

## A REPORT TO MORGAN SINDALL

### A feasibility study for the construction of a natural turf sport pitch at Newhouse Academy, Rochdale.

12<sup>th</sup> December 2022.

TGMS0901.14



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

KEY:  No action required  Action may be required  Action required

#### Site information

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | <b>Objective:</b> A feasibility study for the construction of natural turf sport pitch at Newhouse Academy.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 2  | <b>Site visit:</b> A detailed site visit was conducted by Craig Parry of TGMS on the 9th December 2022.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 3  | <b>Hydrology:</b> Climate data obtained from the Flood Estimation Handbook (FEH) indicate that the standard-period average annual rainfall (SAAR) is 1065 mm/year for this catchment which is above the national average of 855 mm/year and is within the fifth highest category for the whole of the UK (see Figure 6). Greenfield run-off rates and drainage rates do not differ with reference to a 6-hour and 24-hour rainfall events in a return period of 1 year; therefore, the installation of a drainage system would likely not cause faster or greater flow than current greenfield condition. |
| 4  | <b>Flood risk:</b> Based on information obtained from the Environment Agency (EA), the site has a very low risk of flooding from surface water, and rivers and seas, with a chance of flooding less than 0.1%.                                                                                                                                                                                                                                                                                                                                                                                            |
| 5  | <b>Landfill:</b> The site is not located over registered landfill.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 6  | <b>Groundwater Source Protection:</b> The development site is not located within a Groundwater Source Protection Zone, if it were, this could restrict the construction of a deep bored soakaway (depending upon geology) as a means of achieving drainage outfall from the site.                                                                                                                                                                                                                                                                                                                         |
| 7  | <b>Topography:</b> A topographical level survey of the natural playing field has not been provided to TGMS. Ideally pitch gradients should be on a single plane with consistent falls to within Sport England recommended slopes for sports pitches.                                                                                                                                                                                                                                                                                                                                                      |
| 8  | <b>Pitch orientation:</b> The proposed plan in Figure 2 shows that the orientation of the football pitches is approximately 315° and therefore compliant with Sport England guidance.                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 9  | <b>Geology:</b> The soil on site was mapped by the Soil Survey of England and Wales and has been classified as the Brickfield 3 association, described as, 'Slowly permeable seasonally waterlogged fine loamy, fine loamy over clayey and clayey soils'. The soil overlies Till, Devensian - Diamicton. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period.                                                                                                                                                                                     |
| 10 | <b>Soils:</b> The site is characterised by a SANDY LOAM topsoil containing a minimal stone content overlying CLAY LOAM subsoil.                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 11 | <b>Stones/ Sharps:</b> Observations made during the initial site visit identified a minimal stone content running through the topsoil.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 12 | <b>Existing drainage:</b> Aerial imagery would suggest that no drainage scheme is located within the area examined. A point of outfall was not identified within the development site.                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 13 | <b>Agromony:</b> Vegetative cover was ~95% comprising <i>Perennial ryegrass</i> and a low weed content. >5 mm layer of thatch was present across the entirety of the site.                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 14 | <b>Site usage:</b> Based on the condition of the existing site (undrained), it is anticipated that the estimated hours of usage will be under 2 hours per week per pitch before pitch conditions deteriorate.                                                                                                                                                                                                                                                                                                                                                                                             |
| 15 | <b>Performance Quality Standards:</b> The existing site passes 6 elements (of 8 measured) of Sport England's Performance Quality Standards, they are: Ground cover, Weed content, Sward height, pH, Slope and Stone content.                                                                                                                                                                                                                                                                                                                                                                              |

### Summary of Recommendations

|    |                                                                                                                                                                                                                                                                                                                                                                              |                     |                    |                     |            |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------------------|---------------------|------------|
| 1. | The cost of reinstatement works to the natural turf pitch in line with the soil characteristics, topography of the site and carrying capacity is anticipated to be in the region of the following estimate:                                                                                                                                                                  |                     |                    |                     |            |
|    | <b>Option</b>                                                                                                                                                                                                                                                                                                                                                                | <b>Construction</b> | <b>Maintenance</b> | <b>Total ex VAT</b> | <b>VAT</b> |
|    | <b>Option 1</b>                                                                                                                                                                                                                                                                                                                                                              | £46,420.00*         | £4,600.00          | £51,020.00*         | £10,204.00 |
|    | <b>£61,224.00*</b>                                                                                                                                                                                                                                                                                                                                                           |                     |                    |                     |            |
|    | *These costs do not include any earthworks which will be included by the main contractor.                                                                                                                                                                                                                                                                                    |                     |                    |                     |            |
|    | These above costs do not include professional fees for design and specification, tender administration, and construction phase monitoring.                                                                                                                                                                                                                                   |                     |                    |                     |            |
|    | Please note: Actual costs may vary as much as $\pm 15\%$ depending on contractor availability, prices of aggregates and time of year.                                                                                                                                                                                                                                        |                     |                    |                     |            |
| 2. | With respect to timescales for completing the project, it is essential that construction works take place in good, dry ground conditions. Grass is ideally sown in spring or early autumn to maximise the balance between moisture and temperature. The grass must be allowed to establish a healthy and deep root network and mature canopy to resist the stresses applied. |                     |                    |                     |            |
| 3. | It is likely that the reinstated area will perform better than the existing pitch which is undrained.                                                                                                                                                                                                                                                                        |                     |                    |                     |            |

*(All above costs exclude the cost of permissions, planning etc.)*

Please note that the Client should determine whether or not planning permission from the Local Authority is required for the proposed works. The outfall of drainage water into surrounding areas will be subject to permission from the Local Lead Flood Authority and/or the Internal Drainage Board. The costs for obtaining this permission, or any conditions of permission, are not included in the estimates in this document and are the responsibility of the Client.

**Thomas Relf – December 2022**

## 2 INTRODUCTION AND OBJECTIVES

TGMS under PSD Agronomy has been commissioned by Morgan Sindall to conduct a detailed site investigation and agronomic assessment for the feasibility of reinstating a natural turf sports pitch following removal of a Multi-Use-Games-Area (MUGA).

The objectives of the feasibility study are as follows:

- To undertake a site investigation in order to characterise the underlying soil profile and the effects this soil profile may have on pitch performance including drainage and agronomic requirements.
- To evaluate the topography of the site including any drainage and potential outfall arrangements.
- To evaluate the topography of the site to ascertain the extent of any earthworks required.
- To prepare a set of development options for pitch construction based on the information gathered during the visit including any recommended drainage schemes and earthworks.
- To derive indicative construction costs for budgetary purposes and present costed options where applicable.
- To provide an indicative work programme for the possible phasing and duration of the proposed construction works. This will also indicate when the sports facilities may be available for use.

### 3 PHYSICAL SITE SURVEY

Craig Parry of TGMS Sports Surface Consultants conducted a detailed site visit on the 9<sup>th</sup> of December 2022 to evaluate current carrying capacity, soil types, agronomic condition and drainage potential of the site.

#### 3.1 Site location and access

The proposed location of the new pitch is located within land currently used by Newhouse Academy. A hard standing Multi-Use Games Area (MUGA) is currently located within the southern half of the proposed natural turf sports pitch. Morgan Sindall have proposed to reinstate the MUGA with a natural turf area which is of equivalent quality to the surrounding natural turf pitch.

The site address is:

Newhouse Road, Heywood OL10 2NT.

The grid reference for the development area is approximately: OSGB 385701,409391.

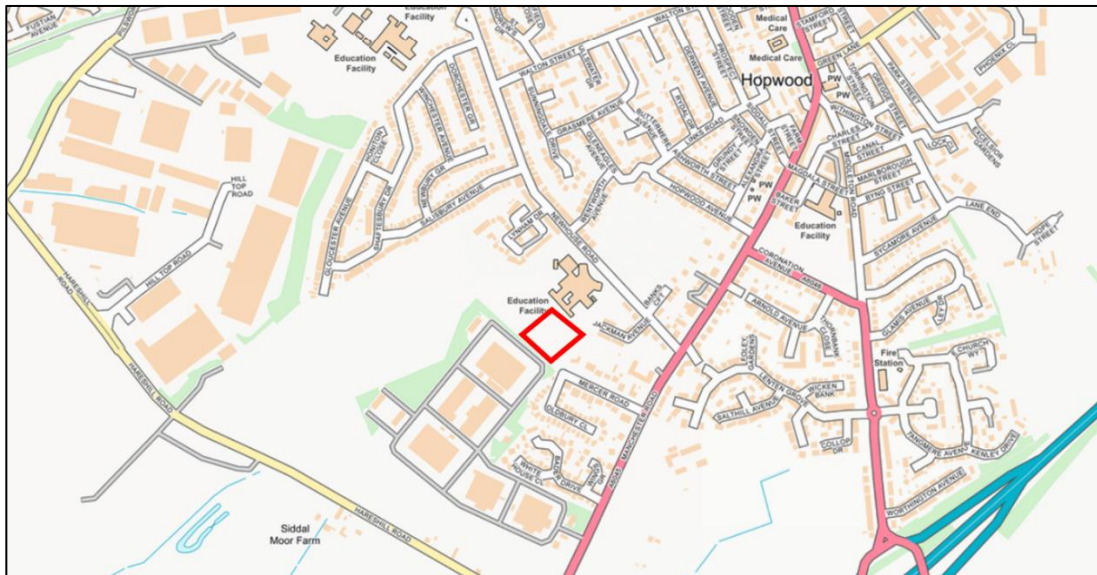


Figure 1 Site location (Red line). Location indicative only and not to scale.

The reinstatement of a MUGA to develop one natural turf sports pitch (part of a school development) has been proposed by Morgan Sindall. The dimensions of the pitch have not been provided to TGMS, however, it is assumed the pitch will be a U15 / U16 pitch (97 m x 61 m). The proposed location for the winter sports pitch is located within Newhouse Academy playing fields, however a section of the proposed pitch currently comprises a hard standing MUGA and long jump pits, both of which will require removal prior to pitch construction. The development options focus on the removal of the MUGA and reinstatement of land to elongate the current natural turf sports area.

The agronomic/soils assessment of the development site was conducted in locations to align with the indicative layout of the pitch post construction. The development site is currently bounded by Newhouse Academy to the north-east, housing development to the south-east and a business park to the south-west. The north is bounded by the remaining section of Newhouse Academy playing fields. The current main entrance to the site is via Newhouse Road to the northeast of the site.

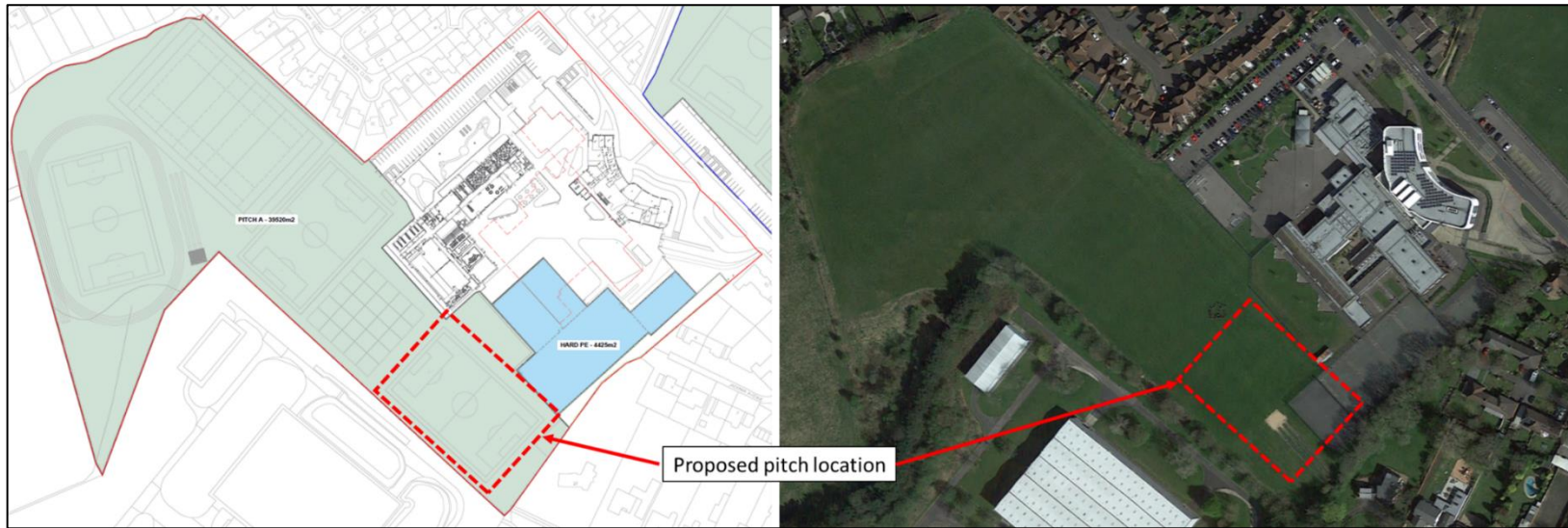


Figure 2 The proposed layout of the development site (courtesy of Morgan Sindall).

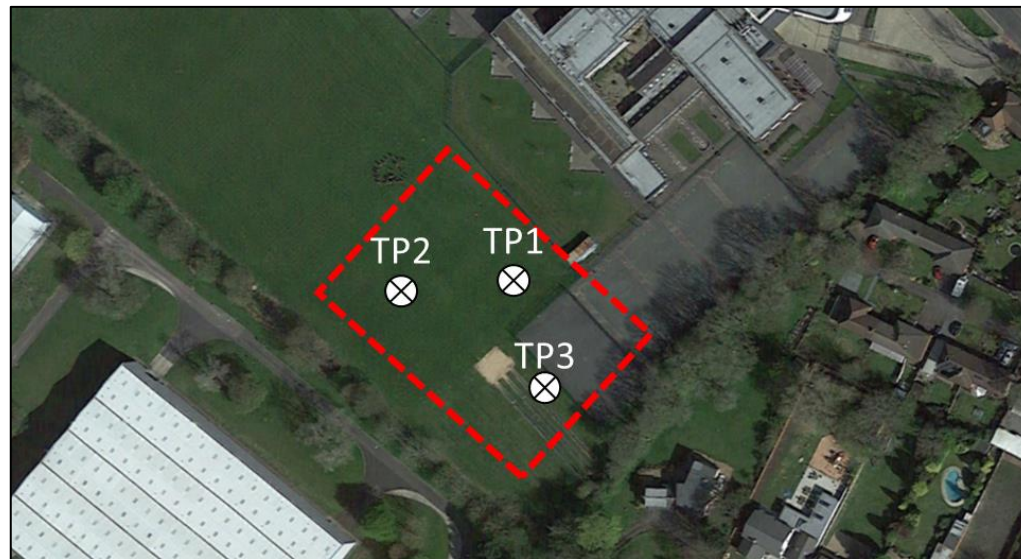


Figure 3 TP1-TP3 mark the approximate location of the trial pits.



*Figure 4 General view of the site looking east from TP2.*



*Figure 5 General view of the site looking north .*

## 3.2 Geomorphology and climate

### 3.2.1 Hydrology

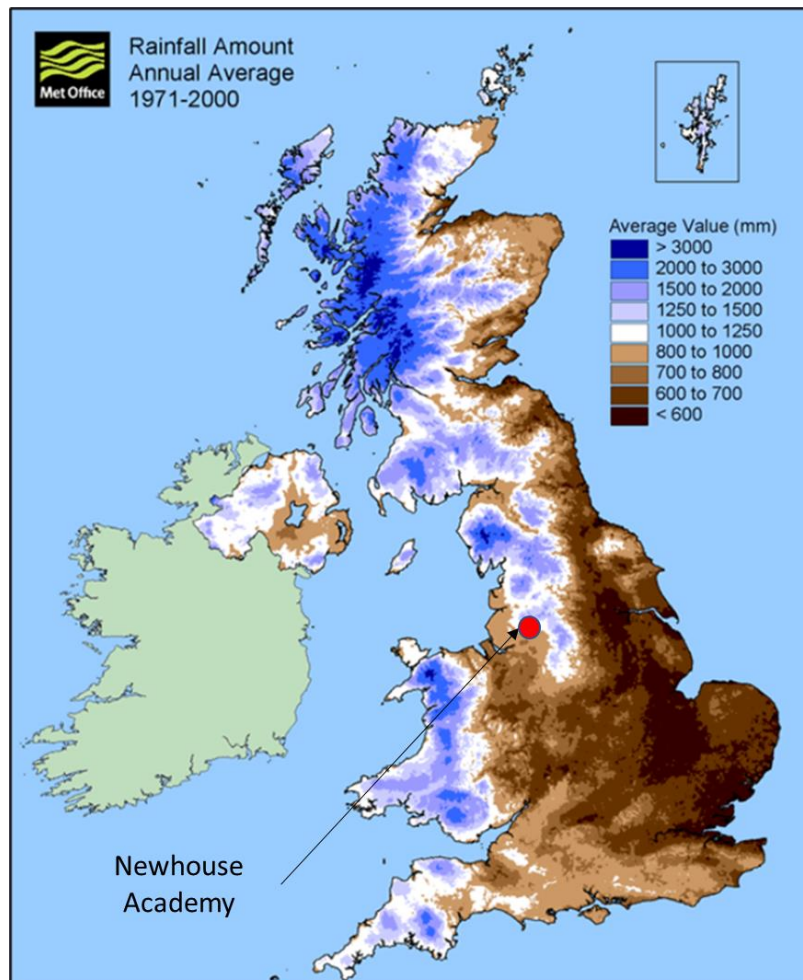
A watercourse was not located within the development site.

Climate data obtained from the Flood Estimation Handbook (FEH) indicate that the standard-period average annual rainfall (SAAR) is 1065 mm/year for this catchment which is above the national average of 855 mm/year and is within the fifth highest category for the whole of the UK (see Figure 6).

Greenfield runoff rates and drainage outfall rates for the site have been calculated using the Flood Estimation Handbook method and are presented in Table 1. It is important to note that both rates are based on 1 hectare and therefore these rates may differ depending on the scope of works. Greenfield run-off rates and drainage rates do not differ with reference to a 6-hour and 24-hour rainfall events in a return period of 1 year; therefore, the installation of a drainage system would likely not cause faster or greater flow than current greenfield condition. These drainage rates are for information only and more accurate drainage rates will need to be established prior to the design process depending on the point of outfall and any relevant flow restrictions.

*Table 1 Greenfield run off rate (FEH method) and Drainage outfall rates (ADAS 345 Method) for the 6 hr duration events for the return periods shown (for 1 ha).*

| Return period | Greenfield Runoff Rate<br>(FEH method)<br>(L/s) | Drainage Outfall Rate<br>(6 hr FEH rainfall event)<br>(L/s) | Drainage Outfall Rate<br>(24 hr FEH rainfall event)<br>(L/s) |
|---------------|-------------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------|
| 1:1           | 9.35                                            | 2.3                                                         | 3.8                                                          |
| 1:30          | 18.27                                           | 5.3                                                         | 7.7                                                          |
| 1:100         | 22.36                                           | 7.0                                                         | 9.9                                                          |



*Figure 6 Location of the development area within the MET office rainfall statistics (1981-2010).*

### 3.2.2 Risk of flooding from surface water

Based on information obtained from the Environment Agency (EA), the site has a very low risk of flooding from surface water with a chance of flooding less than 0.1%.

### 3.2.3 Risk of flooding from Rivers and Seas

Based on information obtained from the Environment Agency (EA), the site has a very low risk of flooding from rivers and seas with a chance of flooding lower than 0.1%.

### 3.2.4 Landfill and groundwater source protection

The development site is not located within a Groundwater Source Protection Zone which could restrict the construction of a deep bored soakaway (depending upon geology) as a means of achieving drainage outfall from the site. Based on information obtained from the Gov.uk, the site is not located over former landfill sites which could affect the nature of any major earthworks.

## 3.3 Topographical (levels) survey

An important aspect of site evaluation and remediation is appropriate utilisation of the natural grade (slope) of the site to optimise future earthworks and effect rapid removal of excess water. A topographical level survey of the natural playing field has not been provided to TGMS. Ideally pitch gradients should be on a single plane with consistent falls. The construction of a natural sports pitch is required to follow the Sport England guidance for pitch gradients, which state that pitch falls should not exceed 1.25% in the direction of play and not exceed 2.00% across the direction of play.

## 3.4 Pitch layout and grading

Sport England have published guidance on optimum pitch orientation for a range of sports (see Figure 7), predominantly to avoid issues with visibility caused by the setting sun. The proposed plan in Figure 2 shows that the orientation of the football pitches is approximately 315° and therefore compliant with Sport England guidance.

## 3.5 Soils and Geology

The soil on site was mapped by the Soil Survey of England and Wales and has been classified as the Brickfield 3 association, described as, 'Slowly permeable seasonally waterlogged fine loamy, fine loamy over clayey and clayey soils'.

Data from the British Geological Survey indicates that the soil overlies the Till, Devensian - Diamicton. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period.

Publicly accessible records of Boreholes located in close proximity to the site indicate topsoil overlying firm mottled slightly sandy clay to a depth of 4 metres which overlies grey mudstone to a depth of 6.7 metres. The site geology offers low permeability in terms of using a shallow soakaway as outfall.

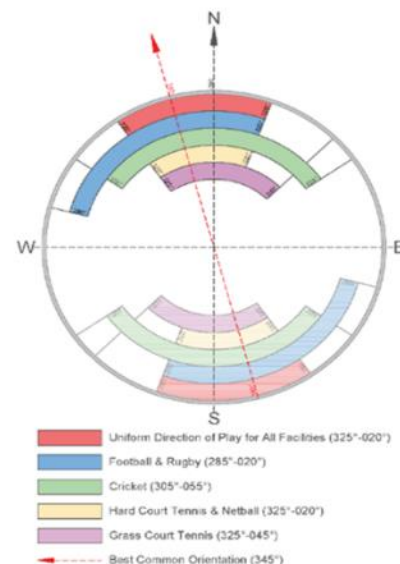


Figure 7 Sport England Orientation Guidelines.

BGS ID: 27174 : BGS Reference: SD80NE219

British National Grid (27700) : 386120,409620

[http://scans.bgs.ac.uk/sobi\\_scans/boreholes/27174/images/10038624.html](http://scans.bgs.ac.uk/sobi_scans/boreholes/27174/images/10038624.html)

### **3.6 Soil sampling**

#### **3.6.1 *Trial Pit Profile Descriptions***

Three soil trial pits (TP1 – TP3, see Figure 3) were excavated by hand at targeted locations to characterise the underlying soil profile and to determine water table depth. One representative soil sample of topsoil and one sample of subsoil was sent for laboratory analysis to determine soil texture and pH.



**Topsoil depth**

240 mm

250 mm

350 mm

**Stones**

Minimal stone content

Minimal stone content

Minimal stone content

**Thatch content**

>5 mm

>5 mm

> 5 mm

**Subsoil texture and depth**

500 mm of Clay

600 mm of Clay

450 mm of Clay

**Groundwater**

None encountered

None encountered

None encountered

**Ground cover**

~95% *Perennial ryegrass*

~95% *Perennial ryegrass*

~95% *Perennial ryegrass*

**Surface level uniformity**

Undulations exceeding SE Guidance

Undulations exceeding SE Guidance

Undulations exceeding SE Guidance

### 3.6.2 Soil Texture

Laboratory analysis of soil texture was similar to field observations (see Table 2).

Table 2 Soil Texture (Sand 2.00 mm – 0.063 mm; Silt 0.063 mm – 0.002 mm; Clay <0.002 mm).

| Trial Pit | Depth (m)     | Sand (%) | Silt (%) | Clay (%) | Gravel (%) | Classification | pH   |
|-----------|---------------|----------|----------|----------|------------|----------------|------|
| 1         | 0.000 – 0.240 | 54.0     | 39.1     | 6.9      | -          | SANDY LOAM     | 5.53 |
|           | 0.240 – 0.740 | 38.5     | 30.9     | 30.6     | -          | CLAY LOAM      | -    |

### 3.6.3 Soil summary

Therefore, in summary, the site is characterised by a SANDY LOAM topsoil containing a minimal stone content overlying CLAY LOAM subsoil.

In general, whilst the composition and texture of the subsoil 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 likely that its drainage capacity will just above sub-optimal (i.e., < 5 mm/hour) for winter sports use.

Once clay contents exceed approximately 30%, they can significantly and adversely affect the rate at which water can percolate through the profile (i.e., characterised by low hydraulic conductivity). Given that the clay content of the subsoil is ~30%, it is expected that drainage rates through this material could be very low (<1 mm/hour). This is further compounded by the moderate silt contents of the topsoil and subsoil (39.1 and 30.9%); silt particles tend to migrate towards and block pores in the soil that are normally associated with the transmission of drainage water and aeration.

Therefore, during the winter months when the rate of precipitation exceeds that rate at which water is removed through drainage or evapotranspiration, water will tend to accumulate within the topsoil. This can lead to saturated conditions at the surface which may prevail throughout the winter. In extreme circumstances, this is manifest by standing water at the surface, but more typically the soil becomes prone to excessive wear and tear and the grass sward suffers due to poor aeration status (i.e., the soil pores that are normally air-filled become filled with water leading to anaerobic conditions; in order for grass to thrive, at least 10% of the pores should be air-filled).

Significant earthmoving can also result in a loss of soil structure, particularly with soils exhibiting a high sand/silt content and installation of a drainage scheme is considered a pre-requisite if earthworks are employed. Construction compaction across the site during construction or maintenance will further limit the rate at which water moves downwards through the soil profile.

In order to correct this situation, consideration should be given to the installation of a surface by-pass drainage system. These systems work by intercepting rainwater at the surface before it has had an opportunity to soak into the soil profile, and then removing this water to a system of piped drains. Typical systems would comprise sand grooves (Figure 8) linked into a system of lateral drains beneath the playing field. More information relating to the issues arising from earthworks and drainage can be seen in Section 4.1 –Development options.

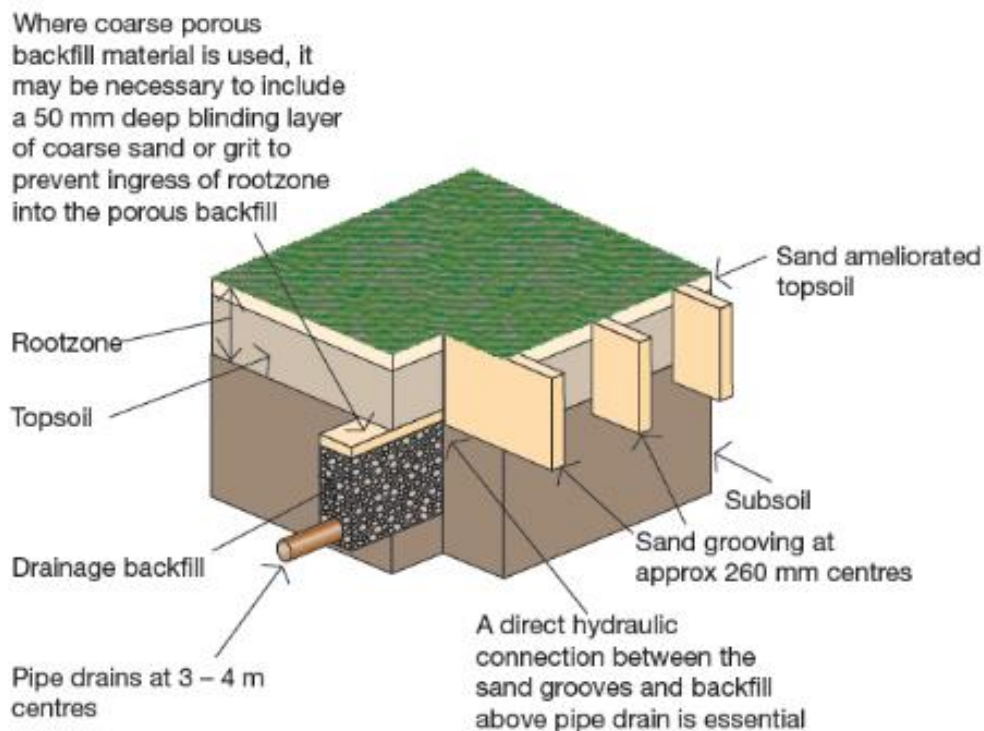


Figure 8 Typical sand groove-based surface by-pass drainage system (Ref: Sport England Design Guidance Note "Natural Turf for Sport", 2011).

### 3.6.4 Issues with Stone Content / Sharps

Observations made during the initial site visit identified a minimal stone content running through the topsoil. Although no stones were uncovered during the site visit, TGMS cannot state that the topsoil is 'clean' and stone free due to the small sample size. No stones were currently exposed on the surface.

Should stones be present within the topsoil, methods to deal with stones during construction works include stone burial, stone removal and topsoil screening. Each method has limitations and complete stone removal is neither practical nor possible.

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

## 3.7 Existing drainage infrastructure and outfall

Aerial imagery would suggest that no drainage scheme is located within the proposed development area. A point of outfall was not identified within the development site, and a potential point of outfall should be confirmed by the client.

## 3.8 Agronomic condition

Not pertinent in the proposed development area as new pitches construction will inevitably include establishment of turf grass from seed. However, current agronomic conditions are characterised by a ground coverage of ~95% *Perennial ryegrass*. A large layer of thatch was present across the entirety of the site, with a depth of over 5 mm.

### 3.8.1 Thatch

Thatch is the accumulation of organic material which is trapped between the turf surface and the underlying soil. Thatch is composed primarily of turfgrass stems and root tissue and is

continually accumulating and breaking down over the course of the year. It is not unusual to accumulate 5 mm thatch per year. Excessive thatch is problematic, and levels of thatch over 10 mm can significantly influence the quality of fine turf.

- Thatch directly influences water movement in and around the grass plant.
- Thatch directly interferes with air movement thus creating potential anaerobic conditions.
- Thatch creates a favourable environment for turf disease and pests (e.g. leatherjackets, chafer grubs).
- Thatch can affect the efficacy of fertilisers and chemical applications.
- Thatch can affect mowing quality (due to soft and spongy conditions)
- Thatch can prevent the movement of water down through the profile leading to dry patch (particularly in hot dry periods).

Excessive thatch build-up occurs when the rate of accumulation exceeds the rate of natural decomposition. This can occur when grass swards are too heavily fertilised and watered too frequently, this encourages vigorous turf growth and production of organic material which cannot be broken down sufficiently quickly by the beneficial organisms within the soil (fungi and bacteria).

In general, small levels of thatch are desirable (>5 mm) to help protect the turf surface however any greater amounts should be managed via an intensive maintenance regime incorporating scarification and verti-cutting.

### 3.9 Site usage

Based on the condition of the existing site, it is anticipated that the estimated hours of usage will be under 2 hours per week per pitch before pitch conditions deteriorate, especially during the winter period as rainfall increases and evaporation and evapotranspiration decreases. It is difficult to predict with any accuracy the likely usage levels in hours of play achievable as this depends on local weather conditions, schedule of use, age of participants and the quality of the on-going maintenance, however Sport England considers the following to represent a reasonable estimation (Ref: Natural Turf for Sport, 2000, ISBN 1 86078 103 9 – 2nd Edition, 2011).

*Table 3 Sport England estimated usage levels.*

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

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

### 3.10 Performance Quality Standards (PQS)

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

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

A PQS assessment was conducted on the natural grass area northwest of the long jump pit and MUGA to inform the design of any pitches. The audited site passes 6 elements (of 8 measured) of Sport England's Performance Quality Standards, they are: Ground cover, Weed content, Sward height, pH, Slope and Stone content.

#### Summary of Performance Quality Standards presented in Appendix I

Client: Morgan Sindall Physical Site Survey date: 9<sup>th</sup> December 2022

Project Title: A feasibility study for the construction of natural turf winter sport pitch at Newhouse Academy.

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

It is pertinent to note that significant earthworks will be required to remove the MUGA and long jump pits. Therefore, any new sports pitches constructed would be required to pass all Sport England PQS parameters to be deemed fit for purpose.

### 3.11 Other items

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

- **Services** – It is recommended that the client obtains up to date service plans of the site prior to any development works. It is important to note that the presence of services may inhibit the scope of works, this is particularly pertinent if drainage works or cut and fill are to be implemented.
- **Planning permission** – Where cut and fill earthworks or drainage are required, it may be prudent to obtain guidance from the local planning department as to whether planning permission is necessary.
- **Irrigation** – The construction of natural grass pitches relies on optimal weather conditions to aid germination and grass plant establishment. In some cases, when construction is carried out in summer and during drought conditions, supplementary irrigation may be required, the costs of which should be factored into the budget. It is the responsibility of the Client to provide sufficient irrigation during the duration of project construction phase and subsequent maintenance phase.
- **Outfall** – When discharging into existing drainage infrastructure or natural water courses, it may be necessary to obtain the relevant permissions including discharge consents and/or land drainage consent from the Environment Agency, landowner or local authority. These procedures can significantly delay proceedings and prior investigation may be

necessary at feasibility stage. It is the responsibility of the Client to obtain the appropriate consents.

- **Maintenance scheme** – With any development, it is imperative that a well-structured intensive maintenance programme is implemented to maintain the pitch following large scale investment. Failure to implement the recommended maintenance operations will result in a deterioration of pitch condition and subsequent availability for use.
- **Settlement of drain lines** – Land drains can be prone to differential settlement (i.e. there can be some sinkage of the drain lines, particularly in high clay areas which is pertinent to the development area) as the soil surrounding the drain pipe dries out and shrinks; this is perfectly normal in new constructions. Whilst topping up drain lines is usually covered by the Contractor during the first 12-months following construction, it is possible that drains may continue to sink to some extent after this time. Therefore, there should be some allowance within the maintenance programme to ensure that drains are kept topped up.
- **Secondary drainage** – Secondary drainage relies on annual topdressing to maintain a direct hydraulic connection between the surface and piped infrastructure, the costs of which can be approximately £2-3k per annum (per pitch). This should be factored into yearly budgets to optimise the efficacy of the land drainage scheme.

## 4 SUMMARY AND RECOMMENDATIONS

1. **Objective:** A feasibility study for the construction of natural turf sports pitch at Newhouse Academy
2. **Site visit:** A detailed site visit was conducted by Craig Parry of TGMS on the 9<sup>th</sup> of December 2022.
3. **Hydrology:** Climate data obtained from the Flood Estimation Handbook (FEH) indicate that the standard-period average annual rainfall (SAAR) is 1065 mm/year for this catchment which is above the national average of 855 mm/year and is within the fifth highest category for the whole of the UK (see Figure 6). Greenfield run-off rates and drainage rates do not differ with reference to a 6-hour and 24-hour rainfall events in a return period of 1 year; therefore, the installation of a drainage system would likely not cause faster or greater flow than current greenfield condition.
4. **Flood risk:** Based on information obtained from the Environment Agency (EA), the site has a very low risk of flooding from surface water, and rivers and seas, with a chance of flooding less than 0.1%.
5. **Landfill:** The site is not located over registered landfill.
6. **Groundwater Source Protection:** The development site is not located within a Groundwater Source Protection Zone, if it were, this could restrict the construction of a deep bored soakaway (depending upon geology) as a means of achieving drainage outfall from the site.
7. **Topography:** A topographical level survey of the natural playing field has not been provided to TGMS. Ideally pitch gradients should be on a single plane with consistent falls within Sport England's recommended slopes for sports pitches.
8. **Pitch orientation:** The proposed plan in Figure 2 shows that the orientation of the football pitches is approximately 315° and therefore compliant with Sport England guidance.
9. **Geology:** The soil on site was mapped by the Soil Survey of England and Wales and has been classified as the Brickfield 3 association, described as, 'Slowly permeable seasonally waterlogged fine loamy, fine loamy over clayey and clayey soils'. The soil overlies Till, Devensian - Diamicton. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period.
10. **Soils:** The site is characterised by a SANDY LOAM topsoil containing a minimal stone content overlying CLAY LOAM subsoil.
11. **Stones/ Sharps:** Observations made during the initial site visit identified a minimal stone content running through the topsoil.
12. **Existing drainage:** Aerial imagery would suggest that no drainage scheme is located within the area examined. A point of outfall was not identified within the development site.
13. **Agronomy:** Vegetative cover was ~95% comprising *Perennial ryegrass* and a low weed content. >5 mm layer of thatch was present across the entirety of the site.
14. **Site usage:** Based on the condition of the existing site (undrained) it is anticipated that the estimated hours of usage will be under 2 hours per week per pitch before pitch conditions deteriorate.
15. **Performance Quality Standards:** The existing site passes 6 elements (of 8 measured) of Sport England's Performance Quality Standards, they are: Ground cover, Weed content, Sward height, pH, Slope and Stone content.

## 5 DEVELOPMENT OPTIONS – NATURAL TURF PITCH

The objective of the feasibility study was to assess the feasibility of constructing a natural turf pitch within the development area and to provide recommendations for natural turf pitch construction.

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

Based on the existing infrastructure on site, notably the existing MUGA, it is imperative that all hardstanding etc. is cleared to true subsoil, prior to the importation of additional subsoil (if required and to match levels) and topsoil. It has not been possible to ascertain what is underneath the existing MUGA, however the MUGA is raised which would suggest this surface has been constructed onto subsoil.

Cut and fill earthworks, and in particular the movement of plant machinery, impacts negatively on soil structure through construction compaction, imparting stress on the soil which causes densification and displacement of air from the pores between the soil particles which would normally be associated with air and water movement. When soils are compacted, the water infiltration rate is reduced which can result in saturated surface conditions, increased wear and tear and a large decrease in carrying capacity and usability of the pitches. To alleviate the effect of these issues, it is industry practice to install a primary and secondary drainage scheme to intercept surface water as efficiently as possible and convey it to a piped system below the surface and away to a point of outfall.

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

- Waterlogged playing conditions following spells of inclement weather; saturated surface conditions will take far longer to return to playable surface conditions in the absence of a land drainage scheme, compared with pitches that incorporate an efficient drainage system.
- Increased susceptibility to wear and tear which is exacerbated by poor drainage status, leading to de-structured surface conditions (mud) and very poor playability.
- Potential ingress of undesirable grass species due to favourable surface conditions (wet).
- Loss of surface levels due to soil de-structuring, a reduction and shear strength, and low traction.
- Wet pitch conditions mean that agronomic maintenance operations can only be conducted when the surface is trafficable, rather than when the operations are needed, thereby contributing to accelerated degradation of surface conditions through compaction and smear.

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

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

### 5.1 Option 1: Site remodelling, installation of a primary drainage system @ 4 metre centres plus the installation of a secondary bypass scheme (sand grooves) within the footprint of the MUGA only

The client has stated that the reinstatement of the MUGA to a natural turf area of equivalent quality to the surrounding playing fields is required. Therefore, this development option is only detailing work which will be completed within the footprint of the existing MUGA.

This is the recommended option for the development of the sports pitch and comprises soil importation to achieve a nominal 0.2 metre depth of topsoil overlying true subsoil comprising site won material or imported subsoil. To remove the foundations of the MUGA and long jump pits, will require significant plant machinery, the issues surrounding the movement of plant machinery on indigenous soil profiles has been discussed above, and the development option is the recommended option to mitigate such issues.

This option includes the installation of a primary land drainage system supplemented by a secondary drainage scheme. This will provide a land drainage system which will perform well during periods of inclement weather and is the most sustainable given the standard average annual rainfall (SAAR) for the site.

The works would comprise the following:

1. **Site clearance** – Removal of all hardstanding such that true subsoil is encountered.
2. **Cut and Fill earthworks** - To provide a playing surface on a consistent gradient in line with SE guidance and the surrounding area.
3. **Subsoil importation** – Import, place and grade clean subsoil (to make up any shortfall) to be used as the remaining sub-base prior to topsoil return and importation.
4. **Import of clean topsoil** – Topsoil import to be laid on subsoil (Sandy Loam topsoil to BS3882 standard)
5. **Installation of a pipe drainage scheme at 4 metre centres** – outfall to be confirmed by the client (land drainage consents will be required and should be obtained by the client).
6. **Final Cultivation** – To produce a suitable tilth for seeding and to restore surface levels.
7. **Establishment of a new grass sward from seed (including seeding and fertiliser)** – it is recommended that a suitable 100% Rye Grass seed is used.
8. **Secondary drainage** – Installation of secondary drainage in the form of sand grooves
9. **Sand topdressing** – Apply 24 mm in increments of 8 mm dressings to protect the sand grooves from capping over.

#### Please note:

- a) With secondary drainage it is very important to note that frequent (minimum 3) sand topdressing applications would be required in the first 12 – 18 months post construction to protect the tops of the sand grooves from contamination with the topsoil.
- b) It is recommended that following this type of construction, the pitch is maintained for a period of 12 months without use prior to handover back to the client. This is to ensure the recipient receives the pitch in the correct condition and the contractor has the necessary time to implement all specified operations.
- c) Please note, playing gradients of the reinstated area will not exactly replicate gradients of the existing natural turf area as existing gradients have not been implemented using laser grading.

- d) It is likely that the reinstated area following drainage installation will perform better than the existing playing field which is undrained.

#### **5.1.1 12-months maintenance post-construction**

Depending on the construction timetable and funding requirements, it is possible that on-going maintenance will be required for the first 12-months following completion of the remediation works. This will include the following items:

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

## **5.2 Material import**

Commonly, soil profiles are characterised by a topsoil (circa 200-300 mm depth) overlying a subsoil with variable depths. This profile provides a balance between natural infiltration and water and nutrient retention and whilst supplementary drainage is often required to provide playable conditions (more so in winter), the soils characteristics will retain sufficient moisture to support grass development.

It is important to ensure the correct material is used for the importation scheme. Should 200 mm of BS3882 Sandy Loam be used then this could potentially drought the pitches in summer leading to poor sward characteristics. Quite often, to counteract the high infiltration rates of sandy loam soils, drainage is omitted which can lead to unusable pitch conditions in winter as a result of surface water ponding, particularly when the rate of precipitation exceeds that rate at which water is removed through drainage or evapotranspiration. Sandy Loam soils also compact more than clay dominated soils which benefit from soil restructuring through shrink swell characteristics.

Additionally, significant topsoil depths can be more prone to differential settlement, particularly when the material contains a high organic matter content which when decays, leaves voids contributing to settlement. Industry standards suggest topsoil depths should ideally not exceed 400 mm for this very reason. It may be prudent to consider the import of 200 mm of topsoil overlaying the existing subsoil within the site, this soil profile would also provide underlying strength in achieving CBR results of >3%, the recommended minimum CBR for natural turf surfaces.

It is likely that material import will only be needed for the section of the development area which is currently occupied by the MUGA and long jump pits. The size of the area which will likely require material import has been estimated to be 0.2 hectares.

### 5.3 Indicative cost estimates – Winter sports pitch

#### 5.3.1 Option 1 (based on a development area of 0.2 ha)

Please note that these costs are indicative only and true cost can only be established by competitive tender

| Item                                                                                   | Cost               |
|----------------------------------------------------------------------------------------|--------------------|
| Removal of existing MUGA and long jump (0.2 ha)                                        | TBC                |
| Cut and Fill earthworks to produce gradients in line with SE guidance                  | TBC                |
| Importation, placement and grading of subsoil (MUGA and long jump only, if required) * | TBC                |
| Importation, placement and grading of topsoil (MUGA and long jump only, if required)   | £20,000.00         |
| Installation of a pipe drainage scheme at 4 metre centres                              | £8,000.00          |
| Final cultivations                                                                     | £1,000.00          |
| Establishment of a new grass sward (includes seeding and fertiliser).                  | £1,200.00          |
| Installation of secondary drainage i.e., Sand grooves (if required)                    | £3,000.00          |
| Sand application (3 x 8 mm)                                                            | £3,000.00          |
| Over-seeding/fertilising                                                               | £1,000.00          |
|                                                                                        |                    |
| Subtotal (ex VAT)                                                                      | £37,200.00         |
|                                                                                        |                    |
| Prelims, mobilisation, setting out and reinstatement                                   | £5,000.00          |
| Subtotal (ex VAT)                                                                      | £42,200.00         |
|                                                                                        |                    |
| Contingency (10%)                                                                      | £4,220.00          |
|                                                                                        |                    |
| <b>Total (ex VAT)</b>                                                                  | <b>£46,420.00*</b> |

**Please note:** \* To be completed by the main contractor.

**Please note:** Some items cannot be priced indicatively until a formal design has been completed.

#### NOTES TO TABLES:

- Costs are based on a general estimation of the works required. If conducted in isolation, the costs are like to increase and would need to be costed accordingly.
- Costs assume that the arisings associated with drainage installation will be disposed of on-site.
- Costs do not include temporary irrigation which may be required if dry weather is experienced during grass establishment.
- Costs are based on recent Contractors' rates (2022).

### 5.4 12-months maintenance post-construction

| Item                                   | Cost             |
|----------------------------------------|------------------|
| Mowing (30cuts)                        | £2,000.00        |
| Fertiliser x3                          | £600.00          |
| Verti-draining/spiking x2              | £600.00          |
| Selective herbicide (as required)      | £400.00          |
| Pest and disease control (as required) | £400.00          |
| Overseeding                            | £600.00          |
|                                        |                  |
| <b>Subtotal (ex VAT)</b>               | <b>£4,600.00</b> |

## 5.5 Summary of indicative project costs for the development of sports pitch

| Option   | Construction | Maintenance | Total ex VAT | VAT        | Total Inc. VAT |
|----------|--------------|-------------|--------------|------------|----------------|
| Option 1 | £46,420.00*  | £4,600.00   | £51,020.00*  | £10,204.00 | £61,224.00*    |

\*These costs do not include any earthworks or MUGA removal which will be included by the main contractor.

These above costs do not include professional fees for design and specification, tender administration, and construction phase monitoring.

**Please note:** Actual costs may vary as much as  $\pm 15\%$  depending on contractor availability, prices of aggregates and time of year.

## 5.6 Indicative work programme

With respect to timescales for completing the project, it is essential that construction works take place in good, dry ground conditions. Grass is ideally sown in spring or early autumn to maximise the balance between moisture and temperature. The grass must be allowed to establish a healthy and deep root network and mature canopy to resist the stresses applied.

### Indicative work programme for Option 1– Natural Turf Pitch

| Activity                                   | Year 1 |   |   |   |   |   |   |   |   |   |   |   | Year 2 |   |   |   |   |   |   |   |   |   |   |   |
|--------------------------------------------|--------|---|---|---|---|---|---|---|---|---|---|---|--------|---|---|---|---|---|---|---|---|---|---|---|
|                                            | J      | F | M | A | M | J | J | A | S | O | N | D | J      | F | M | A | M | J | J | A | S | O | N | D |
| Contractor mobilisation                    |        |   |   |   |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |   |   |   |   |
| Site clearance                             |        |   |   |   |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |   |   |   |   |
| Soil importation (subsoil and topsoil)     |        |   |   |   |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |   |   |   |   |
| Drainage installation                      |        |   |   |   |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |   |   |   |   |
| Final cultivations, fertiliser and seeding |        |   |   |   |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |   |   |   |   |
| Initial agronomic maintenance              |        |   |   |   |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |   |   |   |   |
| Sand groove installation                   |        |   |   |   |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |   |   |   |   |
| Pitches ready for play (full use)          |        |   |   |   |   |   |   |   |   |   |   |   |        |   |   |   |   |   |   |   |   |   |   |   |

#### N.B. (in all cases)

1. It is essential that earthworks only take place in good, dry ground conditions, which limits the window for these works to the late spring / summer, i.e. the period between the end of one season and the beginning of the next. Normally, the grass must be allowed to establish a healthy and deep root network and mature canopy prior to first use and a full 12 month maintenance period is recommended.

## 5.7 Implications of works on future maintenance, system longevity and usage

### 5.7.1 Maintenance issues – Natural turf pitches

- It is essential that adequate allowance is made for annual sand topdressing as this helps to protect the sand bands/grooves from contamination with topsoil. As a guide it is recommended that a minimum 5 mm depth of sand should be applied annually as part of the renovations programme.
- Land drains can be prone to differential settlement (i.e., there can be some sinkage over the drain lines) as the soil surrounding the drain pipe dries out and shrinks; this is perfectly normal in new constructions. Whilst topping up drain lines is usually covered by the Contractor during the first 12-months following construction, it is possible that drains may continue to sink to some extent after this time. Therefore, there should be some allowance within the maintenance programme to ensure that drains are kept topped up.
- In general terms, a maintenance budget of ~£6-8k is normally required to maintain a single pitch in good condition. This figure would include the cost for annual sand topdressing but excludes irrigation. Without good maintenance, the pitch will become unusable relatively quickly. With good maintenance the pitch will be usable when many other pitches are not.

### 5.7.2 System longevity

- Whilst only a guide, the piped drainage system should have an operational lifespan of approximately 25 years if well maintained (e.g., silt traps regularly inspected and emptied and collector drains flushed).

### 5.7.3 Usage

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

## 5.8 Outline Project Risk Assessment – Natural turf pitches only

The following risks to the project should be considered:

1. **Weather:** Good dry weather during construction is essential for project progress, this is particularly sensitive once the vegetation has been removed and the topsoil has been stripped. Cut and Fill should realistically only be carried out between the months of April and September.
2. **Timeliness and quality of construction:** It is important that the Contractor appointed has the scale of operation and capacity to deliver this project on time and with high quality. A premium for highly experienced, well-equipped Contractors must be valued in the tender process. Cost should not be the only consideration.
3. **Drain line sinkage and establishment challenges:** Whenever piped or slit drainage is installed there are challenges with settlement of the permeable drain back fill and getting grass to establish in the drain runs. Settlement occurs due to a combination of shrinkage of the surrounding soil on drying and natural settlement of the permeable backfill with time, so construction method and monitoring of the Contractor are essential. Grass establishment problems along the drain runs can occur because the backfill materials are freely draining (so the drains work) and therefore do not retain much water and also readily leach nutrients. This is mitigated to an extent at the design stage by the specification of the construction method for mixing some topsoil into the tops of the

drains, but this approach is dependent upon the inclusion of a secondary drainage scheme. Routine watering and fertiliser applications to the primary and secondary drain runs during establishment is recommended and is the responsibility of the client.

4. **Spoil:** Spoil shall be disposed of on-site unless the Client would prefer off-site removal. Off-site removal of spoil will significantly increase costs and should be considered at the early stages of the project.
5. **Ongoing operational finance:** The Client should carefully consider the maintenance demand (in terms of time, skill and cost) for the proposed surfaces.

## 6 CONFIDENTIALITY

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## 7 CONTACT DETAILS

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## 8 APPENDICES

- Appendix I      Performance Quality Standards.  
Appendix II     Outline Maintenance Recommendations.

## Appendix I: Performance Quality Standards

Client: Morgan Sindall

Physical Site Survey date: 9<sup>th</sup> December 2022

Project Title: A feasibility study for the construction of a natural turf winter sport pitch at Newhouse Academy

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

KEY: SH = Sward Height      PS = Playing Season      SM = Summer Maintenance

*Visual assessment is an acceptable alternative method of testing, if undertaken by a turfgrass consultant who is able to satisfy the selection criteria identified within the Turfgrass Consultants – Construction/Upgrade Brief.*

Assessment undertaken by: Thomas Relf

Consultancy: TGMS Limited

## Appendix II: Outline Maintenance Recommendations

**Mowing.** The grass shall be maintained between a height of 20 and 25 mm using cylinder mowing equipment. The grass should never be allowed to exceed a height of 30 mm. If the grass does become too long, the height of cut should be reduced gradually over 3 – 4 cuts allowing some time for recovery in between. N.B. On no account should the grass height be reduced by more than 50% on any one occasion. Overall, approximately 30 mowing operations may be required each year, depending on weather and growing conditions.

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

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

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

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

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

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

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

**Sand topdressing.** Supply and spread an approved medium-fine sand suitable for sports use during the renovations period at the rate of 85 t/ha. After each application, the sand should be worked into the surface with brushes or drag mats.

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

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

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

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