – 60 PS<br>25 – 70 SM | BS 7370 |
| Thatch Depth mm | < 5 | BS 7370 |
| Water Infiltration Rate mm/hr | < 5 | BS 7370 |
| Hardness in g | 35 – 200 | Clegg Hammer / STRI |
| Evenness – 2 metre straight edge | < 20 mm | BS 7370 |
| Slope - Direction of Play | < 1.25% (1 in 80) | |
| Across Play | < 2.5% (1 in 40) | BS 7370 |
| pH range | 6.5 – 7.5 | |
| Topsoil layer – max. dia. Particle size | < 25 mm | BS 1377 |

Key SH = Sward Height
PS = Playing Season
SM = Summer Maintenance

***SOURCE: Performance Quality Standard (PQS) adopted by Sport England and Football Association as a basic quality standard for natural grass pitches. Developed by STRI, NPFA and IOG.***

**3.1.7** In the context of educational use to support curriculum delivery, playing field provision contains both summer and winter games pitches and ancillary features such as cricket practice nets and athletics field events facilities.

Extended community use will necessitate that natural turf games facilities will require an enhanced specification to sustain greater intensity of use beyond the core curriculum profile.

**3.1.8** For effective use and safety, pitch layouts should allow for the provision of adequate margins around the playing area. Margins include run off areas and the ability to realign pitches to compensate for wear.

Pitch sizes should be provided to reflect the age range of year groups attending the school. Educationalists and Sports Governing bodies recognise the need to encourage maximum involvement of all pupils and the provision of pitch dimensions reflective to age groups reduces the risk of skeletal and muscular stress injuries in younger pupils. The layout, size and range of sports pitches on a school site are often dictated by school staff based upon a preference (i.e. some schools will 'favour' football over rugby or vice versa) or seasonal variation which needs to consider the possibility that some areas will become worn throughout the winter period and cannot be used to overplay summer games (cricket outfield and athletics tracks).As an example, recognised football pitch dimensions and associated for margins are illustrated in Table 1. (On the basis of football being the priority sport for the area).

**Table 1**

The FA Guide to Pitch and Goalpost Dimensions

## Pitch Dimensions

Pitches in the past have been marked out using the maximum and minimum pitches sizes as outlined in the laws of the game. These sizes vary tremendously, are often adapted to fit the space available and have been open to local interpretation. The FA has consulted widely and has been encouraged to produce national pitch sizes for mini soccer, 9v9, Youth football and Adult football.

**The FA Recommended Pitch Sizes**

| Age grouping | Type | Recommended size **without** runoff (safety area around pitch) | | Recommended size **including** runoff (safety area around pitch) | | Recommended size of goal posts | |
|---|---|---|---|---|---|---|---|
| | | Length x width (yards) | | Length x width (yards) | | Height x width (ft) | |
| Mini-Soccer U7/U8 | 5 v 5 | 40 | 30 | 46 | 36 | 6 | 12 |
| Mini-Soccer U9/U10 | 7 v 7 | 60 | 40 | 66 | 46 | 6 | 12 |
| Youth U11/U12 | 9 v 9 | 80 | 50 | 86 | 56 | 7 | 16 |
| Youth U13/U14 | 11 v 11 | 90 | 55 | 96 | 61 | 7 | 21* |
| Youth U15/U16 | 11 v 11 | 100 | 60 | 106 | 66 | 8 | 24 |
| Youth U17/U18 | 11 v 11 | 110 | 70 | 116 | 76 | 8 | 24 |
| Over 18 (senior ages) | 11 v 11 | 110 | 70 | 116 | 76 | 8 | 24 |

*If a pitch is to be provided for U13/14 it is recommended that 7 x 21 goalposts are provided. However, it should be noted that 8 x 24 would also be acceptable as not all sites will be able to provide specifically for this age group.

**3.1.9** The orientation of pitches is more critical in some sports compared to others. The general preference is for a North – South orientation to avoid problems caused by the sun at various times of the year. Recommended gradients for sports are defined within current guidance. For winter sports (Football, Rugby etc.) and Cricket Outfields the gradient should not exceed 1 in 60 and preferably be a maximum of 1 in 80 across the direction of play, with provision if existing topography is problematical to increase the gradient to a maximum of 1 in 40. By inference and by reference to Sport England guidance it is suggested that where practical gradients should be no steeper than 1 in 80 – 1 in 100 along the line of play. Cricket squares should preferably be level between the batting ends (stump to stump) with 1 in 100 as a maximum gradient, with a cross-fall of 1 in 80, with 1 in 60 as a maximum.

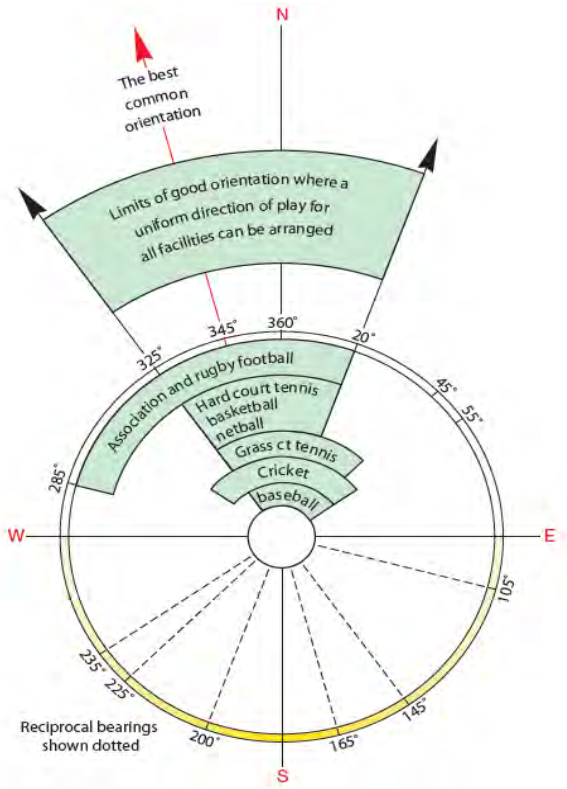
**3.1.10** Grass is still the preferred surface for many sports despite the advancements in the provision of artificial turf surfaces in recent years. Whilst sports such as Hockey have tendered to favour the use of artificial surfaces other sports are still predominantly played on natural turf pitches. The influence of soil type, climate and user demand will determine the capacity of a grass pitch to sustain use, and it is recognised that the construction of playing fields should be undertaken to provide determinable indicators of quality and performance. Suitable systems of land drainage should be considered together with amelioration of the topsoil layer and the implementation of appropriate maintenance regimes to maximise use.

**3.1.11** Whist there is no statutory requirement to provide a specific range of sports pitch type and sizes on a school site within the minimum 'team game playing field area' described within the Education (School Premises) Regulations 1999 and by reference to the guidance contained within Building Bulletin 98 Briefing Framework for Secondary School Projects Revision of BB82: Area Guidelines for Schools (Secondary section), BB 98 provides an indication of the possible range of team games and sports provision on the statutory area. These are illustrated in Table 2.

**Table 2**

| Number of pupils in school | Statutory area | Possible team games and sports provision on statutory area | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Grass pitches | | | Cricket facilities | | | Athletics facilities | | |
| | Minimum total in $m^2$ | Small | Medium | Large | Cricket Square | Cricket Pitch (non-turf) | Cricket Nets | 400m 6 lane track | High Jump | Long Jump |
| 401 to 500 | 25,000 | 1 | 1 | 1 | 1 | - | 3 | 1 | 1 | 1 |
| 501 to 600 | 30,000 | 2 | 1 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| 601 to 750 | 35,000 | 2 | 2 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| 751 to 900 | 40,000 | 3 | 2 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| 901 to 1,050 | 45,000 | 3 | 3 | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| 1,051 to 1,200 | 50,000 | 3 | 3 | 2 | 1 | 2 | 3 | 1 | 1 | 1 |
| 1,201 to 1,350 | 55,000 | 4 | 3 | 2 | 1 | 2 | 4 | 1 | 1 | 1 |
| 1,351 to 1,500 | 60,000 | 4 | 4 | 2 | 1 | 2 | 4 | 1 | 1 | 1 |

**3.1.12** The orientation of pitches is more critical in some sports compared to others. The general preference is for a North – South orientation to avoid problems caused by the sun at various times of the year.




**Recommended pitch orientation**
(Goal to goal, wicket to wicket, or baseline to baseline)

### 3.2 Hard Surface Games Courts /Multi Use Games Area (MUGA)

**3.2.1** The range of games courts defined by the Applicant / Agent and illustrated within Figure 1 (Extract from Drawing No. K. 0158 34-4 Dated 28th August 2013) are:-

- ④ **0.24 ha** Multi-purpose hard surface (incorporating 4 tennis courts (international) 3 netball courts (international) and 3 basketball courts (recreational) markings).
- **D 0.12 ha** 2 tennis courts re-surfaced and re-marked to recreational community use standard.

**3.2.2** Sport England guidance provides a classification grade for Multi Use Games Areas (MUGA) which is based upon the type of surface provided and the principal sports to be played on the area. BB 98 comments upon the benefits of considering the provision of synthetic surfaces for multi-sport areas. Where cost considerations prevent the provision of a full sized pitch, reduced areas can effectively support small games (mini – versions) or training/practice sessions. Laying out a variety of courts within a single multi-use games area makes the planning and supervision of games easier and extends the range of sports available.

**3.2.3** It is important to recognise whilst macadam might be used for both Tennis and Netball, the required National Governing Bodies (NGB's) performance characteristics of the laid surface differ between Netball and Tennis particularly in terms of the slip resistance/traction value required by each sport. Tennis requires a slip resistance value greater than or equal to 60, whereas Netball requires a value greater than or equal to 75 when measured in accordance with stipulated testing procedures. (Ref. ITF CS/02/01).

**3.2.4** In the context of school based facilities, the choice of surface type should obviously be driven by curriculum requirements, but in addition it should also enhance community use and assist local sports development aspirations. The latter is implied within the Planning Condition 4.

**3.2.5** The choice of surface type will be dependent upon the range of sports to be played on the area. Depending on the specification, multi-sports surfaces have different characteristics that make them suitable for different mixes of sport; no one surface type can be considered best for every situation. The choice will depend on the dominant sport

requirement and the balance between attaining the optimum characteristics for this sport and achieving a more versatile mix.

**3.2.6** In many ways the construction of a MUGA is similar to an artificial turf pitch. However; there are differences. These primarily relate to the surface, types of fencing and floodlighting used. As a general rule any facility surfaced with macadam or polymeric surfacing is considered to be a MUGA, as are artificial turf areas of less than 3,000 sqm.

**3.2.7** The most common forms of surface utilised on MUGA's are macadam, polymeric or artificial grass. Among the most commonly played sports on multi-sports games areas are Tennis / Mini Tennis, Netball, Basketball, Football / Five-a-side Football, and Hockey. Other sports that might also be played include Rugby / Tag Rugby, Rounders, Athletics practice, Roller Hockey and Volleyball etc. The need for facilities to compromise arises mainly due to the choice of playing surface, as certain surface types are more suitable than others for different sports.

**3.2.8** One of the most important issues relating to the choice of surface is the need for some form of shock absorbency, (or cushioning), but again, there can be conflicting requirements between the sports. On the one hand there are clear benefits for participants in protection from injury, but too much cushioning of the surface may be detrimental to the performance of certain sports, such as Tennis, Basketball and Netball. It is increasingly possible to quantify the playing performance of sports surfaces, using a series of standard test methods to measure the different characteristics and a number of sports governing bodies provide guidance on the individual recommendations for their own sports.

**3.2.9 Multi-Use Games Area (MUGA) Classification**

For purposes of clarification the following provides commentary on the potential options for consideration on the areas defined for use under 3.2.1 ④ and **D** above.

**3.2.9.1** There are five principal types of MUGA described in the Sport England guidance. Whilst the generic choice of surface type may be the same, the playing requirements of the range of sports differ. As an example whilst porous macadam is specified under the description of a Type 1 and Type 2 facility, as the slip resistance requirements of Tennis are different from those of Netball, this requirement should be included within the specification of the aggregate and bitumen constituents which comprise the macadam surface following the identification of the principal sport to be played on the area. The classification of MUGA types referred to under the Sport England guidance are:-

*Type 1 MUGA*

Open textured porous macadam areas used for ball rebound sports where Tennis is the priority and sports such as Mini-Tennis, Netball, and Basketball are secondary users. These areas are suitable for wheelchair sports although care is needed in warm weather during the first year of use.

*Type 2 MUGA*

Open textured porous macadam areas used for ball rebound sports where Netball is the priority and sports such as Tennis, Mini-Tennis, and Basketball are secondary users. These areas are suitable for wheelchair sports although care is needed in warm weather during the first year of use.

*Type 3 MUGA*

Porous Polymeric surfaced areas used for ball rebound sports where Netball is the priority and sports such as Tennis, Mini-Tennis, and Basketball are secondary users. These areas are suitable for wheelchair sports.

*Type 4 MUGA*

Porous Polymeric surfaced areas used for five-a-side football, basketball and general sports and recreational training and play. Due to their greater shock absorbency and lower surface friction these areas are not recommended for Tennis or Netball.

*Type 5 MUGA*

Artificial turf areas (ATPs) surfaced with a shock pad and either sand filled or sand dressed synthetic turf or a needle-punch carpet. The areas are used for sports such as Hockey, Five-a-side Football, and Football, Lacrosse, American

Football and training areas for activities such as Athletics and Rugby Union and Rugby League. More recent developments have utilised a longer pile (Third Generation – 3G) carpet type in-filled with sand and fine rubber particles, suited to high impact sports such as Rugby and Football.

**3.2.9.2 Macadam Surfaces**

The use of a macadam surface is the most compatible to achieve the range of sports referred to within 3.2.1 above:-

- ④ **0.24 ha** Multi-purpose hard surface (incorporating 4 tennis courts (international) 3 netball courts (international) and 3 basketball courts (recreational) markings).
- **D 0.12 ha** 2 tennis courts re-surfaced and re-marked to recreational community use standard.
-

Macadam surfaces may take the form of dense or porous macadam. Whilst the former may provide a more durable surface and is typically laid on school playgrounds etc. its inability to drain is a major constraint on sports use. For this reason porous macadam is considered more suitable and is used on around 80% of all Tennis and Netball courts in the UK. Porous macadam can be played on in most weather conditions year round.

Porous macadam courts may be colour coated to improve aesthetics and the playing environment. Additives within the colour coating may be incorporated to increase the slip resistance values referred to within 3.2.3 above. This is achieved by either using pigmented materials to form the macadam or by painting the un-pigmented surface after installation. Although the cost of pigmented macadam may be initially higher the increased durability of the colour may make it more suitable for areas of high use. It should be noted however that the longevity of maintaining the required slip resistance values for some sports when utilising colour coating techniques can be relatively short and courts may need to be re-painted every 4/5 years. Repeat applications of colour coating can impede the porosity of the court surface and therefore it is important to consider the additional costs involved in effectively maintaining colour coated court surfaces to the required playing performance standards.

**Cross section of typical games court construction**


**Illustrative macadam games court layout (combining Tennis and Netball courts) with colour coated playing surface finish**

**3.2.9.3 Court Layout**

**A)** Drawing No. K. 0158 34-4 Dated 28th August 2013, illustrates the proposed layout of facilities and defines the key sports to be accommodated within the scheme. The Applicant / Agent has defined the usage profiles as referred to within 3.2.1 above. The Planning Condition 5 includes commentary upon the standards to be achieved and guidance to be followed.

**B)** The identified provision of Netball and Tennis as illustrated on the drawing requires differing performance requirements (particularly with regards to slip resistance values) for each sport as described within 3.2.3 above. Therefore the decision to favour one sport above the other will determine the actual finished surface performance values.

**C)** If the proposed games courts identified as Area ④ are to combine Netball and Tennis use, then the provision of Netball will provide the key performance values to be achieved on the area. The Netball court playing dimension of 30.50m x 15.25m will result in the Tennis court marking dimensions of 23.77m x 10.97m, being positioned centrally within the larger Netball court dimensions. The highest value category achievable in the outdoor environment in terms of Netball (Ref: England Netball publication entitled Categories of Netball Court and Surface Performance Requirements) is **Category 4** courts, which are dedicated outdoor courts intended for higher levels of play such as national clubs league, inter county competitions and national squad training. For reference the full classifications described under the England Netball Guidance are as follows:-

**D)** The categories relate to the different levels of play and training that will take place on the courts.

**Category 1** courts are outdoor courts intended for school, recreation and community use.

**Category 2** courts are indoor or outdoor courts intended for local league, school, recreation and community use.

**Category 3** courts are indoor or outdoor courts intended for county premier league and county first team use.

**Category 4** courts are dedicated outdoor courts intended for higher levels of play such as national clubs league, inter county competitions and national squad training.

(Note: EN also have a Category 5 court. This is a dedicated indoor court intended for national clubs league and inter county competitions).

**E)** When designing a netball facility it is essential that the scheme has the appropriate number and categories of court for its intended use, as defined in the relevant County Netball Association facility strategy.

The court comprises the primary playing area, the side and end run-offs and for certain categories spectator and team areas. The dimensions of the playing area are specified in the Official Rules of Netball, whilst the size of the side and end run-offs and team and spectator areas depends upon the layout of the courts and the category level it is designed to meet. The layout of a single Netball court is shown in **Figure 4A**.

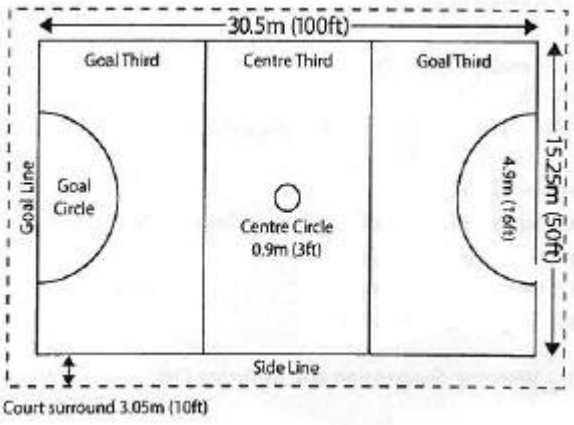



**Figure 4A.**

**F)** For the purposes of this report, it has been assumed that the games courts will as the Planning Condition 4 describes, - *''Use of the facilities shall not commence until a community use agreement prepared in consultation with Sport England has been submitted and approved in writing by the Local Planning Authority. The agreement shall apply to the indoor sports hall, playing fields and other outdoor sports facilities ''*, - require that the **Area ④** games courts shall as a minimum requirement achieve the standards described within the England Netball guidance for classification as Category 2 use.

**Extract from England Netball Guidance Category 2 Courts**

| Property | England Netball Requirement |
|---|---|
| Principal Playing Area (as specified in the Official Rules of Netball | 30.5m by 15.25 |
| End run-off (distance between goal line and any permanent or temporary fencing or fixtures) | 3.05m at both ends of Court is the requirement for all new build courts. Where courts are laid end to end with no division fencing or change in surfacing, a common end-run of at least 3.05 m should be used. |
| Side run-off (distance between side line and any permanent or temporary fencing or fixtures) | Minimum of 3.05m at both sides of Court (see Note 1). Where courts are laid side to side with no division fencing or change in surfacing, a common side run-off of at least 4.00m may be used. |
| Ceiling height (indoor courts) | Minimum of 7.5m |
| Team bench/match officials area Between courts | Where space along the side of the court allows, an extra area 2.0m wide should be provided (see Note 2). |
| Surface Type | Any form of surfacing meeting the Basic Requirements as defined in the England Netball Performance Requirements for Netball Surfaces. |
| Line markings | White lines, 50mm wide (where other markings conflicts, other colours may be used except yellow) |
| Goal posts | Free standing or socketed goal posts with protective padding along the entire post length. Goal posts and padding to conform to the Official Rules of Netball (see Note 3). Lines are part of the court and are included in the overall dimensions. |
| Lighting | Outdoor courts:<br>Minimum maintained illuminance of 400 lux with a uniformity ratio of at least 0.7 (see Notes 4, 5 and 6) |
| | Indoor courts:<br>Minimum maintained illuminance of 750 lux with a uniformity ratio of at least 0.7 (see Note 4 & 5). |
| Spectator seating | Optional |

**Notes:**

1. *End run-offs and side run-offs shall have the same surface as the playing area. They shall be free of all permanent and temporary fixtures at court level and to a vertical height of 2.5m. 2. Line Markings where the overall dimensions of an area do not allow a full size court and the specified side run-offs and/or end run-offs, the dimensions of the Principal Playing Area should be reduced to allow the required run-offs according to on-site safety.*

2. *To cater for young people's Netball (High Five Netball) and Wheelchair Netball, goal posts shall have adjustable net ring heights of 3.05m, 2.75m and 2.44m. The values shall be measured on the playing surface. Measurements shall be made on a 5m grid over the court area.*

3. *Uniformity ratio = Emin/eav.*

4. *It is recommended that the system also allows lighting at 200 lux for training etc.*

5. *Tennis post sockets and other equipment fixtures shall not be located within the playing area, side run-offs or end run-offs of the Netball court.*

**G)** In addition for the purposes of this report, it has been assumed that the games courts will as the Planning Condition 4 describes - *''Use of the facilities shall not commence until a community use agreement prepared in consultation with Sport England has been submitted and approved in writing by the Local Planning Authority. The agreement shall apply to the indoor sports hall, playing fields and other outdoor sports facilities ''*, - require that the **Area D** games courts shall as a minimum requirement achieve the standards described within the Sport England guidance for classification as a Type 1 facility (Tennis as priority sport) as described within 3.2.9 above. The layout of a single Tennis court is shown in **Figure 4B.**

**H)** For Tennis, the minimum recommended run-off margin (beyond the playing lines) is 5.49m at the ends (preferred 6.40m) and 3.05m to the sides (recommended 3.05m). Therefore the recommended minimum overall dimension for a single court is 34.75m x 17.07m. (recommended 36.57m x 18.29m). When courts of the same surface type are laid side by side it is possible to share the side-run between adjacent courts meaning a smaller overall width is required. Common side-runs should be between 4.27m (recommended) and 3.66m (minimum). Refer to **Table 3** for comparative spatial requirements of games courts.

**Figure 4B.**

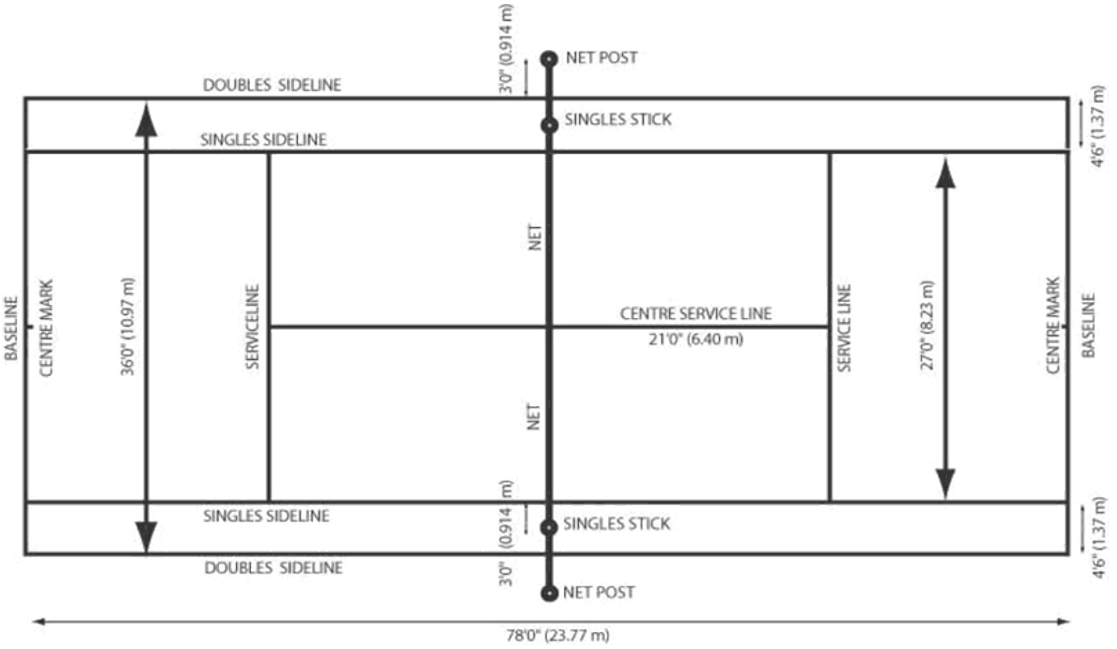



**Table 3: Comparative Spatial Requirements of Games Courts**

| | Tennis Recommended | Tennis Minimum | Netball Minimum |
|---|---|---|---|
| **Single Court** | 36.57m x 18.29m | 34.75m x 17.07m | 36.60m x 21.35m |
| **Two Courts Common Side -Run** | 36.57m x 33.53m | 34.75m x 31.70m | 36.60m x 40.60m |
| **Three Courts Common Side -Run** | 36.57m x 48.78m | 34.75m x 46.33m | 36.60m x 59.85m |
| **Four Courts Common Side -Run** | 36.57m x 64.01m | 34.75m x 60.96m | 36.60m x 79.10m |

### 3.3 Floodlighting

**3.3.1** If extended community use is required, then the provision of a suitable floodlighting system will be necessary. Any floodlighting scheme will require formal planning permission. The granting of planning permission to operate a floodlighting system may incorporate a stipulated curfew time at which all use must cease. The extent of the permitted period of operation will be influential upon the potential income stream which may be generated from extended use of the facility particularly during periods of restricted daylight hours.

**3.3.2** The advantages of floodlights are:

**Increased use of facilities**. Floodlighting facilities enables them to be used on winter evenings, giving substantially higher usage rates than equivalent non-floodlit facilities and increasing choice and flexibility of playing times for users.

**Programming flexibility.** Longer operating hours give facility managers and users more freedom in programming and in initiating sports development programmes.

**Additional income.** Increased use means greater potential to generate additional income – essential with the high capital cost of providing a facility, although there will be increased wear and tear of the surfaces reducing its service life.

**Usage options.** Floodlit facilities adjoining a sports hall can accommodate activities such as football, netball and tennis, releasing more expensive indoor space for other activities.

In accordance with good practice the proposals for the design of the floodlighting of the sports facilities should be based upon the standards set out in the following guidance documents:

- Sport England Guidance Notes – Artificial Sports Floodlighting
- Institution of Lighting Professionals (ILP) Guidance Notes for the Reduction of Light Pollution.
- CIBSE Lighting Guide – Sports Lighting
- DOE - Good Practice Guide

At this stage the site has been considered to be within Environmental Zone E2. (Area of low district brightness – rural or relatively dark urban location). Both Tennis and Netball will require illuminance to 400 lux.
The following every day illuminance levels may help to provide a perspective on the values given above.

- Moonlight 0.5 to 1Lux
- Residential road lighting 3 – 10 Lux
- Commercial office lighting 500 to 1000 Lux
- Overcast day 5000 Lux
- Televised Football 800 to 1200 Lux

**Illustrative lighting system utilising 'flat glass' light units used on a MUGA facility**

**3.3.3** In addition to the requirement to provide the required illuminance value the column height and floodlight type must be calculated to reduce the potential visual impact to the surrounding area and to conform to the requirements of the ILP planning guidance from the considerations of the angle at which the floodlights are to be aimed. The floodlights should be mounted in a close to 'flat glass' orientation (parallel to the playing surface) thereby reducing upward glare (sky glare) and allowing close control of the asymmetric beam light beam for accurate aiming onto the playing area and minimising spill.

**3.3.4** The management of the lighting scheme should incorporate a timing control which ensures that a system could not be operated after any curfew time stipulated within any planning approval. In addition the floodlighting systems should be capable of allowing the facilities to be operated at lower levels of light or in halves for training purposes or to suit other recreational sports or activities.

**3.4 Perimeter Fencing**

**3.4.1** Fencing forms an important part of the overall design of any games court facility. The principal features of any

sports facility fencing scheme are security, durability and the ability to retain balls within the playing area. The most common form of fencing is galvanised or powder coated welded mesh at heights of 3 m. This may be extended if additional height is required provided that posts and ground anchorage design is appropriately considered with regard to sub strate types and the potential effects of exposure to high winds etc.

**3.4.2** If use involving sports where high impact from balls is likely (Five-a-side Football), additional rebound characteristics must be incorporated into the perimeter fence system. In addition the provision of 'wind break' materials may be necessary on exposed sites.



**Illustrative court perimeter fence types including the use of additional 'wind break' detail on exposed site**

## 4.0 SITE SURVEY AND ANALYSIS

### 4.1 Natural Turf Pitches

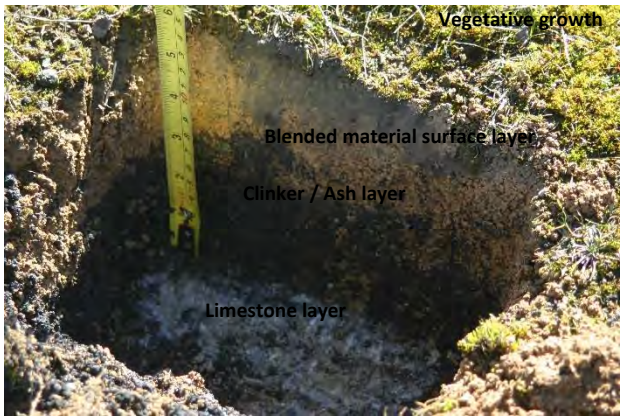
The range of natural turf pitches defined by the Applicant / Agent and illustrated within Figure 1 (Extract from Drawing No. K. 0158 34-4 Dated 28th August 2013 are:-

- ③ **1.03 ha** Multi-sport pitch (incorporating football pitch to Sport England's Natural Turf for Sport guidance, touch rugby and athletics track markings).
- ⑤ **0.68 ha** Multi-purpose grass pitch (incorporating softball, rounders, 5-a-side markings) to recreational community use standard.
- **E 0.75 ha** 7-a-side football pitch to recreational community use standard.

**4.1.1 AREA ③ 1.03 ha Multi-sport pitch** (incorporating football pitch to Sport England's Natural Turf for Sport guidance, touch rugby and athletics track markings).

The study area principally comprises the redundant footprint of an Athletics track, within which is a central grass pitch. The boundaries of the area are currently formed by the former site perimeter fence to the South (with agricultural fields beyond), redundant terracing and 'grandstand' to the North, former air base land currently under redevelopment to the East, and the footprint of redundant games courts to the West (identified as facility D on Drawing No. K. 0158 34-4). The approximate area of the site including all margins equates to 1.80 ha. (TBV)

The footprint of the redundant Athletics Track comprises an inner and outer concrete kerb detail, with a surface profile of an approximate 50mm depth of a blended material made up from fine stone (identified as Dolomitic Limestone) and clay. This type of product was widely used for surfacing athletics tracks and associated field events Long / triple jumps and high jump approaches) throughout the 1960's and 1970's until the evolution of artificial (Polymeric) surface types in the 1980's. The product was often marketed under the brand name of 'Redgra', and whilst some facilities surfaced in this material are still in existence within the UK, the commercial production of the blended mix is now limited due to the recent innovations in other forms of artificial sports surface types. The surface material is laid on a sub base comprising an approximate 35mm depth of clinker / ash material upon a formation layer of limestone (full depth to be verified). The measured width of the feature (kerb – kerb) is approximately 7.40m. The total footprint area of the redundant Athletics Track has been assessed as approximately 3,500 sqm. (TBV).

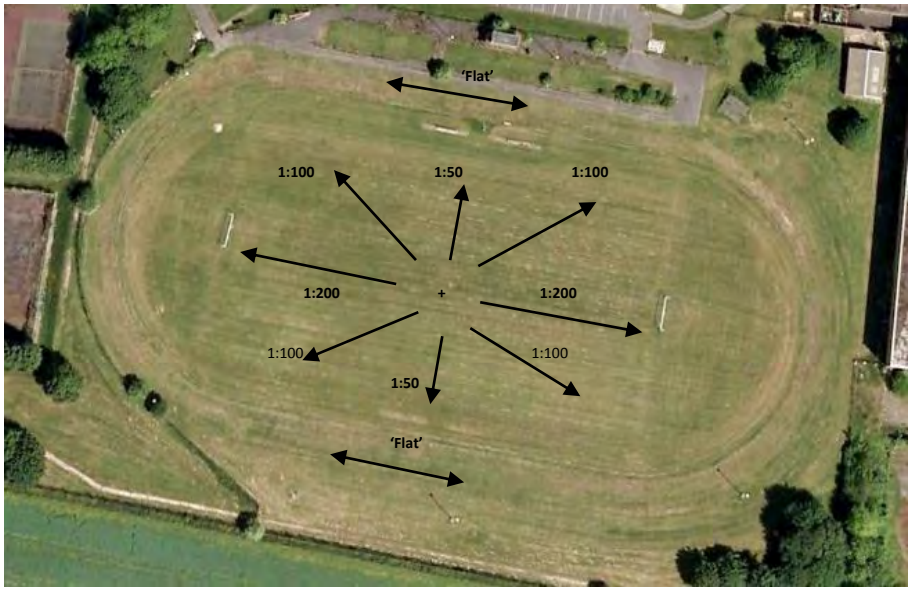



**4.1.2 Site Contours and Gradients**

The area has been previously re-engineered to create the current site gradients. The footprint of the redundant Athletics Track is virtually 'flat' along the running line with a minimal cross-fall between the identified kerb lines (inner and outer).

The central grass pitch area has been engineered to create a 'crowned' surface with the centre spot being the highest point, and with induced falls to the touchlines of approximately 1:200 in the direction of play, and 1:50 across the playing area. The approximate gradients recorded during the survey are illustrated in **Figure 5**.

**Figure 5**



The margin to the South of the Athletics Track is characterised by a mounded land form of approximately 0.75m above the immediate surrounding ground levels. It is possible that this area was formed from the excess soil arising's from the re-engineering of the site; however this will need to be confirmed through more invasive sampling if any consideration to reform this feature is planned in subsequent site redevelopment.

**Area to South of redundant Athletics Track – mounded land form**

**4.1.3 Ground Conditions**

**4.1.3.1** Examination of the published British Geological Survey map indicates that the geology of the site should be relatively straightforward. Examination of the published British Geological Survey map at a scale of 1:50,000, indicates that the geology of the site is predominantly classified as Keuper Marl range of Triassic age. The site geology is thought to comprise the existence of fragmented marl and limestone beneath a clay topsoil layer. It is likely therefore, that drainage of the areas is reliant upon the naturally occurring capacity of the sub strate to disperse ground water during periods of average rainfall.

The capacity of the area to be free draining during periods of increased or more persistent rainfall is likely to be more restricted due to the predominantly fine grained characteristics (clay content) of the topsoil layer, and the requirement for additional forms of land drainage becomes necessary if intensity of use occurs.

**4.1.3.2** Limestone of the type recorded on the site typically is fissured at depth potentially giving rise to relatively good natural soakage characteristics within undisturbed margins. The process of any previous earthworks to create the desired gradients for the redundant Athletics Track and pitch area, has in all probability altered the structure of the substrate and reduced the limit of naturally occurring drainage or soakage capacity. It is essential therefore to supplement the movement of excess groundwater through an appropriate land drainage system.

**4.1.3.3** An average recorded depth of 100mm identified topsoil was found across the area. The material was assessed as comprising a dark brown predominantly silty clay classification soil matrix with fragmented limestone particles, and traces of fine graded re-worked materials present. Earthworm activity was also observed within samples. The topsoil layer overlays a substrate of fragmented limestone within a stiff reddish brown clay thought to be naturally occurring, and generally consistent with the recorded geology for the local area.


**Examined soil profile on Area ③**

**4.1.3.4** The pore size of the topsoil material is influenced by the clay and silt content present, which results in very fine particles filling all potential macro-pore space between any mineral (sand/stone) or organic particles. The inherent silty clay structure is one of a fine-grained character, which is prone to smearing and compaction. It is unlikely that the area has received any sustained inputs s to re-establish the correct conditions for growing and maintaining sports turf since the closure of the site.

**4.1.3.5** The footprint of the redundant Athletics Track is characterised by naturally occurring invasive moss and weed vegetation with sparse grass species present. The constructed profile will not sustain growth to an acceptable level for sport, and will require complete removal and replacement incorporating appropriate soil profiles. (**NOTE**: the presence of the noted ash / clinker material within the sub surface formation will require appropriate methods of contaminate testing to be undertaken before disturbance / removal, in accordance with relevant guidance).

**Track footprint to left delineated by concrete kerb edge.**

**4.1.4 Agronomy and Land Drainage**

**4.1.4.1** The area is characterised by a short close mown sward. Generally the composition of the existing turf sward on the pitch was considered to be un-conducive to sustaining increased levels of play and all will require remedial work to improve conditions. A low percentage of rye grass and fescue species are present however these are significantly outcompeted by non-desirable grass and weed species. The sward will if more intensively used, be likely to become sparse in coverage and potentially compact leading to restricted drainage characteristics. Whilst the inherent problem of clay soil is that it tends to readily hold water, it can be more efficient at storing important plant nutrients in a readily available state, thereby promoting fertility. The pH value of the soil is considered favourable for the establishment of a suitable turf sward in normal circumstances, ranging from 6.5 to 7.5.

**4.1.4.2** The playing characteristics of a Football pitch are greatly influenced by the amount of play, which results in an approximate diamond – shaped pattern of wear that extends from one goalmouth to the halfway line and then tapers towards the opposite goalmouth. Wear is referred to as the damage sustained during the use of a pitch, and is not limited therefore to the damage to or loss of the grass plants, but also concerns soil compaction and changes to other soil characteristics such as permeability.

**4.1.4.3** The assessment of ground cover and surface hardness as observed in the survey, indicate that even with restricted use in recent times, areas of more intensive use (the diamond – shape) become compacted and lose their ground cover quickly during the playing season. Once ground cover is lost, the immediate soil layer becomes more susceptible to smearing and puddling primarily due to the reduction of soil pore spaces thereby reducing any drainage efficiency. In terms of how this scenario effects play, football rebound and rolling on the surface and player – surface traction will be significantly reduced.

**4.1.4.4** Reference to current Sport England and Football Association guidelines in relation to gradients for play, state gradients should be no steeper than 1 in 100 to 1 in 80 along the line of play, with a cross fall of no steeper than 1 in 40 to 1 in 50.The existing gradients conform to these criteria.

**4.1.4.5** The quality of turf was generally poor across the playing area in terms of the percentage of non-desirable species evident at the time of inspection. There is an unacceptable percentage of weed infestation within the existing turf on the pitch. The effect of such a high proportion of undesirable species within the turf is that they will, if left unchecked, ultimately completely suppress the more desirable grass plants, as they are more adept at extracting any available water and nutrients from the soil and will crowd and shade grasses from light. In relation to the direct effect that a poor turf sward has on the playing of games, weeds will influence the characteristics of ball bounce and rolling and are generally less tolerant of the effects of wear caused by players' movement during games. If left unchecked he likelihood of increased competition from undesirable weed species becoming more widespread will significantly reduce the wearing capacity of the pitch.

**Area ③: Illustrative areas of heavy weed infestation on pitch.**

**Low % of desirable grass plants within plot study areas.**

**4.1.4.6** Visual identification of undesirable and predominant weed species included the following:-

Dandelion (Taraxacum officinale)
Smooth Hawk's – Beard (Crepis capilaris)
Plantain (Plantago spp)
Daisy (Bellis perennis)
Buttercup (Rannuculus spp)
Moss (Barbula spp)
Creeping Thistle (Crisium arvense)

All of the above are to a greater or lesser extent indicative of poorly drained, compacted soil. The characteristics of the topsoil structure result in restricted root development, thereby lessening the ability of grass plants to thrive and sustain wear and tear associated with sports use.

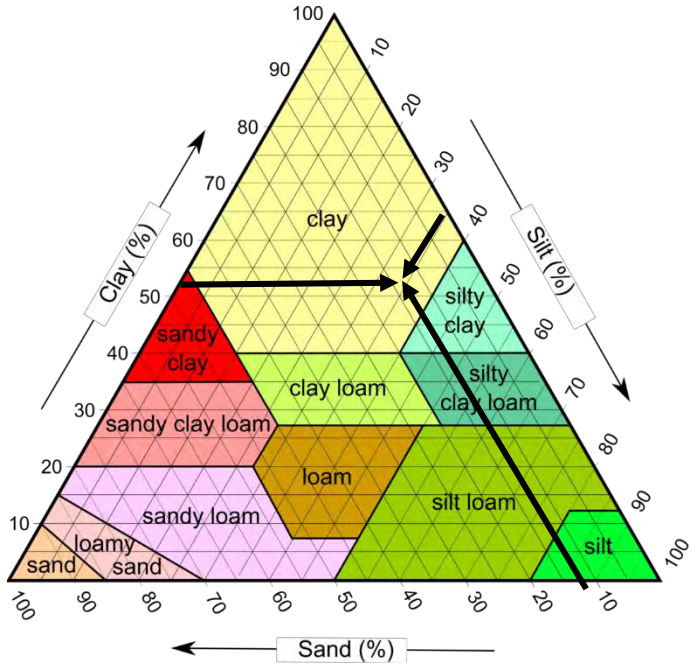
**4.1.4.7** Organic matter within the soil has primarily been derived as a result of grass clippings being left uncollected, thereby returning a percentage of nutrient and organic value to the soil. Nutrient levels are considered to be relatively poor in terms of those desirable within sports turf, and the presence of the density and nature of the identified weed

species indicates that they have 'out competed' the desirable grass species in securing nutrient availability. In addition compaction of the surface bought about by play and the existing soil structure has led to an increase in weed species.

**4.1.4.8** The results from a soil textural analysis for Area ③ are presented in **Table 4**. The results concur with the observations made during the site investigation.

**Table 4**

| TP 1 | Depth (mm) | Sand (%) | Silt (%) | Clay (%) | Classification |
|---|---|---|---|---|---|
| **1** | 0 – 50 | 18 | 36 | 46 | Clay/ Silty Clay |
| | 50 – 100 | 10 | 33 | 57 | Clay / Silty Clay |
| **2** | 0 – 50 | 17 | 36 | 47 | Clay / Silty Clay |
| | 50 – 100 | 8 | 33 | 59 | Clay / Silty Clay |
| **3** | 0 – 50 | 10 | 36 | 46 | Clay / Silty Clay |
| | 50 – 100 | 10 | 33 | 57 | Clay / Silty Clay |




**AREA ③: STANDARD SOIL TRIANGLE CLASSIFICATION Based Upon Average % of Samples**

In summary, the site is classified by a shallow clay topsoil containing some stone content, overlying a clay subsoil with limestone fragments. Whilst the composition of the soil profile is conducive to water and nutrient retention i.e. the site should not be particularly drought prone and soil bound nutrients should not be readily leached, it is very likely that its drainage capacity will be sub-optimal (i.e. < 5mm/hour) for winter sports use.

**4.1.4.9** An interpretation from the description provided within the analysis would suggest that the topsoil structure is one of a fine-grained character, which is prone to smearing and compaction. The pore size is influenced by the clay and silt content present, which results in very fine particles filling all potential macro-pore space between any mineral (sand/stone) or organic particles. Whilst the inherent problem of clay soil is that it tends to readily hold water, it can be more efficient at storing important plant nutrients in a readily available state, thereby promoting fertility. The poor condition of the sward in terms of its high percentage of weed species and general health in certain areas is likely to be the result of soil compaction and poor structure, together with the invasion of weed species, and deficiency in nutrient levels.

**4.1.4.10** Preliminary Hydraulic Conductivity testing has been undertaken to ascertain the flow rate of water through the soil medium present on site. The capacity of the soil type described to filter moisture is relatively poor in comparison

to what are recognised as acceptable performance indicators. This information is considered necessary to accurately determine drainage requirements on the site. (**Refer to Physical Survey Table**)

**4.1.4.11** Based upon a visual appraisal there was no evidence to suggest the presence of any form of piped land drainage system within the area. The formation of the crowned gradients would suggest that the drainage of the pitch was reliant upon natural surface flow through gradient and any natural soakage to ground.

**4.1.4.12** The capacity of the areas to be free draining during periods of increased or more persistent rainfall is likely to be more restricted due to the predominantly fine grained characteristics (clay content) of the topsoil layer, and the requirement for additional forms of land drainage becomes necessary if intensity of use occurs. The preliminary hydraulic conductivity selected sample test suggests that the current soil structure does not possess a suitable level of permeability to ensure that excess water can be removed effectively to sustain growth and wear throughout the recognised playing season, in accordance with the reference guidance for natural turf sports pitches.

**4.1.4.13** The site is at an approximate elevation of 132m / 433 Feet (AMSL) and is relatively open in nature. Exposure to high winds at certain times throughout the year will affect temperature and relative humidity. Environments that are extremely detrimental to turfgrass growth include high winds combined with high temperature and low humidity. Under such conditions, evaporation and transpiration are rapid and the grass plants may suffer water deficit situations despite the presence of plentiful soil water early in the day. This results in wilting and restricted root development causing stress on the plants, loss of vigour and colour. The likely scenario is that more tolerant (non –desirable) species will overtake the preferred sports turf grass cultivars. Whilst these plants can survive the more extreme conditions, they cannot sustain more intensive use and the effects from regular play and use. Therefore a balance between soil structures, plant (species / cultivar), micro-climate management and maintenance inputs needs to be considered to provide a sustainable surface for play.

**4.1.5 Additional General Commentary**

**4.1.5.1** The site contains a number of redundant features which it is assumed will be removed or adapted / re-profiled under any scheme to re-furbish the site. The following features were recorded during the site survey work.

- Grandstand and associated terracing.
- Assumed ex. Athletics throwing event concrete circles.
- Paved features.
- Inspections chambers ( not proved if working or required)
- Ex. Floodlighting columns.

**Heyford Site – Physical Survey** **Area ③**

| ELEMENT | LIMITS | TEST | RESULT | COMMENT (Date of Survey: 17/01/2015) |
|---|---|---|---|---|
| **Ground Cover %** | > 75 | BS 7370 | Average 75% | General unsatisfactory in terms of non-desirable species present. Excessive weed species growth in many areas |
| **Broadleaf Weeds %** | < 10 | BS 7370 | Range 35% - 85% | Excessive in many areas. |
| **Sward Height mm** | 25 – 60 | BS 7370 | 25 mm -35 mm | Undesirable species evident. |
| **Thatch Depth mm** | < 5 | BS 7370 | 15 | Above desired value |
| **Water Infiltration Rate mm/hr** | 5 | BS 7370 | Av. 1.25mm/hr (Topsoil)<br>Av. 1.50 mm/hr (Subsoil) | See Note . Below recommended values. |
| **Hardness in g** | 35 - 150 | Clegg Impact Hammer STRI | Average 58 | Measured compaction within goal/penalty areas Average 38. Measured compaction within wings/touchline margins Average 78. |
| **Evenness – 2m straight edge** | < 20mm | BS 7370 | Relatively few areas in excess | Recorded maximum of 70mm over 2m straight edge. Inconsistent tolerances in some localised areas. |
| **Slope** | Direction of Play < 1. in 80<br><br>Across Play < 1 in 40 | BS 7370 | Measured 1 in 200<br><br>Range 1 in 50 | Compliant<br><br>Compliant |
| **pH range** | 6.5 – 7.5 | | Av. 7.0 | Satisfactory |
| **Topsoil layer – maximum dia. Particle size** | < 25mm | BS 1377 | Particle size range. Less than 5% volume < 25mm | Average 100mm. The soil within this area comprised dark brown silty clay with fragments of limestone recorded. Previously re-worked material. Compacted margin. |

**NOTES:** The above readings are the mean average of results obtained from firmed and puddled samples. (Topsoil depth sample taken at 100mm bgl. Subsoil depth sample taken at 200mm bgl) – both within predicted land drainage profile/margin. Desired performance criteria between 5mm/hour for topsoil margin. (Based upon Football Association Natural grass Construction Upgrade Quality Standard)

**General view of Area ③ from SE**

**Redundant 'Grandstand' and terracing**

**Redundant Athletics Track and ancillary features within site area**

**4.2 AREA ⑤ 0.68 ha** Multi-purpose grass pitch (incorporating softball, rounders, 5-a-side markings) and **AREA E 0.75 ha** 7-a-side football pitch to recreational community use standard.

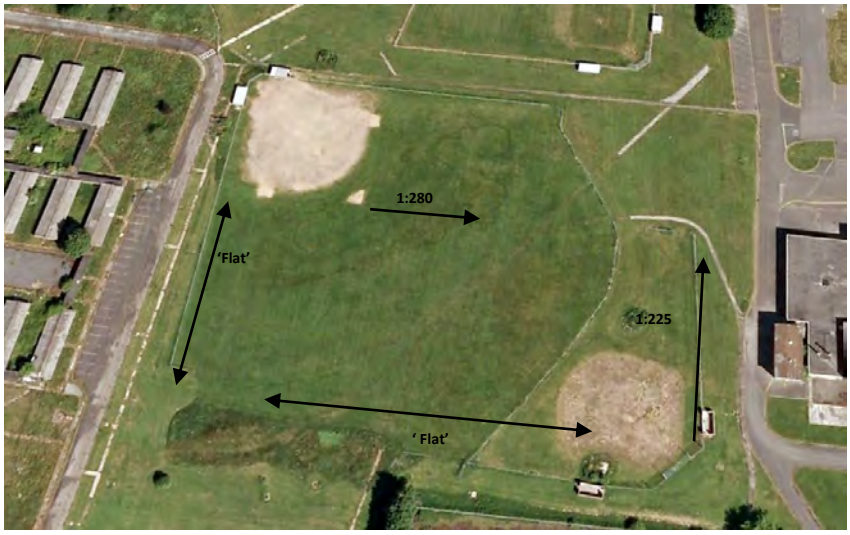
**4.2.1** The study area principally comprises the redundant footprint of Baseball area (Diamond) and grass outfield, together with the remains of fencing and 'grandstand' structures. The boundaries of the area are currently formed by an access route to the Gymnasium / Sports Hall building (under refurbishment) to the East, the redundant games courts (Area ④) to the South, redundant ex. Military building's to the West and a second former Baseball area and grass outfield to the North. The approximate area of the site including all margins equates to 1.45 ha. (TBV)

**4.2.2** The footprint of the redundant Baseball areas comprises a surface profile of an approximate 100mm depth of a blended material made up of fine stone (identified as Dolomitic Limestone) and clay. This type of product was widely used for surfacing such areas. The product was often marketed under the brand name of 'Redgra', and whilst some facilities surfaced in this material are still in existence within the UK, the commercial production of the blended mix is now limited due to the recent innovations in other forms of artificial sports surface types. The surface material is laid on a sub base mix of 10mm – 40mm limestone (full depth to be verified). The total footprint area of the redundant Baseball diamonds has been assessed as approximately 1800 sqm. (TBV).


**4.2.3 Site Contours and Gradients**

The area is likely to have been previously re-engineered to create the current minimal site gradients. The approximate gradients recorded during the survey are illustrated in **Figure 6**.

**Figure 6**




**4.2.4 Ground Conditions**

**4.2.4.1** Examination of the published British Geological Survey map indicates that the geology of the site should be relatively straightforward. Examination of the published British Geological Survey map at a scale of 1:50,000, indicates that the geology of the site is predominantly classified as Keuper Marl range of Triassic age. The site geology is thought to comprise the existence of fragmented marl and limestone beneath a clay topsoil layer. It is likely therefore, that drainage of the areas is reliant upon the naturally occurring capacity of the sub strate to disperse ground water during periods of average rainfall.

The capacity of the area to be free draining during periods of increased or more persistent rainfall is likely to be more restricted due to the predominantly fine grained characteristics (clay content) of the topsoil layer, and the requirement for additional forms of land drainage becomes necessary if intensity of use above recreational community use standard occurs.

**4.2.4.2** Limestone of the type recorded on the site typically is fissured at depth giving rise to relatively good natural soakage characteristics within undisturbed margins. The process of any previous re-engineering works to create the desired gradients for the area, has in all probability altered the structure of the substrate and reduced the limit of naturally occurring drainage or soakage capacity, however if the usage profile is confined to recreational community use standards, supplementary drainage may not be necessary.

**4.2.4.3** An average recorded depth of 135mm identified topsoil was found across the area. The material was assessed as comprising a dark brown predominantly silty clay classification soil matrix with fragmented limestone particles, and traces of fine graded re-worked materials present. Earthworm activity was also observed within samples. The topsoil layer overlays a substrate of fragmented limestone within a stiff reddish brown clay thought to be naturally occurring, and generally consistent with the recorded geology for the local area.

**4.2.4.4** The pore size of the topsoil material is influenced by the clay and silt content present, which results in very fine particles filling all potential macro-pore space between any mineral (sand/stone) or organic particles. The inherent silty clay structure is one of a fine-grained character, which is prone to smearing and compaction. It is unlikely that the area has received any sustained cultural inputs to re-establish the correct conditions for growing and maintaining sports turf since the closure of the site.

**4.2.4.5** The footprint of the redundant Baseball diamonds are characterised by naturally occurring invasive moss and weed vegetation with sparse grass species present. The constructed profile will not sustain growth to an acceptable level for sport, and will require complete removal and replacement incorporating appropriate soil profiles.

**Examined soil profile on Areas ⑤ and E**

**4.2.5 Agronomy and Land Drainage**

**4.2.5.1** The area is characterised by an unmanaged grassland with a 'tussocky' nature (clumps or tufts of growing grass species). Generally the present condition of the existing turf sward on the area was considered to be un-conducive to sustaining increased levels of play and all will require remedial work to improve conditions. Some rye grass and fescue species are present however these are significantly outcompeted by non-desirable weed species. The sward will if more frequently used, be likely to become sparse in coverage and potentially compact leading to restricted drainage characteristics. Whilst the inherent problem of clay soil is that it tends to readily hold water, it can be more efficient at storing important plant nutrients in a readily available state, thereby promoting fertility. The pH value of the soil is considered favourable for the establishment of a suitable turf sward in normal circumstances, ranging from 6.5 to 7.5.

**4.2.5.2** Reference to current Sport England and Football Association guidelines in relation to gradients for play, state gradients should be no steeper than 1 in 100 to 1 in 80 along the line of play, with a cross fall of no steeper than 1 in 40 to 1 in 50.The existing gradients conform to these criteria; however gradients are minimal and will not assist surface drainage unless the topsoil structure is improved to assist in the more efficient movement of water through the layer. (Refer to Section 5.0 for further commentary).

**4.2.5.3** The quality and habit of turf growth was generally poor across the playing area in terms of the required values for sport, even at a recreational community use level. The effect of a high proportion of undesirable species within the turf is that they will, if left unchecked, ultimately completely suppress the more desirable grass plants, as they are more adept at extracting any available water and nutrients from the soil and will crowd and shade grasses from light. In relation to the direct effect that a poor turf sward has on the playing of games, weeds will influence the characteristics of ball bounce and rolling and are generally less tolerant of the effects of wear caused by players' movement during games. If left unchecked he likelihood of increased competition from undesirable weed species becoming more widespread will significantly reduce the wearing capacity of the pitch.

**General condition of grass sward**

**Low % of desirable grass plants within plot study areas.**

**4.2.5.3** Visual identification of undesirable and predominant weed species included the following:-

Yarrow (Achillea millefolium)
Plantain (Plantago spp)
Daisy (Bellis perennis)
Buttercup (Rannuculus spp)
Moss (Barbula spp)
Creeping Thistle (Crisium arvense)

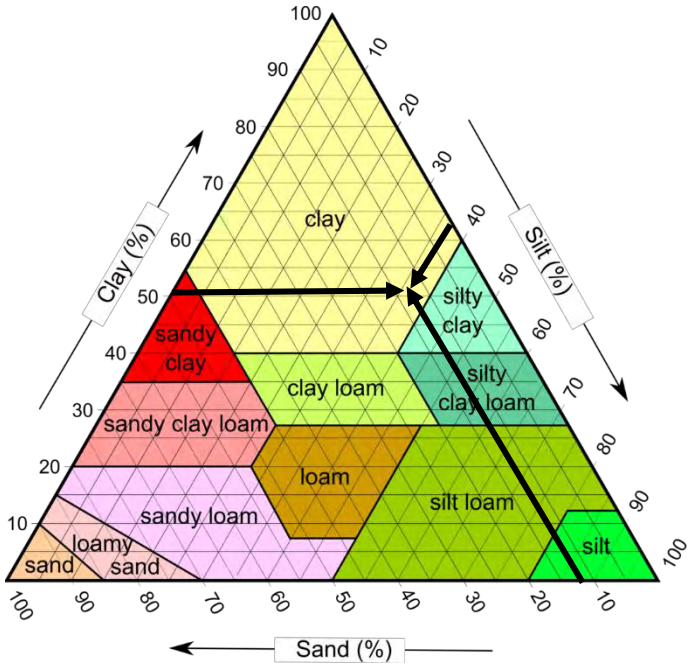
All of the above are to a greater or lesser extent indicative of poorly drained soil types. The characteristics of the topsoil structure result in restricted root development, thereby lessening the ability of grass plants to thrive and sustain wear and tear associated with sports use.

**4.2.5.4** Organic matter within the soil has primarily been derived as a result of seed stem die back and natural plant decomposition. Nutrient levels are considered to be relatively poor in terms of those desirable within sports turf, and the presence of the density and nature of the identified non desirable species indicates that they have 'out competed' the desirable grass species in securing nutrient availability.

**4.2.5.5** The results from a soil textural analysis for Areas ⑤ and **E** are presented in **Table 5**. The results concur with the observations made during the site investigation.

**Table 5**

| TP 1 | Depth (mm) | Sand (%) | Silt (%) | Clay (%) | Classification |
|---|---|---|---|---|---|
| **1** | 0 - 50 | 15 | 36 | 49 | Clay/ Silty Clay |
| | 50 - 100 | 12 | 37 | 51 | Clay/ Silty Clay |
| | 100 - 150 | 9 | 44 | 57 | Clay/ Silty Clay |
| **2** | 0 – 50 | 15 | 38 | 47 | Clay/ Silty Clay |
| | 50 – 100 | 12 | 37 | 51 | Clay/ Silty Clay |
| | 100 - 150 | 10 | 39 | 51 | Clay/ Silty Clay |
| **3** | 0 – 50 | 15 | 37 | 48 | Clay/ Silty Clay |
| | 50 – 100 | 12 | 38 | 50 | Clay/ Silty Clay |
| | 100 - 150 | 8 | 37 | 55 | Clay/ Silty Clay |




**AREAS ⑤ and E : STANDARD SOIL TRIANGLE CLASSIFICATION Based Upon Average % of Samples**

In summary, the site is classified by a clay topsoil containing some stone content, overlying a clay subsoil with limestone fragments. Whilst the composition of the soil profile is conducive to water and nutrient retention i.e. the site should not be particularly drought prone and soil bound nutrients should not be readily leached, it is very likely that its drainage capacity will be sub-optimal (i.e. < 5mm/hour) for winter sports use.

**4.2.5.6** An interpretation from the description provided within the analysis would suggest that the topsoil structure is one of a fine-grained character, which is prone to smearing and compaction. The pore size is influenced by the clay and silt content present, which results in very fine particles filling all potential macro-pore space between any mineral (sand/stone) or organic particles. Whilst the inherent problem of clay soil is that it tends to readily hold water, it can be more efficient at storing important plant nutrients in a readily available state, thereby promoting fertility. The poor condition of the sward in terms of its high percentage of weed species and general health in certain areas is likely to be the result of soil compaction and poor structure, together with the invasion of weed species, and deficiency in nutrient levels.

**4.2.5.7** Preliminary Hydraulic Conductivity testing has been undertaken to ascertain the flow rate of water through the soil medium present on site. The capacity of the soil type described to filter moisture is relatively poor in comparison to what are recognised as acceptable performance indicators. This information is considered necessary to accurately determine drainage requirements on the site. (**Refer to Physical Survey Table**)

**4.2.5.8** Based upon a visual appraisal there was no evidence to suggest the presence of any form of piped land drainage system within the area. The formation of the minimal gradients would suggest that the drainage of the area was predominantly reliant upon natural soakage to ground.

**4.2.5.9** The capacity of the areas to be free draining during periods of increased or more persistent rainfall is likely to be more restricted due to the predominantly fine grained characteristics (clay content) of the topsoil layer, and the requirement for additional forms of land drainage becomes necessary if intensity of use occurs. The preliminary hydraulic conductivity selected sample test suggests that the current soil structure does not possess a suitable level of permeability to ensure that excess water can be removed effectively from the surface to sustain growth and wear throughout the recognised playing season, in accordance with the reference guidance for natural turf sports pitches.

**Heyford Site – Physical Survey AREAS ⑤ and E**

| ELEMENT | LIMITS | TEST | RESULT | COMMENT (Date of Survey: 17/01/2015) |
|---|---|---|---|---|
| **Ground Cover %** | > 75 | BS 7370 | Average 95% | General unsatisfactory in terms of non-desirable species present. Excessive weed species growth in many areas |
| **Broadleaf Weeds %** | < 10 | BS 7370 | Range 15 - 20% | Excessive in some areas. |
| **Sward Height mm** | 25 – 60 | BS 7370 | 60 - 160mm | Tussock / clump forming character. Undesirable species evident. |
| **Thatch Depth mm** | < 5 | BS 7370 | 18 | Above desired value |
| **Water Infiltration Rate mm/hr** | 5 | BS 7370 | Av. 1.25mm/hr (Topsoil)<br>Av. 1.50 mm/hr (Subsoil) | See Note . Below recommended values. |
| **Hardness in g** | 35 - 150 | Clegg Impact Hammer STRI | Unable to test | Unable to test due to sward character. |
| **Evenness – 2m straight edge** | < 20mm | BS 7370 | Unable to test | Unable to test due to sward character. |
| **Slope** | Direction of Play < 1. in 80<br><br>Across Play < 1 in 40 | BS 7370 | Range 1;225 – 'Flat' | Compliant – but minimal gradient will not assist surface drainage. |
| **pH range** | 6.5 – 7.5 | | Av. 7.0 | Satisfactory |
| **Topsoil layer – maximum dia. Particle size** | < 25mm | BS 1377 | Particle size range. Less than 5% volume < 25mm | Average 150mm. The soil within this area comprised dark brown silty clay with fragments of limestone recorded. Previously re-worked material. |

**NOTES:** The above readings are the mean average of results obtained from firmed and puddled samples. (Topsoil depth sample taken at 100mm bgl. Subsoil depth sample taken at 200mm bgl) – both within predicted land drainage profile/margin. Desired performance criteria between 5mm/hour for topsoil margin. (Based upon Football Association Natural grass Construction Upgrade Quality Standard)

**4.2.5.10** The site is at an approximate elevation of 132m / 433 Feet (AMSL) and is relatively open in nature. Exposure to high winds at certain times throughout the year will affect temperature and relative humidity. Environments that are extremely detrimental to turf grass growth include high winds combined with high temperature and low humidity. Under such conditions, evaporation and transpiration are rapid and the grass plants may suffer water deficit situations despite the presence of plentiful soil water early in the day. This results in wilting and restricted root development causing stress on the plants, loss of vigour and colour. The likely scenario is that more tolerant (non –desirable) species will overtake the preferred sports turf grass cultivars. Whilst these plants can survive the more extreme conditions, they cannot sustain more intensive use and the effects from regular play and use. Therefore a balance between soil structures, plant (species / cultivar), micro-climate management and maintenance inputs needs to be considered to provide a sustainable surface for play.

**4.2.6 Additional General Commentary**

**4.2.6.1** The site contains a number of redundant features which it is assumed will be removed or adapted / re-profiled under any scheme to re-furbish the site. The following features were recorded during the site survey work.

- 'Team' buildings and associated terracing.
- All of the Baseball diamond footprints.
- Paved features.
- Fence structures.

**General view of site Southern Baseball diamond, fence and 'built' structures requiring removal**

**General view of site Northern Baseball diamond, fence and 'built' structures requiring removal**

**Southern site margins**

**General view of site from NW towards Area ④**

**4.3 Hard Surface Games Courts /Multi Use Games Area (MUGA)**

**4.3.1** The range of games courts illustrated within Figure 1 (Extract from Drawing No. K. 0158 34-4 Dated 28th August 2013) are:-

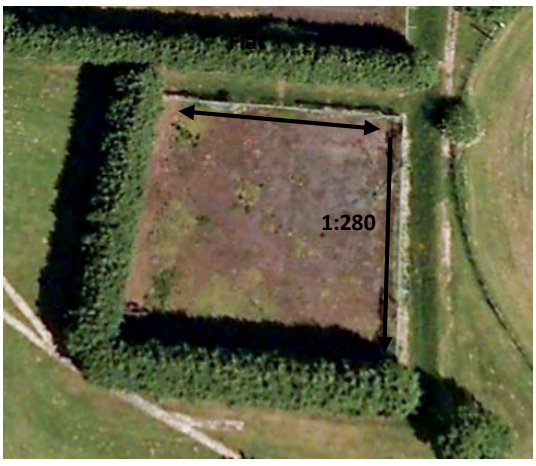
- ④ **0.24 ha** Multi-purpose hard surface (incorporating 4 tennis courts (international) 3 netball courts (international) and 3 basketball courts (recreational) markings).
- **D 0.12 ha** 2 tennis courts re-surfaced and re-marked to recreational community use standard.


The redundant footprint of the two separate areas are bounded to the South and West by a mature windbreak screen of coniferous trees approximately 12m high. Area D is bounded to the East by a steep 'cut' embankment engineered to create the current landform, with the study area ③ (Redundant Athletics Track) beyond. Area ④ lies to the North of Area D with the mature coniferous screen separating the two areas.

The two areas are set within a re-engineered ground profile approximately 1.40m below the surrounding features to the East (Area③) and Areas ⑤ and E to the North.

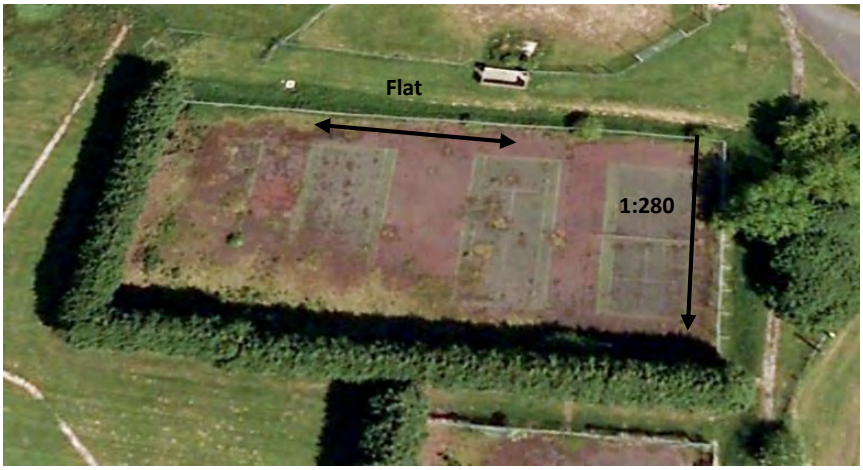
**4.3.2.1 Area D** comprises a measured dimension of 34.70m (N/S) and 34.20m (E/W). The principal construction features of the area were recorded as follows:-

- Approximate single 40mm depth layer of open macadam laid over a graded stone sub base (Depth to be verified).
- Chain link perimeter fence of green PPC mesh 3.60m high supported on angle iron posts with remnants of wind break netting attached.
- Measured gradients 1: 280 N/S. 'Flat' E/W.



**4.3.2.2 Area** ④ comprises a measured dimension of 34.70m (N/S) and 34.20m (E/W). The principal construction features of the area were recorded as follows:-

- Approximate single 20mm depth layer of open macadam laid over a graded stone sub base (Depth to be verified).
- Chain link perimeter fence of green PPC mesh 3.60m high supported on angle iron posts with remnants of wind break netting attached.
- Measured gradients 1: 280 N/S. 'Flat' E/W.




**4.3.3** The following commentary is common to both study areas.

**4.3.3.1** The whole of the current fencing system on all boundaries is considered to be unserviceable due to the high level of distortion of both the mesh and post components.

**4.3.3.2** The general condition of the courts is extremely poor, with the surface being subject to a high degree of degradation, fretting and aggregate loss. In addition moss, algae and shrub species growth is prevalent across the entire surface area.

**4.3.3.3** There is significant ingress of root growth from the surrounding mature coniferous screen which has resulted in surface heave particularly within the perimeter margins on the courts. In addition the root ingress has affected the network of link pathways between the court areas.

**4.3.3.4** Engineered gradients are minimal and compliant; however the future consideration of the refurbished construction profile will require drainage issues to be effectively dealt with.

**4.3.3.5** The 'historic' orientation of the courts in a general N/S alignment is compliant with relevant guidance.

**4.3.3.6** The N/S dimensions of the areas are the minimum required for Tennis providing a back line run-off of 5.49m as described in 3.2.9.3 above. However the N/S dimension of Area ④ is insufficient for the provision of Netball Courts which requires an overall recommended dimension (direction of play) of 36.60m. (Deficit 1.90m). Refer to **Table 3** for comparative spatial requirements.

**4.3.3.7** The precise depth and characteristics of the existing redundant construction particularly in relation to the sub surface aggregates and their suitability for re-use within any future reconstruction will need to be proven by appropriate sampling and testing. There is an initial concern that the materials may be susceptible to frost heave and degradation. A preliminary appraisal of construction profiles may be referenced within **Table 6** below. (Source: SAPCA Guidance).

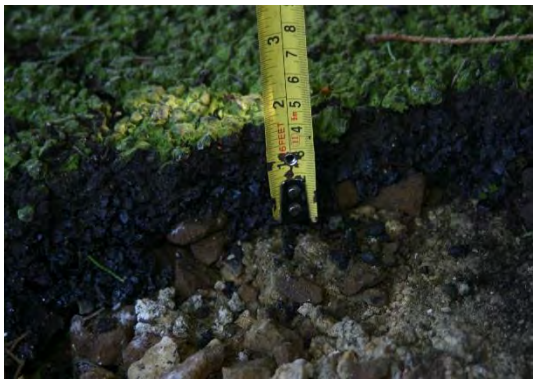
**Table 6: Recommended Construction Profile Depths**

| Soil Type | Clay or Silt % | Potential Frost Action | Potential Shrinkage / Swelling | Foundation Depth (mm) | Surface Layers | Total Construction Depth (mm) |
|---|---|---|---|---|---|---|
| Slightly silty / clayey sand or gravel | 0 - 5 | Minimal | Minimal | 150 | 65 | 215 |
| Silty/clayey gravel | 5 - 15 | Slight | Minimal | 150 | 65 | 215 |
| Silty / clayey sand | 5 - 15 | Medium | Minimal | 150 - 200 | 65 | 215 - 265 |
| Very silty / clayey gravel | 15 - 35 | Slight - medium | Minimal | 150 - 200 | 65 | 215 - 265 |
| Very silty / clayey sand | 15 - 35 | Minimal | Minimal - medium | 150 - 250 | 65 | 215 - 315 |
| Sandy / gravelly silt or clay | 35 - 65 | Medium - high | Slight - medium | 250 - 335 | 65 | 315 - 400 |
| Silt | 65 - 100 | Medium – very high | Slight - medium | 300 - 385 | 65 | 365 - 450 |
| Clay | 65 - 100 | Medium - high | Medium - high | 300 - 385 | 65 | 365 - 450 |
| Chalk / Soft rocks | 65 - 100 | Medium - very high | Minimal | 150 - 385 | 65 | 215 - 450 |
| Peat | | Low | Very high | 335 + | 65 | 400 + |

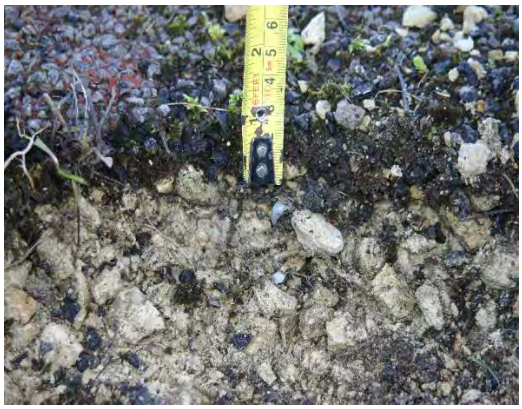
**4.3.3.8** The site is at an approximate elevation of 132m / 433 Feet (AMSL) and is relatively open in nature. Exposure to high winds at certain times throughout the year will affect temperature and the playing of the identified games.

The previous provision of the coniferous screen and additional wind break netting on the courts is a clear indication that the exposed nature of the location will require supplementary forms of shelter to decrease the adverse effects of wind on the areas.

**General Views of Court Area D**



**General Views of Court Area ④**



**Tree root damage to surfaces common to all areas**

**5.0 <u>CONCLUSIONS FROM ANALYSIS</u>**

**5.1 <u>Natural Turf Pitch Areas</u>**

**③ 1.03 ha** Multi-sport pitch (incorporating football pitch to Sport England's Natural Turf for Sport guidance, touch rugby and athletics track markings).

**⑤ 0.68 ha** Multi-purpose grass pitch (incorporating softball, rounders, 5-a-side markings) to recreational community use standard.

**E 0.75 ha** 7-a-side football pitch to recreational community use standard.

**5.1.1** There is no recognised formula for calculating the carrying capacity or usage potential of pitches as it is dependent upon a wide range of factors such as weather conditions, age/weight of players, quality of players etc. The Sport England Playing Pitch Strategy – Towards a Level Playing Field requires the quality of a pitch to be taken into account when determining its' capacity to sustain use.

**5.1.2** It is generally recognised that the Performance Quality Standard (PQS) is an indication of the physical criteria necessary to provide a pitch of a suitable standard to facilitate at least two adult games per week. The resistance of a football pitch to wear by players and the ability of a pitch to provide a stable platform for quality football is highly dependent upon the turfgrass and the soil in which it grows. The grass plant provides a cushioned surface, with natural lubrication to reduce skin abrasion – its root network also provides a core structural function. The soil not only provides an anchorage for the grass plant but it is also the key load bearing component. The two components combined (grass and soil), must be of sufficient strength to resist damage from repeated use – both from running and sliding, but not of excessive strength so as to cause impact or musculoskeletal damage.

In relation to the implementation of the PQS standard at the Heyford site, the following provides commentary upon the potential improvement works required based upon the level of investigation undertaken.

**5.1.3 <u>Gradients and Profiles</u>**

**5.1.3.1** Gradients on the Area ③ are generally consistent and require no significant adjustment. Local deviations can be corrected through conventional husbandry operations and surface dressings.

**5.1.3.2** Gradients on the Areas ⑤ and **E** are minimal. If use above recreational community use standard is considered at a future date, the provision of drainage within the area will need to take account of minimal gradients with the incorporation of induced sub surface inverts to assist flow.

**5.1.3.3** The entire (full depth) existing construction profiles of the redundant Athletics Track on Area ③ and the Baseball diamonds on Areas ⑤ and **E** will require removal within any proposed redevelopment scheme. The replaced profile will be based upon an appropriate specification utilising selected imported soils ( or the utilisation of drainage excavations from proposed systems) to create a suitable medium in which to re-establish a suitable sports turf grass sward.

**5.1.4 <u>Turf Quality</u>**

**5.1.4.1** In general terms the pitch playing surface on Area ③ is of a poor quality sward caused by a number of cultural and physical characteristics. The present condition of the soil structure and turf sward will result in the pitch at some stage throughout the playing season, suffering from poor drainage bought about by compaction of the surface and immediate (predominantly fine textured clay / silt) soil horizon. At present undesirable weed species exist in larger than acceptable percentages in significant areas of the site. If allowed to remain, they will further compete and dominate the grass species to the detriment of the sward, leading to poor playing quality and wearing capability.

**5.1.4.2** The generally 'rank' conditions of Areas ⑤ and **E** have arisen due to the effects of natural degradation over time by comparison to the original condition when in regular use. The exposed nature of the site and lack of maintenance inputs have allowed weed species to establish and dominate the sward.

**5.1.4.3** It is essential that a uniformity of turf quality is established on the site in order to provide the maximum potential for the areas to sustain envisaged use throughout the playing season and suitable playing characteristics. Subject to determination of future usage demand the improvement of drainage below the turf surface is considered to be essential to enable the new playing sward to develop and be maintained correctly. Any attempt to improve the structure of the topsoil to assist drainage will prove only marginally successful if an inadequate system of water dispersal is not provided via a land drainage system installed within the sub soil and topsoil layers.

**5.1.4.4** Soil quality and structure must also be improved by cultural methods to promote the establishment of a more suitable turf sward. Root development must be encouraged to its maximum and soil fertility levels increased to minimise effects of drought, disease and the invasion of weed species which occur in poorly maintained sports turf.

**5.1.4.5** Nutrient levels may be deficient to some extent and will need to be improved and maintained to encourage sustained turf sward quality and develop the necessary relationship between leaf growth and plant strength, which is critical in sports turf.

**5.1.4.6** On Area ③ it will be necessary to remove the existing sward and implement a process to establish a new soil profile in which the new sward can establish using a selected mixture of grass cultivars adapted to the prevailing conditions and capable of sustaining regular use for sport throughout the year. On Areas ⑤ and **E**, if remediation of the existing sward is undertaken, recreational community use will be achievable.

**5.1.5 <u>Soil Structure and Drainage</u>**

**5.1.5.1** The present topsoil structure is one, which is susceptible to panning and smearing due to the percentage of clay content present within the identified layer. Water permeation is further restricted if the soil becomes compacted through play. Preliminary hydraulic conductivity analysis of the soil samples taken on the pitch has revealed low permeability rates characteristic of the silty clay fine grained type found. (Refer to Physical Survey Tables).

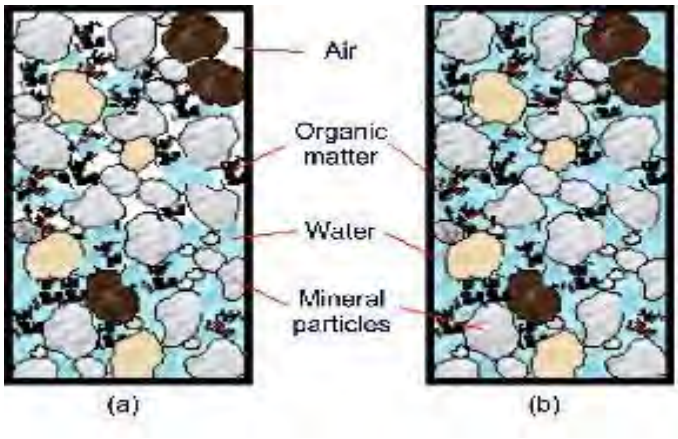
**5.1.5.2** No form of land drainage system is evident on the study areas. It is likely that if any system was installed as part of the original construction in the late 1960's / early 1970's, that it is largely ineffectual and must be considered as 'non-viable' within any future redevelopment process.

**5.1.5.3** Excess surface moisture over a prolonged period will generally lead to a number of problems on turf areas. These include some or all of the following, which to a greater or lesser extent have been identified during site analysis undertaken to produce this report.

- Reduced root development
- Reduced aeration of the soil
- Inefficient uptake and use of nutrients
- Slower growth patterns
- Susceptibility to disease
- Decreased resistance to drought and wear
- Increased invasion of weed species

**5.1.5.4** The combination of the above factors will result in grass quality, which is insufficiently durable to support the desired quality of provision normally expected. There is obviously a need to improve the overall texture, structure and quality of the existing topsoil on the areas in order that playing areas will in-filter the water required to sustain grass growth and clear excess so as to maintain an adequately aerated and balanced soil environment for healthy root and sward development during both the playing and non-playing season for the various sports planned for the area.

**5.1 5.5** The topsoil pore structure needs improvement to encourage more rapid infiltration of water and air movement, thereby creating a more favourable growing environment for grass plants. Water in a soil is pulled downwards by gravity; large pores will drain because there is not enough suction to hold the water in the pore against gravity, meanwhile small pores, where the suction is greater than the pull of gravity do not drain. This is why sandy soils, where the particles are large, and hence the pores are large, drain easily under gravity, but clay soils such as that on the Heyford site, where the particles and pores are very small will hardly drain under gravity and require land drainage schemes. In fact in clay soils, it is very difficult to pull water out – it must be pushed out, this happens when the soil is saturated.




**Unsaturated (a) and saturated (b) rootzones. In the saturated condition all the pores are full of water**

**5.1.5.6** The strength of a turfgrass plant is a function of agronomic factors related to plant health and growing environment. The strength of a natural soil or sand rootzone is a question of engineering and is closely related to the bulk density of the soil (how well packed the soil is) and its moisture content (how wet the soil is). Typically, as bulk density increases – soil strength increases and as moisture content increases – soil strength decreases. The principal target for groundstaff is to prepare surfaces that have a sufficiently high bulk density so as to provide strength to resist wear. The problem is that as bulk density increases, porosity (the amount of pores in a soil) decreases and restricts the amount of air in the soil available for the turfgrass; a balance is required.

**5.1.5.7** Amelioration to improve the existing structure of the topsoil is achievable by conventional husbandry methods involving the incorporation of organic matter and suitable soil conditioners.

**5.1.5.8** More rapid movement of water from the surface through the topsoil will only be beneficial in terms of achieving desired 'playing ability' of pitches, if a suitable supplementary system of land drainage is installed. The extent to which artificial drainage is likely to be required depends not only on the natural drainage capacity of the land and the rainfall expectancy, but also the type and amount of use to which the playing surface may be subjected. Predicted usage factors (the carrying capacity) need to be taken into account when designing a suitable scheme and should include the following:

- Standard of Play
- Number of weekly games and training sessions
- Pattern of use, i.e. spread of games

**5.1.5.9** Within Areas ⑤ and **E** the provision of playing surfaces for community use is achievable without the need for drainage systems.

**5.1.5.10** Within Area ③ **g**iven the nature of the soil type on the site and the envisaged profile of use, a primary system of closely spaced piped land drains laid within the subsoil layer would need to be installed within the proposed sports pitch. In addition it will be an essential requirement to install a secondary system comprising a series of gravel/sand slits within the topsoil layer and the top tier of the subsoil layer. This work should be undertaken following the re-establishment of the turf sward. The interconnection of the two systems would maximise drainage potential to meet designed discharge rates from the area. For this type of installation to remain effective, annual topdressings of sand must be applied to ensure the integrity of the material used in the secondary system remains, and to maintain the requirement of an open pore structure within the topsoil layer. This will need to be carefully controlled and nutrient values maintained.

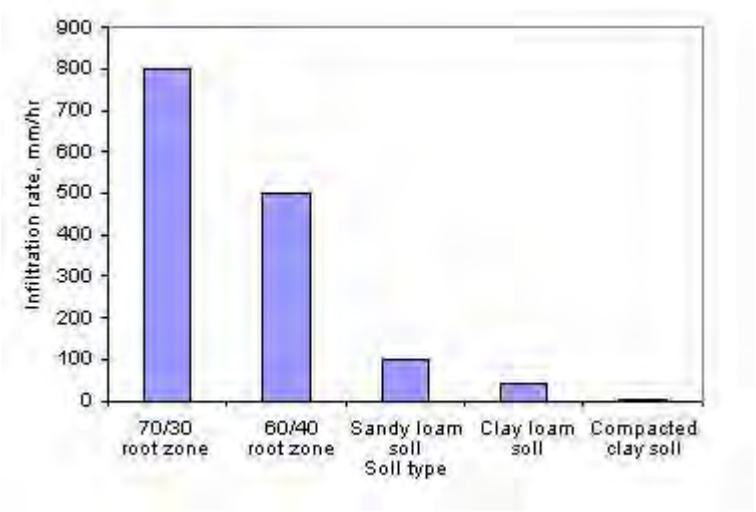
**5.1.5.9** Within Areas ⑤ and **E** the provision of playing surfaces for community use is achievable without the need for drainage systems.

**5.1.5.11** The infiltration rate (how quickly water enters the soil) is a function of many factors but is governed by the pore space in the soil – if the soil has an open structure at the surface water can flow into the soil easily; if the soil is capped or has small pores, the infiltration rate is reduced.

Low infiltration rate in sports surfaces is caused by:

- small pore sizes (eg. clay soils)
- compaction (wheeled traffic)
- capping (silts or sliding feet)
- some types of organic matter, including thatch
- or a combination of all of these.

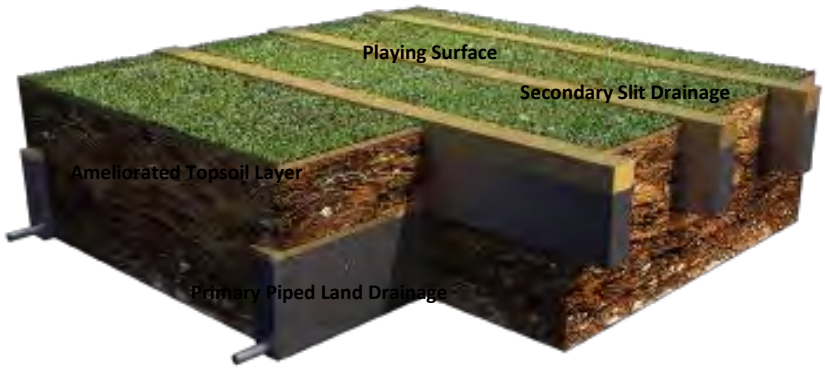
The inability to get water into a sports surface is one of the most common land drainage issues and is known as a surface drainage problem.




**Typical infiltration rates for different soil types**

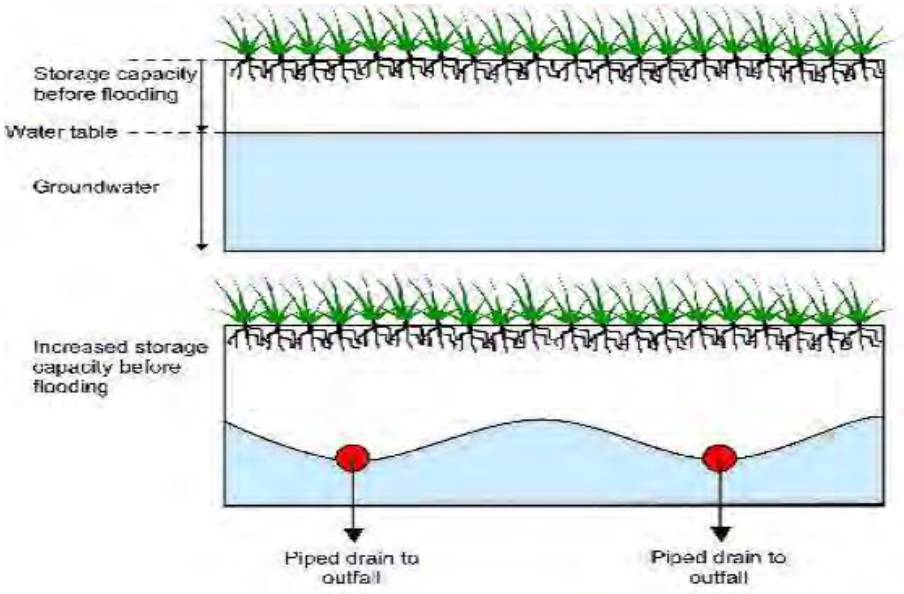
**5.1.5.12** Consideration of the above factors shows why clay soils are so susceptible to this problem – they have very small pores and the surface is easily smeared – providing a water tight seal over the soil. Installation of primary groundwater (land) drains will not solve this problem if the water cannot even get into the soil, let alone exit through the drains. If waterlogged and flooded pitches are to be avoided then it is necessary to bypass this impermeable surface completely using a surface drainage (secondary or bypass) system. A surface drainage system uses bands of higher hydraulic conductivity / infiltration rate material to allow precipitation to bypass the low conductivity soil, straight from the surface to a piped drainage system. Such a scheme is shown below; the low conductivity soil (such as heavy clay) has a very low infiltration rate and low hydraulic conductivity.

**Primary Piped and Secondary Slit Drainage System**



**5.1.5.13** In addition to the provision of the Primary and Secondary drainage systems it will be necessary to undertake appropriate forms of amelioration of the topsoil layer in order to create a homogenous soil profile, an effective link between the turf surface and the piped system, and provide the correct balance within the soil structure and retain fertility levels.

**5.1.5.14** In conclusion the capacity of the grass areas to sustain use throughout the playing season is severely compromised by two main factors. Firstly, the present condition of the soil structure prevents effective percolation through the upper margins, and secondly the lack of any form of drainage system. It will be necessary to initially install a primary drainage system and to introduce a secondary slit system together with amelioration of the upper soil margin to create a homogenous profile allowing the more effective movement of groundwater and creation of a more stable growing medium for the grass plants.




**The effect on a groundwater table of the installation of piped drainage. Note that at the drain locality, the water table is lowered, increasing the capacity of the soil to store rainwater and reducing the frequency of flooding. Note also, how the water table rises in-between the drains – the height to which it rises is a function of the depth of drains and their spacing. If the drains are too shallow or too far apart, they can actually cause flooding – a common indication of poor drainage design.**

**5.1.5.14** Subject to further site appraisal the most sustainable approach to the provision of a suitable outflow for drainage systems will be in the form of SuDS through the introduction of attenuation within the drainage network, soakaway's (subject to infiltration testing) swales and seasonal open water features where margins permit.

**5.1.5.15 <u>Indicative Flow Rates</u>**

Based upon the Sport England / PQS guidance the assumption is made that the objective is to be able to clear up to 5mm/hr through the installed drainage network consisting of a first tier of piped trenches overlain by a second tier of slit trenches within an ameliorated topsoil layer. The significance of this design rate value is that it comes very close to the maximum at which agro-meteorologists assume to be appropriate for the requirements of sports turf drainage.

Given that the system effectively comprises topsoil, gravel fill within trenches and pipework, it is recognised that temporary storage space for the attenuation of groundwater within the system exists, provided a suitable outlet is available to permit a free flow/discharge, and that the topsoil layer is regularly ameliorated and aerated to maintain the integrity of the system.

Performance is obviously related to soil type, hydraulic conductivity values, drainage spacing and substrate permeability etc. Based upon the foregoing the following volumes are possible:-

PER DAY/ HECTARE (10,000 $m^2$)

140,000 – 160,000 Litres/day (Approx. 31,100 – 35,000 gallons)

Volume 140 – 160 $m^3$ / day

**5.1.5.16 Ancillary Works**

The site contains a number of redundant features which it is assumed will be removed or adapted / re-profiled under any scheme to re-furbish the site. The following features were recorded during the site survey work.

**AREA ③ 1.03 ha** Multi-sport pitch (incorporating football pitch to Sport England's Natural Turf for Sport guidance, touch rugby and athletics track markings).

- Grandstand and associated terracing.
- Assumed ex. Athletics throwing event concrete circles.
- Paved features.
- Inspections chambers ( not proved if working or required)
- Ex. Floodlighting columns.

**AREAS ⑤ 0.68 ha** Multi-purpose grass pitch (incorporating softball, rounders, 5-a-side markings) and **E 0.75 ha** 7-a-side football pitch to recreational community use standard.

- 'Team' buildings and associated terracing.
- All of the Baseball diamond footprints.
- Paved features.
- Fence structures.

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**5.2 Hard Surface Games Courts**

**Area ④ 0.24 ha** Multi-purpose hard surface (incorporating 4 tennis courts (international) 3 netball courts (international) and 3 basketball courts (recreational) markings).

**Area D 0.12 ha** 2 tennis courts re-surfaced and re-marked to recreational community use standard.

The following commentary is common to both study areas.

**5.2.1** The whole of the current fencing system on all boundaries is considered to be unserviceable due to the high level of distortion of both the mesh and post components, and will require complete replacement.

**5.2.2** The precise depth and characteristics of the existing redundant construction particularly in relation to the sub surface aggregates and their suitability for re-use within any future reconstruction will need to be proven by appropriate sampling and testing. There is an initial concern that the materials may be susceptible to frost heave and degradation. A preliminary appraisal of construction profiles may be referenced within **Table 6**.In all probability the existing materials will need to be overlain to a suitable depth by a new construction profile, or removed entirely.

**5.2.3** There is significant ingress of root growth from the surrounding mature coniferous screen which has resulted in surface heave on the courts. In addition the root ingress has affected the network of link pathways between the court areas. The existing trees should be removed and new screening provision made. This may take the form of earth mounding and shelter belt planting together with the selection of fencing types and materials to reduce the effects of wind across the proposed court provision.

**5.2.4** Engineered gradients are minimal and compliant; however the future consideration of the refurbished construction profile will require drainage issues to be effectively dealt with in conjunction with 5.2.2 above.

**5.2.5** The 'historic' orientation of the courts in a general N/S alignment is compliant with relevant guidance, and the refurbished layout should mirror this approach.

**5.2.6** The N/S dimensions of the areas are the minimum required for Tennis providing a back line run-off of 5.49m as described in 3.2.9.3 above. However the N/S dimension of Area ④ is insufficient for the provision of Netball Courts which requires an overall recommended dimension (direction of play) of 36.60m. (Deficit 1.90m). Refer to **Table 3** for comparative spatial requirements.

## 6.0 RECOMMENDATIONS

**The following information is provided for discussion purposes only based upon the areas of study contained and considered within the main body of this report, and on the level of information described. Descriptions given are broad based and will require refinement in the form of detailed specification and drawings before work is considered**

### 6.1 NATURAL TURF PITCHES

The range of natural turf pitches illustrated within Figure 1 (Extract from Drawing No. K. 0158 34-4 Dated 28th August 2013 are:-

- ③ **1.03 ha** Multi-sport pitch (incorporating football pitch to Sport England's Natural Turf for Sport guidance, touch rugby and athletics track markings).
- ⑤ **0.68 ha** Multi-purpose grass pitch (incorporating softball, rounders, 5-a-side markings) to recreational community use standard
- **E 0.75 ha** 7-a-side football pitch to recreational community use standard.

**6.1.1.1** **Area ③ 1.03 ha** Multi-sport pitch (incorporating football pitch to Sport England's Natural Turf for Sport guidance, touch rugby and athletics track markings).

#### 6.1.1.1 Drainage

The PQA developed by Sport England and the Football Association suggest that the water infiltration rate on community or recreation pitches should be not less than 5mm/hour. This will only be achievable at the site by the amelioration of the existing topsoil layer to create a more pervious medium and the installation of a land drainage network to create an integrated system for the controlled transmission of water from the surface to pipework for discharge from the area. Land drainage together with appropriate forms of maintenance and husbandry will be essential to assist this requirement.

From the research undertaken on the site to date, it would appear that there may be limited scope for discharge via either engineered drainage outlets (storm water systems) or existing networks such as open ditches or ponds etc. Subject to further detailed appraisal the most effective methods of discharging water from the land drainage system will be suitable SuDS based systems.

Sport England Guidance in relation to this approach states:

*Very often, there is a requirement to attenuate drainage water before it reaches its final outfall (e.g. ditch, river, or connection to the surface water drainage scheme). These systems may comprise the following: • Attenuation basins, ponds or lakes • Grassland swales • Shallow or deep-bored soakaway's. The design of such systems is site specific, and typically, will be subject to statutory approval from the Environment Agency, who will require supporting calculations to demonstrate its compliance to their requirements.*

The proposal to sustain an increased intensity of use would be to install additional Primary System piped drains to supplement the existing network, overlain by a Secondary System of Slit Drains. There will be a significantly increased

flow of water from the site. Therefore the capacity of any outfall to deal with the anticipated flow rates from the area needs to be assessed.

In addition to the provision of the Primary and Secondary drainage systems it will be necessary to undertake appropriate forms of amelioration of the topsoil layer in order to create a homogenous soil profile and an effective link between the playing surface turf and pipework.

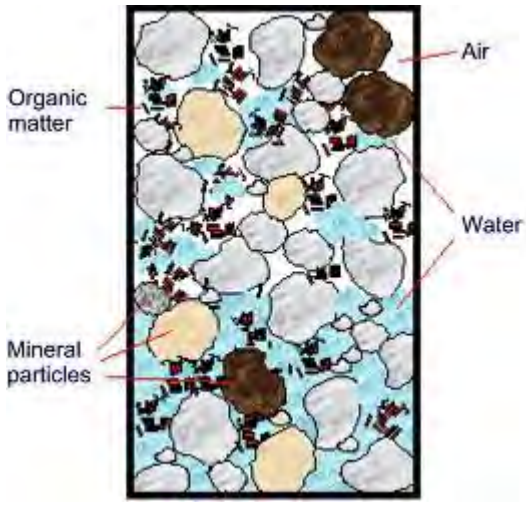
- Install additional / supplementary primary piped land drainage system comprising a grid pattern of drains laid to falls within the subsoil layer (Typical Depth 450 – 600 mm below surface). Spacing to be determined by design – at this stage based upon approximately 5m centres (subject to final design calculation).
- Install secondary slit system across the piped primary system to interconnect. Slits at 1000mm centres, depth 250 mm. Secondary system installed once the new turf sward has established sufficiently.
- Annually top-dress the area with appropriate particle size of sand to maintain integrity of the system.
- Subject to provision of outfall, consider additional methods of attenuation / regulation of flow within the system to prevent surcharge.

**Installation of Primary Piped System**

**Installation of Secondary Slit System**

#### 6.1.1.2 Soil Structure and Profiles

In addition to the provision of the Primary and Secondary drainage systems it will be necessary to undertake appropriate forms of amelioration of the topsoil layer in order to create a homogenous soil profile, an effective link between the turf surface and the piped system, and provide the correct balance within the soil structure and retain fertility levels.




The achievement of a suitable soil structure requires the layer to have the correct balance of air (pore space), organic matter and mineral particles from which to store and derive nutrients and moisture to sustain growth.

The pore structure of the existing clay/silt soil type may be improved by conventional husbandry methods broadly described below: -

- Amelioration of the topsoil layer by the incorporation of a suitable sand of defined particle range, to encourage increased pore space between clay/silt particles and promote percolation and air availability to roots.

The entire (full depth) existing construction profiles of the redundant Athletics Track on Area ③ will require removal within any proposed redevelopment scheme. The replaced profile will be based upon an appropriate specification utilising selected imported (or re-used soils from drainage system excavations) soils to create a suitable medium in which to re-establish a suitable sports turf grass sward. (**NOTE**: the presence of the noted ash / clinker material within the sub surface formation will require appropriate methods of contaminate testing to be undertaken before disturbance / removal, in accordance with relevant guidance).

**6.1.1.3 <u>Turf Quality</u>**

A programme of work is necessary to eradicate the excessive weed and non-desirable grass species growth present, and to encourage the establishment of a more desirable form of turf sward. The following course of treatment may be considered.

- Undertake process to remove the existing sward through 'Koroing'. This will remove all traces of the existing sward and prepare the area for subsequent re-establishment.

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- Top dress surface to restore tolerances. Over-seed the area with an appropriate grass seed mix comprising selected rye grass cultivars capable of sustaining predicted usage and wear criteria.

- Apply fertiliser to the entire area of appropriate consistent ratios to encourage grass leaf development, tillering, strength, health and wearing qualities of the turf. This can be provided by the elements of Nitrogen (N), Potassium (K) and Phosphorus (P) together with ancillary trace elements. Nitrogen will promote vegetative growth and colour, Potassium will assist general plant health and Phosphorous will encourage root development and subsequent nutrient uptake.

#### 6.1.1.4 Maintenance

It is essential that a defined programme of maintenance be specified for the area to ensure it remains capable of sustaining the degree of required use. With inappropriate maintenance the area will deteriorate, particularly in relation to the quality of the playing surface. Maintenance should include the following:

- Mowing to correct heights and at appropriate frequencies throughout both the playing and non-playing season.
- Appropriate fertiliser applications, particularly in the Spring and Autumn periods to maintain nutrient levels.
- Regular aeration of the area by the action of spiking and slitting.
- Harrowing of the winter games pitches to discourage thatch and encourage the entrance of air and moisture to turf.
- Appropriate topdressing application to ameliorate and maintain soil structure and quality.
- Regular observation of weed species within turf sward to identify undesirable forms, which will suppress grass development.

#### 6.1.1.5 Timescale

The installation of the recommended primary system of land drains together with a secondary slit system must take place during optimum ground conditions where sufficient ground moisture content exists to prevent excessive heave but avoid shrinkage, and any rutting or smearing of the surface is prevented. The normal timing for this operation is late April to early September. Based upon a total of approximately 10,000$m^2$ the work is estimated to take 10 -15 days to complete.

The site material will comprise a mixture of fragmentary limestone and the shallow silty clay topsoil/made ground layer. These materials should be within the excavating capacity of conventional plant. Specialist trenching equipment should be used with appropriate tracked fittings or grassland tyres.

Improving the turf sward characteristics through the removal of the existing sward and subsequent over-seeding of an entire pitch, will need to allow re-establishment to take place before play is permitted. Subject to correct growing conditions this may take 12 - 18 months to achieve. Seeding can be undertaken in late Spring (April/May) or September, however if drier conditions prevail germination will be affected and the re-establishment of the grass sward delayed unless irrigation can be provided.

Any consideration of the potential to lay turf on the area should be considered as unviable unless appropriate forms of supplementary irrigation are provided.

#### 6.1.1.6 Specialist Contractors

The installation of sports facilities is a specialised form of construction. For this reason, it is recommended that the project works are undertaken by an experienced specialist contractor with a proven track record. There are a considerable number of contractors who now have experience of installing good quality turf pitches. In order to reduce the potential tender list to manageable proportions, membership of a recognised trade association should also be considered as a significant criterion.

#### 6.1.1.7 Outline Works

It is recommended that the entire pitch area is identified for the provision of the remedial works programme to include primary and secondary land drainage, soil amelioration, turf structure and establishment based upon a total of approximately 10,000$m^2$. (TBV)

**Primary and Secondary Land Drainage**

Install Primary land drains at approx. 5m centres av. 450mm – 600mm below surface.

- Install secondary slit system at 1000mm centres, 250mm depth, min. 20mm width using specified backfill material.
- Provisional Item. Attenuation / SuDS provision.

**Soil Structure and Amelioration**

- Existing sward eradication (Koroing), Soil Amelioration, Surface Dressing, Cultivation and Seeding.
- 12 Months Maintenance Establishment

**Re- Profiling of Redundant Athletics Track**

Remove existing profile, create new profile using specified selected soils. Seed and establish etc.

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**6.1.2 Area ⑤ 0.68 ha** Multi-purpose grass pitch (incorporating softball, rounders, 5-a-side markings) and **Area E 0.75 ha** 7-a-side football pitch to recreational community use standard.

**6.1.2.1 Turf Quality** Refer to commentary provided within **6.1.1.3**

In addition, due to the existing 'rank' nature of the grassland it will be necessary to reduce the sward height to an acceptable level by agricultural flail mower before any operation to 'Koro' or similar remediation processes may be considered. Undertake herbicide application and treatment prior to grading and cultivation etc.

**6.1.2.2 Maintenance**

It is essential that a defined programme of maintenance be specified for the area to ensure it remains capable of sustaining the degree of required use. Maintenance should include the following:

- Mowing to correct heights and at appropriate frequencies throughout both the playing and non-playing season.
- Appropriate fertiliser applications, particularly in the Spring and Autumn periods to maintain nutrient levels.
- Regular aeration of the area by the action of spiking and slitting.
- Regular observation of weed species within turf sward to identify undesirable forms, which will suppress grass development.

**6.1.2.3 Specialist Contractors** Refer to commentary provided within **6.1.1.6**

**6.1.2.4 Timescale** Improving the turf sward characteristics through the remediation of the existing sward and subsequent over-seeding of an entire pitch, will need to allow re-establishment to take place before play is permitted. Subject to correct growing conditions this may take 12 - 18 months to achieve. Seeding can be undertaken in late Spring (April/May) or September, however if drier conditions prevail germination will be affected and the re-establishment of the grass sward delayed unless irrigation can be provided.

**6.1.2.5 Outline Works**

It is recommended that the area is identified for the provision of the remedial works programme to include turf re-structure and establishment based upon a total of approximately 14,500m$^2$. (TBV). Drainage is not considered necessary due to the recreational use profile of this area.

**Turf Re-Structure and Amelioration**

- Existing sward eradication Cutting, Koroing, Soil Amelioration, Surface Dressing, Cultivation and Seeding.
- 12 Months Maintenance Establishment.
- **Re- Profiling of Redundant Baseball diamonds** Remove existing profile, create new profile using specified selected soils. Seed and establish etc.

**6.2 Hard Surface Games Courts**

**Area ④ 0.24 ha** Multi-purpose hard surface (incorporating 4 tennis courts (international) 3 netball courts (international) and 3 basketball courts (recreational) markings).

**Area D 0.12 ha** 2 tennis courts re-surfaced and re-marked, to recreational community use standard.

**6.2.1 General Performance Values**

- Permeability Rate to exceed 100mm/hr. when tested to ITF CS 06/01.
- Slip Resistance of area (including all courts, run off margins and line markings) for **TENNIS (AREA D)** greater than 60 (dry or wet) and for (**NETBALL AREA ④**) when tested to ITF CS 02/01.Courts to be colour coated.
- Maximum permitted deviation in consistency/evenness of surface to be not greater than 8mm when measured with a 3m straight edge in accordance with ITF CS 08/01.
- Maximum gradient in any direction not to exceed 1 in 120.
- Binder/base coarse macadam shall be produced in accordance with SAPCA Code of Practice (2007 Rev.) Clause 2.14.2. Wearing/surface coarse macadam shall be produced in accordance with SAPCA Code of Practice (2007 Rev.) Clause 2.14.3. Macadam shall be specially formulated and certified for use in Tennis or Netball Court Construction as appropriate.
- The courts shall be fenced on all sides. All fencing works shall be undertaken in accordance with the appropriate sections of BS 1722. The fencing system is to be fully compliant with EN 15312.2007.
- Equipment (posts, nets etc.) to be supplied.
- **Area ④** to have minimum footprint of **36.60m x 64.01m** to facilitate provision of 4 Tennis courts and 3 Netball courts.
- **Area D** to have minimum footprint of **34.75m x 31.70m** to facilitate provision of 2 Tennis courts.

**6.2.3 Timescales**

The estimated construction period for the two facilities is 10 – 12 weeks. Both areas will be available for play immediately upon completion

**6.2.4 Specialist Contractors**

The installation of sports facilities is a specialised form of construction. For this reason, it is recommended that the project works are undertaken by an experienced specialist contractor with a proven track record. There are a considerable number of contractors who now have experience of installing good quality specialist sports surface facilities. In order to reduce the potential tender list to manageable proportions, membership of a recognised trade association should also be considered as a significant criterion.

**6.2.5 Outline Works**

**Area ④ 0.24 ha** Remove existing fence materials. Remove existing tree belt. Lay new court construction. Install new perimeter fence system.

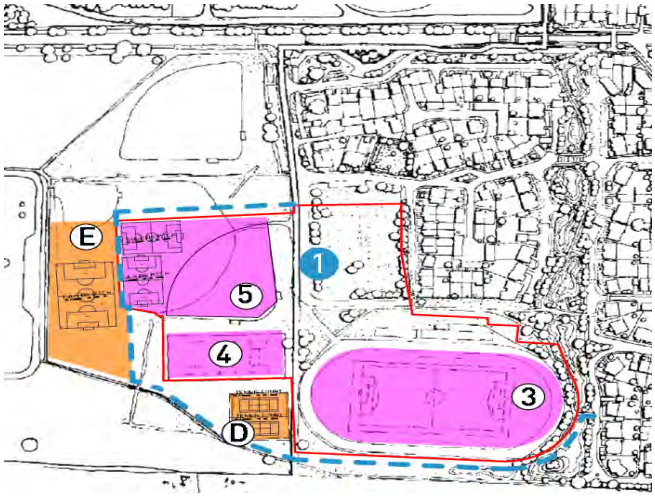
**Area D 0.12 ha** 2 tennis courts re-surfaced and re-marked. Remove existing fence materials. Remove existing tree belt. Lay new court construction. Install new perimeter fence system.

**PROVISIONAL ITEM: Floodlighting**

At this stage the site has been considered to be within Environmental Zone E2. (Area of low district brightness – rural or relatively dark urban location). Both Tennis and Netball will require illuminance to 400 lux.

## EXECUTIVE SUMMARY

**Extract from Drawing No. K. 0158 34-4 Dated 28th August 2013**




By reference to the content and commentary provided within the main body of this report we summarise our findings as follows:-

**Natural Turf Pitch Areas**

**③ 1.03 ha** Multi-sport pitch (incorporating football pitch to Sport England's Natural Turf for Sport guidance, touch rugby and athletics track markings).

**⑤ 0.68 ha** Multi-purpose grass pitch (incorporating softball, rounders, 5-a-side markings), to recreational community use standard.

**E 0.75 ha** 7-a-side football pitch to recreational community use standard.

- Gradients on the Area ③ are generally consistent and require no significant adjustment. Local deviations can be corrected through conventional husbandry operations and surface dressings.

- Gradients on the Areas ⑤ and **E** are minimal. If the predicted usage profile increases above recreational community use levels any future provision of drainage within the area will need to take account of minimal gradients with the incorporation of induced sub surface inverts to assist flow.

- The present topsoil structure is one, which is susceptible to panning and smearing due to the percentage of clay content present within the identified layer. Water permeation is further restricted if the soil becomes compacted through play. Preliminary hydraulic conductivity analysis of the soil samples taken on the areas has revealed low permeability rates characteristic of the silty clay fine grained type found. (Refer to Physical Survey Tables).

- Given the nature of the soil type on the site, a primary system of closely spaced piped land drains laid within the subsoil layer would need to be installed within the proposed sports pitch Area ③. In addition it will be an essential requirement to install a secondary system comprising a series of gravel/sand slits within the topsoil layer and the top tier of the subsoil layer. This work should be undertaken following the re-establishment of the turf sward. The interconnection of the two systems would maximise drainage potential to meet designed discharge rates from the area.

- Consideration of SuDS systems to accept water discharge flows from the drainage systems subject to further detailed appraisal.

- Based upon the defined usage level of Areas ⑤ and **E** as recreational community use, the inclusion of land drainage systems is not necessary during initial turf re-structuring works. If the predicted usage profile increases above recreational community use levels any future provision of drainage within the area will need to take account of minimal gradients with the incorporation of induced sub surface inverts to assist flow.

- The entire (full depth) existing construction profiles of the redundant Athletics Track on Area ③ and the Baseball diamonds on Areas ⑤ and **E** will require removal within any proposed redevelopment scheme. The replaced profile will be based upon an appropriate specification utilising selected imported soils to create a suitable medium in which to re-establish a suitable sports turf grass sward. Consideration is possible of the potential to utilise excavations from drainage system installation within re-profiling works. (**NOTE**: the presence of the noted ash / clinker material within the sub surface formation of the redundant Athletics Track within Area③ will require appropriate methods of contaminate testing to be undertaken before disturbance / removal, in accordance with relevant guidance).

- In general terms the pitch playing surface on Area ③ is of a poor quality sward caused by a number of cultural and physical characteristics. The present condition of the soil structure and turf sward will result in the pitch areas at some stage throughout the playing season, suffering from poor drainage bought about by compaction of the surface and immediate (predominantly fine textured clay / silt) soil horizon.

- The generally 'rank' conditions of Areas ⑤ and **E** have arisen due to the effects of natural degradation over time by comparison to the original condition when in regular use. The exposed nature of the site and lack of maintenance inputs have allowed weed species to establish and dominate the sward.

- It is essential that a uniformity of turf quality is established on the site in order to provide the maximum potential for the areas to sustain use throughout the playing season and suitable playing characteristics for the envisaged profile of use.

- Soil quality and structure must also be improved by cultural methods to promote the establishment of a more suitable turf sward. Root development must be encouraged to its maximum and soil fertility levels increased to minimise effects of drought, disease and the invasion of weed species which occur in poorly maintained sports turf.

- On all of the Area ③ it will be necessary to remove the existing sward and implement a process to establish new soil profiles in which the new sward can establish using a selected mixture of grass cultivars adapted to the prevailing conditions and capable of sustaining regular use for sport throughout the year. On Areas ⑤

and **E**, the remediation of the existing sward can be undertaken through cultural methods to provide surfaces suitable for recreational community use.

- It is essential that a defined programme of maintenance be specified for the areas to ensure they remain capable of sustaining the degree of required use. With inappropriate maintenance the areas will deteriorate, particularly in relation to the quality of the playing surface.

- Area ③ to meet Performance Quality Standard (PQS) guidance values, Areas⑤ and **E** to recreational community use standards.

**Hard Surface Games Courts**

**Area ④ 0.24 ha** Multi-purpose hard surface (incorporating 4 tennis courts (international) 3 netball courts (international) and 3 basketball courts (recreational) markings).

**Area D 0.12 ha** 2 tennis courts re-surfaced and re-marked, to recreational community use standard.

- The whole of the current fencing system on all boundaries is considered to be unserviceable due to the high level of distortion of both the mesh and post components, and will require complete replacement.

- The precise depth and characteristics of the existing redundant construction particularly in relation to the sub surface aggregates and their suitability for re-use within any future reconstruction will need to be proven by appropriate sampling and testing. There is an initial concern that the materials may be susceptible to frost heave and degradation. In all probability the existing materials will need to be overlain to a suitable depth by a new construction profile, or removed entirely.

- There is significant ingress of root growth from the surrounding mature coniferous screen which has resulted in surface heave on the courts. In addition the root ingress has affected the network of link pathways between the court areas. The existing trees should be removed and new screening provision made. This may take the form of earth mounding and shelter belt planting together with the selection of fencing types and materials to reduce the effects of wind across the proposed court provision.

- Engineered gradients are minimal and compliant; however the future consideration of the refurbished construction profile will require drainage issues to be effectively dealt with.

- The 'historic' orientation of the courts in a general N/S alignment is compliant with relevant guidance, and the refurbished layout should mirror this approach.

- The N/S dimensions of the areas are the minimum required for Tennis. However the N/S dimension of Area ④ is insufficient for the provision of Netball Courts which requires an overall recommended dimension (direction of play) of 36.60m. (Deficit 1.90m). The facilities should be constructed to meet the recommended guidance for court size and layout.

- Courts to achieve NGB guidance values as relevant to defined usage profiles.

**REFERENCES**

Background publications and records used to assist in the compilation of this report are as follows:-


British Geological Survey 1:50 000 Scale Map & Regional Geology 3rd Edition

BS 7755 Soil Analysis

BS 7370 Grounds Maintenance

BS 4962 Land Drainage

BS 3882 Soil Classification

Sport England Design Guidance Note – Natural Turf for Sport

Sport England Design Guidance Note – Artificial Surfaces for Outdoor Sport

Sport England Design Guidance Note – Comparative Sizes of Sports Pitches and Courts

Sport England – Facilities Costs Guidance

Sports Turf Science Construction and Maintenance – V I Stewart (Published NPFA & E&FN Spon).

Spon's Landscape and External Works Price Book (Published E & FN Spon)

Building Bulletin 98 Briefing Framework for Secondary School Projects Revision of BB82: Area Guidelines for Schools (Secondary section)

The Agricultural Climate of England and Wales (Published DEFRA)

Guidelines for Sports Turf Drainage Installation (Published LDCA)

Football Foundation Facilities Data Sheet – Grass Pitches for Football

Football Association – Natural Grass Pitch Upgrade Performance Quality Standard

The FA Guide to Pitch and Goalpost Dimensions