

A Report to Tal-y-bont & District Playing-field Association

Feasibility Study for the Development of a Natural Turf Winter Games Pitch at Tal-y-bont



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29th November 2018



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County Council



Job Title Feasibility Study for the Development of a Natural Turf Winter Games Pitch at Tal-y-bont

Job Number GTC00610

Document Title Feasibility Study for the Development of a Natural Turf Winter Games Pitch at Tal-y-bont

Document Reference GTC00610001 FINAL ISSUE

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Signed



Date 29th November 2018

REVISION RECORD					
Revision	Date	Description/Filename		Prepared	Approved
A	06/12/2018	GTC00610 REV A ISSUED		JS	JS

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1.0 EXECUTIVE SUMMARY

1.1 Site Information

Tal-y-bont and District Playing-field Association is in the process of assessing the feasibility of developing a natural turf winter games pitch on a grassland field located to the east of the Primary school in Tal-y-bont. As part of this work GEO Turf Consulting was commissioned to undertake an assessment of the field and the suitability of it for the development of a natural turf winter games pitch. .

	1. It should be possible to construct a pitch of 90 x 50m with 3m wide margins. This complies with laws of the game but may not comply with local league requirements.
	2. Planning consent for the development will be required. Consent conditions placed on Planning consents typically include, but are not limited to, the procurement of ecological, habitat and tree surveys, drainage system and water attenuation design, flood risk, assessment details of existing and proposed ground levels with sections. Planning consent may put a limit on lorry movements to and from the site during the facility construction works.
	3. There is a gas main running through the proposed development area. It needs to be established from the facility owner that it will be possible to construct a playing field over the gas main and increase ground levels over it. The gas main means that ground levels over it cannot be reduced. This means that the a large amount of fill material will need to be imported into site resulting in the build up of ground by approximately 3.0m at the highest point. A topographic survey of the site will be required followed by computer ground modelling of existing and proposed ground levels. From this the amount of imported fill material will be determined. The slow importation of fill may have implication of the construction works programme.
	4. Security fencing will be required around the pitch
	5. There is a river on the site boundary. Subject to the appropriate consents this would appear to be a suitable outlet for the pitch drainage water. It is likely that planning consent will require the water discharge rate to be the same as the Greenfield run-off rate for the site. The discharge rate from a pitch drainage system is normally quicker than the Greenfield run-off rate. Therefore there will be a requirement to attenuate drainage water prior to discharge into the river.
	6. The proposed location of the playing-field appears to be outside of the river floodplain and is presently at low risk from surface water flooding.
	7. The topsoil has high silt content and the surface of the field was soft and moisture retentive. Sand will need to be added to the topsoil to improve drainage and surface durability. Water infiltration rates are relatively good, but these will deteriorate unless the topsoil is modified with sand.
	8. Groundwater was found to be present near the surface of the proposed development area. This may have an impact on the feasibility of installing water attenuation features. Cut off drainage around the playing field may also be required to help to divert groundwater around it. It is recommended that groundwater monitoring wells are installed as soon as possible to monitor ground water over the winter period. It would also be advisable to undertake further geotechnical site investigations and obtain geotechnical advice at an early stage, as the presence of groundwater on the ability to attenuate pitch drainage water needs to be fully understood prior to the proposed development proceeding. This may have an impact on the feasibility of the project.
	9. Trees will need to be removed and it needs to be checked if there are any preservation orders on them. Replanting scheme may be required.
	10. Site access is restricted and may need to be developed.
	11. Although the pitch size produced will be compliant in relation to the Laws of the Game, it may not be compliant with local league requirements now or in the future. These requirements should be checked prior to proceeding with the project.
	12. If grass establishment is required within 10 -12 weeks and a permanent irrigation system is not installed, then it will be necessary for the contractor to supply and operate a temporary irrigation system. Without a temporary irrigation the grass establishment period will be in the order of one year.
	13. The works will need to be undertaken in accordance with the CDM 2015 H&S Regulations

KEY: No action required Action may be required Action required

1.2 Recommendations & Guideline Cost Summary

Presented below is a summary of the guideline facility construction, drainage attention and initial grow-in maintenance costs:

The principal problems are heavy-textured topsoil and subsoil with poor natural drainage properties and the presence of groundwater close to the surface in areas. Restrictions on the degree of cut and fill earthworks are made due to the presence of an underground gas main which is reported to cross the site.

The size of the facility which may be constructed is restricted due to the size of the site. The restriction is mainly on the width of the pitch. Subject to a detailed topographic survey and 3D computer ground modelling of the site it should be possible to construct a pitch of maximum dimensions of 90 x 50m plus 3.0m wide margins all round. The laws of the game require a pitch to have minimum dimensions of 90 x 45m. It should however be noted that a pitch of 90 x 50 m may not comply with local league requirements and this should be investigated prior to the development commencing.

Presented below is a summary of the guideline construction cost facility construction costs. It should be noted that the costs presented assume that the imported fill material required to reduce the overall slope to an acceptable level is free.

GUIDELINE COST SUMMARY RANGE			
1 No PITCH (90 X 50 m + 3.0m MARGINS)			
		Minimum	Maximum
1.0	CONSTRUCTION WORKS	£106,762.00	£133,796.00
2.0	DRAINAGE	£39,365.00	£89,635.00
3.0	GROW IN MAINTENANCE	£22,525.00	£22,525.00
4.0	ROTARAIN IRRIGATION	£15,200.00	£15,200.00
	TOTAL EXC VAT	£183,852.00	£261,156.00
	CONTINGENCY (5%)	£9,192.60	£13,057.80
	TOTAL (EXCL. VAT)	£193,044.60	£274,213.80
	VAT @20%	£38,608.92	£54,842.76
	ESTIMATED TOTAL (INC. VAT)	£231,653.52	£329,056.56

2.0 INTRODUCTION AND OBJECTIVES

GEO Turf Consulting was commissioned by Tal-y-bont and District Playing-field Association to undertake an assessment two adjacent grassland fields in Tal-y-bont in relation to developing a recreation ground on them.

The address of the site is:

*Land of east of Dol Pistyll
Tal-y-bont
Ceredigion Wales*

A site survey of the fields was undertaken by Jonathan Smith on 9th November 2018. The main objective of this report is to present the findings of a site appraisal which investigated the proposed development site topography, characteristics of the near-surface soils and drainage. Investigating and understanding the characteristics of the soils was undertaken to assist in the preparation of guideline cost estimates for the development of the proposed facility.

The objectives of this feasibility study are as follows:

- To establish the physical properties of the topsoil.
- To undertake an initial assessment of the suitability of the pitch drainage system outlet.
- To outline characterise the underlying near-surface subsoil profile.
- To prepare a set of development proposals for the natural turf pitch.
- To derive indicative guideline pitch construction and establishment costs for budgetary purposes.
- To provide an indicative work programme for the duration of the proposed construction and pitch establishment works.

3.0 PHYSICAL SITE SURVEY

3.1 Site Location & Access

The site is located on farm land east of the Primary School at: Tal –y- bont, Cardiganshire Wales.

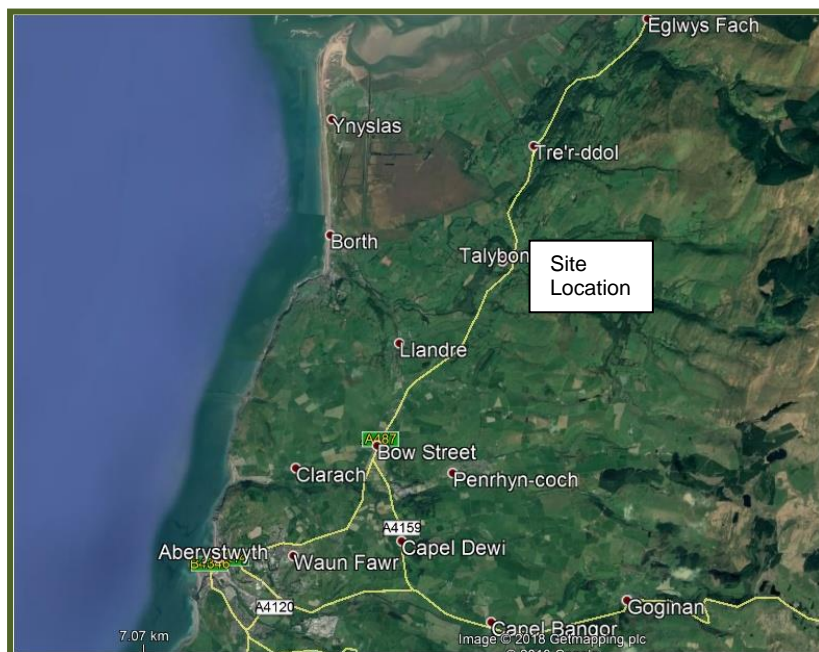


Figure 1 Site Location



Figure 2 - Extent and location of proposed playing field area

3.2 Geomorphology

3.2.1 Geology

The British Geological Survey describes the site geology as:

Superficial Deposits:

Western side of site

River Terrace Deposits - Sand and gravel. Sedimentary superficial deposit formed between 2,588 million years ago and the present during the Quaternary period.

Eastern side of site

Alluvium - Clay, silt, sand and gravel. Sedimentary superficial deposit formed between 11.8 thousand years ago and the present during the Quaternary period.

Bedrock Geology:

Western side of site

Borth Mudstones Formation - Mudstone. Sedimentary bedrock formed between 443.8 and 433.4 million years ago during the Silurian period.

Eastern side of site

Devil's Bridge Formation - Mudstone and sandstone, interbedded. Sedimentary bedrock formed between 443.8 and 433.4 million years ago during the Silurian period.

Flood Risk

Based on information obtained from the Natural Resource Wales (NRW) website on 27th November 2018, the proposed development site is shown to be located adjacent to areas which are susceptible to flooding by rivers and surface water flooding. It is unlikely that the proposed pitch area within the site will be liable to flooding. However, it will be important the remodelled site does not impact on the areas liable to flooding and the river floodplain as this will potentially reduce the flood capacity of these areas. The proposed works will be subject to planning consent and the applicant may need to demonstrate that the proposed development will not impact on the flood zones. A flood risk assessment may therefore be required as part of the planning consent submission together with the proposed earthwork design including cross sections.

The proposed development area also appears to be located outside low and high flood-risk areas (Figures 3-5).



Figure 3. Flood risk from reservoirs.



- = High risk of flooding
- = Low risk of flooding.

Figure 4. Flooding from rivers or the sea.



- = High risk
- = Low risk

Figure 5. Surface water flood risk

Site Trial Holes

Two trial holes were excavated to a maximum depth of 0.5m at the approximate locations shown in Appendix II. The trial holes were made in order to characterise the near-surface soil profile. The depth was limited, however, due to hard stony ground being encountered.

Trial Hole 1

0 - 200mm Moist silt loam topsoil. Well structured and low stone content. Thatch present
200 - 700mm Brown to grey moist soft clay with lenses of sand. Wet clay at 700mm

Groundwater encountered at 400mm depth



Plate 1 – Trial hole 2 soil profile increasing with depth from left to right.



Plate 2 – Groundwater encountered at 400mm depth

Trial Hole 2

0 - 200mm Moist silt loam topsoil. Well structured and low stone content. 20mm thatch present
200 - 600mm Moist and weak organic clay
600-800mm Moist grey clay
800-900mm Wet clay

Groundwater encountered at 900mm.



Plate 3 – Trial hole 2 soil profile increasing with depth from left to right.



Plate 4 – Trial hole 2 water at 900mm depth.

3.3 Topsoil Sampling

Topsoil depth was established at three locations across the site and the average depth of 200mm was established. The topsoil was found to have high moisture content but was in good physical condition and well structured. In all instances there was a sharp interface between the base of the topsoil and the top of the subsoil. The topsoil was subject to hand texture tests it was concluded that the topsoil should be classified as a silt loam

3.4 Surface Water Infiltration Rates

Three water infiltration rate tests were undertaken with double ring infiltrometers and the infiltration rates recorded are detailed below:

Test Location	Infiltration Rate
1	70 mm/hour
2	34mm/hour
3	45mm/hour
Average Infiltration Rate	49mm/hour




Plate 5 – Water infiltration rate test.

The average value of 49mm/hour is considered to be relatively good given the soil texture. A value of 49mm/hour should cope with moderate rainfall. However when such a soil becomes compacted under sports turf use drainage infiltration rates will greatly reduce. Therefore the topsoil will need to be ameliorated with approved salt- and lime free medium/fine sands so that porosity and hydraulic conductivity may be maintained to a satisfactory level. The sand added to the topsoil will also reduce the likelihood of the surface smearing and increase pitch surface durability

3.5 Topsoil Moisture Content

Soil moisture content was recorded at a depth of 40mm at on four pitch areas and the results are presented below:

Soil Moisture Content (%)	Lowest %	Highest %	Average %
Field 1 & 2	64	92	73

These values are considered to be very high and indicate that the topsoil is poorly drained and has the ability to retain high levels of moisture.

3.6 Surface Hardness

Surface hardness was measured across the four pitch areas using a 2.25 Kg Clegg hammer. The results are presented below:

Surface Hardness (g)	Lowest	Highest	Average
Field 1 & 2	29	41	35

Surface hardness levels ranged from 29 to 41g and the overall average value calculated was 35g. Values are considered to be very low and they should be in the range of 65 – 85g for football use. The low hardness values recorded are a reflection of a silt loam topsoil with a high moisture content. Generally the higher the moisture content the softer the surface.

Natural turf facilities with high moisture content and low surface hardness values will have a low energy restitution value and a high-level surface deformation underfoot. Such surfaces are therefore tiring to use.

3.7 Proposed Orientation

In terms of orientation of the area, Sport England has published guidance on optimum pitch orientation for a range of sports (Figure 4). The limits of orientation for football pitches are 285° and 20°.

It would be possible to develop the pitch just within the ideal range stipulated in the Sport England guidance at an orientation of approximately 20°.



Plate 6. – Pitch orientation

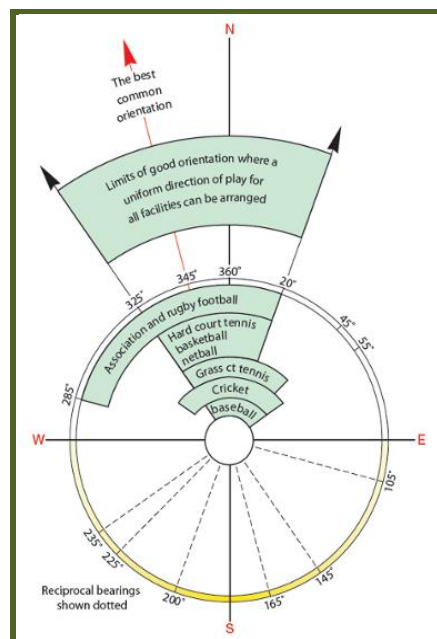


Figure 6. Optimum pitch orientation (Sport England).

3.8 Agronomic Assessment

Grass cover on the area comprised primarily of meadow grass with large areas of Juncus rush. The presence of Juncus indicates that the area is subject to poor drainage and soil with a high moisture content for a large part of the year.



Plate 7 – High proportion of Juncus rush indicating wet ground.

3.9 Pitch Usage

Sport England considers the following to represent a reasonable estimation of the likely usage for a range of construction types (Ref: Natural Turf for Sport, 2000, ISBN 1 86078 103 9 – 2nd Edition, 2011) (Table 4):

Table 4. 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-drained with suspended water table	4 – 6

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

Based on the above table, with the installation of a pipe and slit drainage system (Koro field drains), it is expected that the pitch will be able to withstand 3 – 6 hours/week if adequately maintained. Greater usage levels may be possible but this will be linked to the level and quality of the pitch maintenance works. The Football Association has indicated that they require the best value form of pitch construction and have indicated that there may be a modest budget for the pitch works. More expensive forms of pitch construction are available but these would require the installation of irrigation systems and would need qualified grounds staff to maintain them. It is considered that such forms of construction are not appropriate in this situation

3.10 Underground Utilities

An investigation for the presence of underground utility services has not been commissioned as part of this feasibility study. However, the Football Association have stated that there is an underground gas main across the proposed development site from north to south. The approximate line and location was identified by the Football Association while on site. This is as detailed on the figure below.

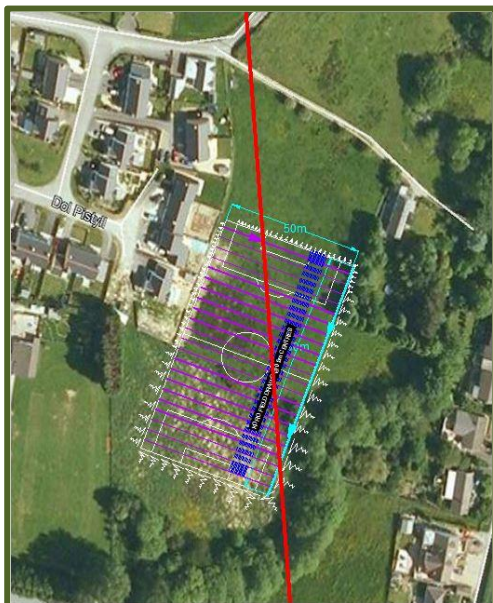


Plate 8 – Red line details the approximate line and location of underground gas main as stated by the Football Association.



Plate 9 Gas main marker at the northern end of the site

4.0 DISCUSSION & RECOMMENDATIONS

4.1 Introduction

The investigation has shown that the site comprises heavy textured and moisture retentive topsoil, overlying clay near surface subsoil. Geological records indicate that these soils are likely to be underlain by more permeable sands and gravels. This is reflected in the presence of groundwater within 400mm of the ground surface.

The outline scope of works which will be required to construct the playing field will be

1. Spray-off remaining vegetation using a total non-residual herbicide.
2. Cultivate (e.g. rotavate) the topsoil (ca. 150mm depth) to create a suitable tilth.
3. Strip topsoil from development area.
4. Import fill to area to create a less steep and more uniform fall
5. Decompact the subsoil
6. Replace the topsoil
7. Undertake in-situ stone separation
8. Undertake grading
9. Undertake sand amelioration of the topsoil
10. Install primary drainage
11. Install secondary drainage
12. If feasible install water attenuation cells with restricted outlet to river
14. Prepare seedbed
15. Undertake further stone picking/burying as required.
16. Fertilise
17. Seed
18. Establish grass with intensive maintenance and irrigation.
19. Install security fencing
20. Topdress with sand and over seed

4.2 Earthworks & Site Levels

The ground falls generally diagonally from the north west to the south east on a diagonal fall of approximately 1 in 26. This is too steep for the proposed football pitch and ground levels will need to be adjusted to produce a less steep gradient across the pitch area, ideally a diagonal fall of 1 in 100. The normal procedure is to cut spoil material from the higher ground and to place it in the lower ground. Normally the earthworks are designed to be a cut and fill balance, so that no material is imported onto or exported from the site.

The presence of the gas main however means that it will not be possible to cut material from the higher ground and the amount of fill required will be greater than normal. It may be possible to generate a proportion of the additional fill material required by digging an attenuation pond. The remaining amount will therefore need to be imported to site from an external source. The precise quantity of material required can only be established after computer ground- modelling of the existing and proposed site contours has been undertaken. The approximate depth of fill required in the south eastern corner of the pitch will, however, be approximately 3.0m. If cut and fill were possible then the depth of build up required at this location would have been less at approximately 1.5m.

It will be important that any imported material is consistent and of good quality. The nature of the material used may impact on the amount and degree of drainage required to the pitch. If clay material is imported it may have the potential to shrink and swell which could affect the integrity of drain lines installed into it.

Planning consent for the works may put restriction on the traffic movement and the hours which soil can be delivered to site. This should be established prior to the works being issued for tender.

At an early stage it must also be established in writing from with the gas company that it is acceptable to place fill material over the gas main line. There will be a requirement to compact the fill material. This work could potentially damage the gas main. It is therefore imperative that any restrictions in relation working close to and/or over the gas main are clearly set out and understood.

4.3 Scope of Recommended Works

4.3.1 - Drainage

The site is characterised by silt loam topsoil containing a low stone content overlying sandy clay subsoil. In its present state the composition and texture of the soil profile allows satisfactory drainage rates across the area, however the soil is moisture retentive.

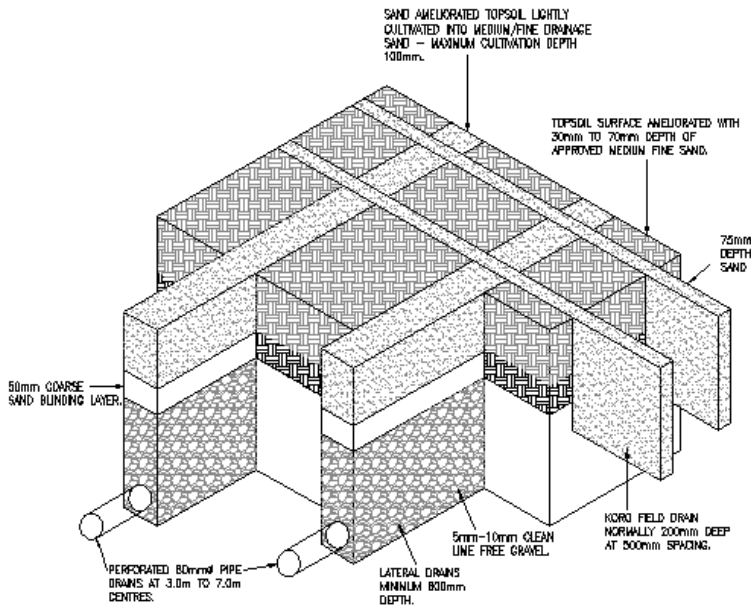
The topsoil, however, has high silt content and such soils tend to be moisture retentive when compacted, and physically weak. Such soil is prone to compaction and de-structuring, especially when wet.

It follows that during the winter months when the rate of precipitation exceeds the rate at which water is removed through drainage or evapotranspiration, water may tend to accumulate within the topsoil. This can lead to saturated conditions at the surface which may prevail throughout the winter.

In some circumstances this is manifested by standing water 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 volume of the soil should comprise air-filled pores).

In order to correct this situation consideration should be given to adding sand to the topsoil and the installation of a surface by-pass drainage system. These systems work by intercepting rain water at the surface before it has had an opportunity to soak in to the soil profile, and then removing this water to a system of piped drains. Typical systems would comprise Koro field drains installed at 500mm centres (Figure 7) linked into a system of lateral drains beneath the pitches.

The following drainage scheme is suggested, however, this can be adjusted depending on budgetary constraints. Clearly, as the intensity of the scheme is reduced so is the rapidity with which the site will drain following rainfall. Lateral drains should be installed at 4.0m centres connecting with a system of collector and main drains.



RECOMMENDED PITCH CONSTRUCTION
WHERE TOPSOIL IS CULTIVATED AND
SUPPLEMENTED WITH KORO FIELD DRAINS.

Figure 7. - Typical pipe and slit drain based surface by-pass drainage system

The installation of a pitch drainage system will mean that drainage water will be directed to a single drainage discharge point. The flow rate from this point will inevitably be higher than the water discharging from the ground prior to the installation of the drainage system. This is known as the greenfield run-off rate. There will be a requirement for the discharge of the water from the pitch drainage system to beat the same rate as the greenfield run-off rate. The rate of water flow from the pitch outlet pipe would, therefore, need to be attenuated to a storm frequency of 1 in 100 years, plus a climate change factor which would be 40%. If this is the case the volume of water which would need to be stored under the ground could be in the order of 200m³.

To achieve this, water will need to be held back in an attenuation feature and then released at a controlled rate through a flow control unit known as a hydro-break.

An attenuation feature could be a

- A fenced pond,
- Underground high capacity attenuation crates

An indicative layout of a possible attenuation pond is detailed below. Please note that this is indicative and the size and capacity of the pond would be dependent on drainage rate calculations and the resulting attenuation volume required. If a pond is constructed it will need to be fenced to keep it safe and to prevent unauthorised access.



Figure 8. – Indicative pitch drainage system and possible water attenuation feature.

A more expensive alternative to a pond would be underground attenuation crates. These are as shown below in Figures 8 & 9 .



Figure 8 – Typical detail of attenuation crates which are installed below ground

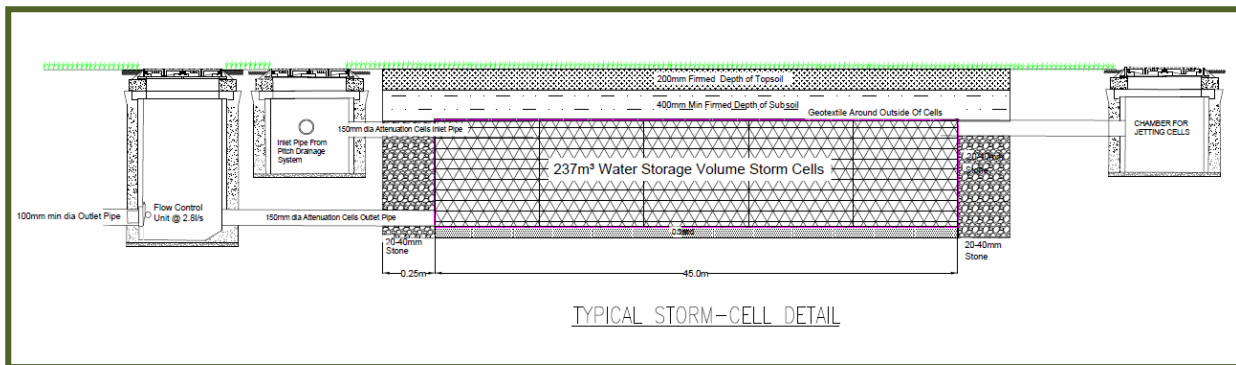


Figure 9 – Typical detail of attenuation crates which are installed below ground

The cost of installing such cells could be in the order of £200/m³ exc VAT. The cost of this system including a drain from the cells into the river via a hydro-break could therefore be in the order of £40,000 exc VAT.

In certain circumstances water can soak-away to the ground naturally, and this may result in a lower volume of attenuation or possibly no attenuation. The viability of a soak-away may be confirmed by undertaking an onsite soak-away test in accordance with BRE Digest 365. If infiltration rates are adequate the test would give information to enable the soak-away to be designed.

It should be noted that the presence of groundwater may have an impact on the viability of attenuation ponds, attenuation crates and the installation of soak-aways. So that the impact of groundwater on drainage can be further understood it is recommended that a series of groundwater monitoring wells are installed across the site and monitored for at least six month including the winter period.

4.3.2 Cultivation & Importation of Sand

On completion of the installation of the trenched drains and attenuation the whole area of the playing field and surrounds should be regraded and/or trimmed including a pass with a stone rake, all arisings to be removed. The topsoil should then be cultivated to relieve any compaction, and to create a good tilth, to a depth of 150mm (on no account should any cultivations be into underlying heavier clay). The graded, cultivated, topsoil should be cleared of all stones having a dimension greater than 16mm by the use of appropriate, approved, machinery. The final depth of 'clean' topsoil must be no less than 125mm. Any subsoil compaction to be relieved, as before described.

Medium/fine sand should be evenly spread to form a layer 40mm deep over the pitch. The sand should be worked into the immediate surface of the soil to a finished depth of 75mm. The amelioration of the existing topsoil with sand will improve water infiltration and the bearing strength of the soil, to maintain drier and firmer playing surface.

4.3.3 Seed Bed Preparation

A fine, firm, seedbed should be prepared, incorporating a general granular fertilizer such as 10:15:10 at the rate of 500 kg/ha.

The surface should be adequately firmed but not over-compacted and should have a smooth, even surface free from ridges, ruts, hollows, humps or other undulations. The final preparation should be carried out using equipment with low ground pressure tyres.

During the final seedbed preparation a further stone picking may need to be carried out and all stones or other debris, with any dimension greater than 16mm, should be collected and removed, to the Contractor's tip off the site.

4.3.4 Seeding

Pitches including surrounds should be sown with a high quality sports turf seed mixture containing a high proportion of wear-tolerant ryegrass comprising at least three different cultivars of perennial ryegrass rated not less than 7.4 for Live Ground Cover in Table S1, Pages 6-7 of Turfgrass Seed 2018 (produced by the BSPB Amenity Committee). An appropriate mixture would be 100% perennial ryegrasses.

The seed should be sown at the rate of 400 kg/ha (the total quantity of seed should be divided in half and each half sown evenly) ensuring an even and uniform cover and should be lightly raked or otherwise worked-in, taking care not to ridge or otherwise disturb the surface. (The works should, preferably, be programmed to allow for a late summer/early autumn seeding.)

4.3.5 12-Months Maintenance Post-Construction

When the grass has grown to approx. 35mm in height the pitch surrounds and banks should be inspected and all stones or other debris having a dimension greater than 16mm should be collected (hand-picked) from the surface and removed off the site. The area should then be carefully rolled, with a flat roller, during suitable ground and weather conditions. When the grass is no longer than 50mm the pitches should be mown, with the height of cut set at 25mm – 35mm, using an approved mower. Mowing should be repeated as and when required, not allowing the growth of the grass to exceed 50mm.

A comprehensive fertilizer programme needs to be carried out and should include (a minimum) 1 No. application of a proprietary autumn/ winter fertilizer and 2 No. applications of a proprietary spring/summer fertilizer, all at the appropriate season. Any defects and/or reinstatement works should be remedied and completed in an approved manner.

Depending on the construction timetable, 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:

1. Mowing & fertiliser application.
2. Compaction alleviation (e.g. Verti-draining).
3. Sand topdressing (3 x 5mm applications).
4. Selective weed control (as required).
5. Pest and disease control (as required).

4.3.6 Irrigation

It is recommended that a basic irrigation system is installed. A cost effective system would be the Briggs Rota Rainer system. It should be noted that this is not an automated system and management will be required. Some damage may be caused to the new grass and pitch surface during the early grass establishment phase and remedial works will most probably be required.

The Briggs Rota Rainer system brochure is presented in Appendix VIII. Typically the system would be comprised of a booster pump, water storage tank, pipe work and self travelling irrigator. If there is adequate mains water pressure (2.5 – 3.0 bar) then it may be possible to run the Briggs Model 2 directly off the mains without the need for a booster pump and water storage tank. A supplier of the Briggs Rotator Rainer system is UK Pump Supplies. (Phillip Francis Tel 01761 232730)

Further investigation is required with regard to the suitability and pressure of the incoming water supply. It should be noted that the cost of mains water is approximately £1.40/m³. During the irrigation season from May to September there may be a requirement to apply up to 40m³ of water per day. To reduce the cost of mains water the option of installing a borehole could be looked into. It is possible to install a borehole and abstract up to 20m³ of water per day without having to obtain licence from Natural Resource Wales.

The installation of such an irrigation system would be beneficial in future years helping to improve grass and pitch quality. If the budget for installation and running of an irrigation system is not available then there will be a requirement for the pitch to be irrigated by the contractor during the grass establishment phase.

If grass establishment is required within 10 -12 weeks and a permanent irrigation system is not installed, then it will be necessary for the contractor to supply and operate a temporary irrigation system. The cost to do this could be in the order of £15,000 - £20,000 exc VAT. The cost of the water used during the grass establishment period could be in the order of £3,000 - £4,000 if taken from the mains. An abstraction licence may be required if water is to be taken from the river

4.4 Indicative Cost Estimates

Item	Description	Unit	Quantity	Min Rate	Max Rate	Min Total	Max Total	Minimum	Maximum
Prelims	Transport and Preliminaries	Item	1	£15,000.00	£20,000.00	£15,000.00	£20,000.00	£15,000.00	£20,000.00
1	Setting Out								
	Setting out working area	Item	1	£500.00	£1,000.00	£500.00	£1,000.00	£500.00	£1,000.00
2	Enabling works and site clearance								
	Total herbicide application	m ²	5,400	£0.08	£0.11	£432.00	£594.00		
	Vegetation removal	m ²	5,400	£1.00	£1.50	£5,400.00	£8,100.00	£5,832.00	£8,694.00
3	Topsoil stripping								
	Cultivation of topsoil to produce friable tilth	m ²	5,400	£0.12	£0.14	£648.00	£756.00		
	Strip & stockpile topsoil (200mm depth) from eastern end of pitch	m ³	1,200	£4.50	£5.50	£5,400.00	£6,600.00	£6,048.00	£7,356.00
4	Earthworks								
	Import Subsoil to reduce gradient - Assumed free material imported	m ³	5,000	£4.00	£5.00	£20,000.00	£25,000.00		
	Subsoil grading	m ²	5,400	£2.00	£3.00	£10,800.00	£16,200.00		
	Proof roll formation	m ²	5,400	£0.08	£0.12	£432.00	£648.00		
	Subsoil loosening (2 directions)	m ²	5,400	£0.13	£0.15	£702.00	£810.00		
	Grading to final levels and tolerances	m ²	5,400	£0.09	£0.11	£486.00	£594.00		
	Trimming	m ²	5,400	£0.10	£0.12	£540.00	£648.00		
	Stone pick (> 50 mm diameter)	m ²	5,400	£0.12	£0.14	£648.00	£756.00	£33,608.00	£44,656.00
6	Topsoil placement								
	Return and place 200 mm depth of topsoil from stockpiles.	m ³	1,200	£4.50	£5.50	£5,400.00	£6,600.00		
	Grade topsoil to specified levels and tolerances	m ²	5,400	£0.30	£0.40	£1,620.00	£2,160.00	£7,020.00	£8,760.00
7	Stone removal								
	Remove all stones >20 mm in any dimension and all sharp-edged stone	m ²	5,400	£0.10	£0.11	£540.00	£594.00	£540.00	£594.00
8	Sand amelioration								
	Supply and spread 40mm approved sand including incorporation.	t	430	£33.00	£36.00	£14,190.00	£15,480.00	£14,190.00	£15,480.00
9	Fertiliser Application								
	Supply and spread specified fertiliser.	m ²	5,400	£0.10	£0.13	£540.00	£702.00	£540.00	£702.00
10	Seedbed preparations								
	Undertake final cultivations and grading to specified levels and tolerances.	m ²	5,400	£0.14	£0.16	£756.00	£864.00	£756.00	£864.00
11	Seeding								
	Supply and drill seed to pitch & surrounds	m ²	5,400	£0.32	£0.35	£1,728.00	£1,890.00	£1,728.00	£1,890.00
12	2.0m High Vmex Security Fencing								
	Reinstatement of damage	m	280	£75.00	£85.00	£21,000.00	£23,800.00	£21,000.00	£23,800.00
TOTAL TO SUMMARY (EXCL. VAT)								£106,762.00	£133,796.00

2.0 - DRAINAGE									
Item	Description	Unit	Quantity	Min Rate	Max Rate	Min Total	Max Total	Minimum	Maximum
1	Setting Out								
	Setting out working area	Item	1	500	£800.00	£500.00	£800.00	£500.00	£800.00
2	Drainage								
	Supply and install 80 mm dia Lateral drains including backfill.	Lin. m	1,200	£9.00	£11.00	£10,800.00	£13,200.00	£10,800.00	£13,200.00
	Supply and install 150 mm dia catch water drains including backfill.	Lin. m	90	£13.50	£15.00	£1,215.00	£1,350.00	£1,215.00	£1,350.00
	Supply and install 150 mm dia Main drains including backfill.	Lin. m	120	£14.00	£15.50	£1,680.00	£1,860.00	£1,680.00	£1,860.00
	Supply and install junctions (Lateral/Collector).	Nr.	21	£10.00	£15.00	£210.00	£315.00	£210.00	£315.00
	Connections to inspection chambers	Nr.	3	£100.00	£150.00	£300.00	£450.00	£300.00	£450.00
	Supply and install inspection chambers	Nr.	3	£450.00	£600.00	£1,350.00	£1,800.00	£1,350.00	£1,800.00
	Construct specified soakaway/attenuation system. Cost will depend on drainage capacity of ground and presence of groundwater	Item	1	£8,000.00	£50,000.00	£8,000.00	£50,000.00	£8,000.00	£50,000.00
	Installation of Koro Field drains	m2	5,400	£1.75	£2.20	£9,450.00	£11,880.00	£9,450.00	£11,880.00
	Installation of sand bands (Provisional)	m2	5,400	£0.90	£1.20	£4,860.00	£6,480.00	£4,860.00	£6,480.00
3	Reinstatement of damage								
	Reinstatement of damage	Item	1	£1,000.00	£1,500.00	£1,000.00	£1,500.00	£1,000.00	£1,500.00
TOTAL TO SUMMARY (EXCL. VAT)								£39,365.00	£89,635.00

3.0 GROW IN MAINTENANCE (Seeded Pitch)					
Item	Description	Unit	Number	£/unit	Cost (£)
1	Transport and Preliminaries	Item	1	£1,500.00	£1,500.00
2	Mowing (35 cuts)	Nr	35	£250.00	£8,750.00
3	Fertiliser (5 applications)	Nr	4	£250.00	£1,000.00
4	Herbicide (1 application)	Nr	1	£275.00	£275.00
5	Over-seeding (2 application)	Nr	2	£1,000.00	£2,000.00
6	Verti-draining (2 operations)	Nr	2	£500.00	£1,000.00
7	Sand topdressing (3 x 5 mm) Over 12 Months	t	235	£34.00	£8,000.00
ESTIMATED TOTAL TO SUMMARY (EXCL. VAT)					£22,525.00
4.0 ROTA RAIN IRRIGATION SYSTEM					
Item	Description	Materials	Installation	Total	
1	WATER SUPPLY & POWER CONNECTIONS	£500.00	£1,000	£3,500.00	
2	BOOSTER PUMP & TANK	£4,000	£1,000	£5,000.00	
3	PIPEWORK, CABLE & FITTINGS	£2,000	£1,000	£3,000.00	
	PITCH EQUIPMENT	£3,500	£200	£3,700.00	
ESTIMATED TOTAL TO SUMMARY (EXCL. VAT)					£15,200.00

GUIDELINE COST SUMMARY RANGE			
1 No PITCH (90 X 50m + 3.0m MARGINS)			
		Minimum	Maximum
1.0	CONSTRUCTION WORKS	£106,762.00	£133,796.00
2.0	DRAINAGE	£39,365.00	£89,635.00
3.0	GROW IN MAINTENANCE	£22,525.00	£22,525.00
4.0	ROTA RAIN IRRIGATION	£15,200.00	£15,200.00
	TOTAL EXC VAT	£183,852.00	£261,156.00
	CONTINGENCY (5%)	£9,192.60	£13,057.80
	TOTAL (EXCL. VAT)	£193,044.60	£274,213.80
	VAT @20%	£38,608.92	£54,842.76
	ESTIMATED TOTAL (INC. VAT)	£231,653.52	£329,056.56

Note the costs for contractor to undertake pitch grow-in maintenance is until first use only. Irrigation water costs are not included.

4.4 Implications of Works on Future Maintenance, System Longevity & Usage

4.4.1 Maintenance issues

With surface bypass drainage systems such as that recommended it is essential that adequate allowance is made for annual sand topdressing as this helps to protect the drains from contamination with topsoil. As a guide it is recommended that a 4mm depth of sand should be applied annually as part of the renovations programme. A 4-5mm depth of sand would equate to approximately 80t at a cost of approximately £2,500.00+VAT (2018 prices).

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. The installation of an irrigation system will help to reduce the likelihood of settlement within the drains.

Ideally the pitch should be subjected to annual renovation and depending on the condition of the pitches the works required could range from light scarification, aeration, top-dressing fertilisation and over-seeding to full removal of surface vegetation and re-establishment from seed. At present day prices the latter operation could cost in the order of £10,000.00 exc. VAT per full size pitch. This does not include the cost to grow-in the new grass.

If vegetation is removed during the irrigation season (April to September) there will be a requirement for approximately 45m³ of water per day to adequately irrigate each pitch. In most areas the cost of mains water is approximately £1.00 to £1.20 m³. If required, the option to install a borehole could be looked at as this may prove to be more cost-effective over time. It should be noted that the licensing process for a new borehole can presently take up to two years.

Outline maintenance procedures are presented in Appendix IV.

4.4.2 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).

If managed well (i.e. annual sand topdressing) and not over-used the Koro drains should have an operational lifespan of 8–10 years, hence a sinking fund should be in place to repeat this operation.

NOTES:

- a. Costs are based on a general estimation of the works required.
- b. Costs assume that the arisings associated with drainage scheme installation will be disposed of on-site.
- c. Costs based on recent Contractors rates (2018).
- d. Cost do not include professional fees
- e. Cost do not include planning consent application fees.

4.5 Indicative Works Programme

With respect to timescales for completing the project, it is recommended that construction works are undertaken only under suitable ground and weather conditions. The date for first use is highly dependent on weather conditions during the construction phase and growing-in period. If works are undertaken then they should not commence prior to April 2020.

5.0 PROJECT PROGRAMME

2020	February				March				April				May				June				July				August					
Week Number					9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Key Stage Tasks																														
Tender & H&S Document Preparation	█	█	█																											
Tender Period				█	█																									
Tender Review & Report						█																								
Review & Approval							█																							
Contractor Interviews & Appointment							█																							
Contractor Mobilisation							█	█	█																					
Pitch Construction Period									█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	
Grass Establishment & Irrigation																					█	█	█	█	█	█	█	█	█	
First Use of Pitch																													█	

Notes

Programme assumes that imported earthworks fill material is imported within a two week period. Stockpile on site prior to works commencing may reduce delay risk if permissible.

Programme assumes that permanent or temporary irrigation is in place at time of seeding and will be able to maintain a soil moisture content of at least 30% during the grass establishment period. If irrigation is not present then the grass establishment period could be up to one year. It is important that the seeding date is as shown in the above programme.

6.0– SUMMARY

6.1 Guideline Costs & Principal Factors Affecting Proposed Development

- It should be possible to construct a pitch of 90 x 50m with 3m wide margins. This complies with laws of the game but may not comply with local league requirements.
- The guideline cost estimate range including contingency and VAT at 20% is £231,653,52 to £329,056.56. These costs assume that the imported fill material required to improve falls across the site is free. .
- Planning consent for the development will be required. Consent conditions placed on Planning consents typically include, but are not limited to, the procurement of ecological, habitat and tree surveys, drainage system and water attenuation design, flood risk assessment details of existing and proposed ground levels with sections. Planning consent may put a limit on lorry movements to and from the site during the facility construction works.
- There is a gas main running through the proposed development area. It needs to be established from the facility owner that it will be possible to construct a playing field over the gas main and increase ground levels over it. The gas main means that ground levels over it cannot be reduced. This means that the a large amount of fill material will need to be imported into site resulting in the build up of ground by approximately 3.0m at the highest point. A topographic survey of the site will be required followed by computer ground-modelling of existing and proposed ground levels. From this the amount of imported fill material will be determined. The slow importation of fill may have implication of the construction works programme.
- Site access is restricted
- Site security fencing will be required around the pitch.
- If grass establishment is required within 10 -12 weeks and a permanent irrigation system is not installed, then it will be necessary for the contractor to supply and operate a temporary irrigation system. The cost to do this could be in the order of £15,000 - £20,000 exc VAT. The cost of the water used during the grass establishment period could be in the order of £3,000 - £4,000 if taken from the mains. An abstraction licence may be required if water is to be taken from the river. Without a temporary irrigation the grass establishment period will be in the order of one year.
- There is a river on the site boundary. Subject to the appropriate consents this would appear to be a suitable outlet for the pitch drainage water. It is likely that planning consent will require the water discharge rate to be the same as the greenfield run-off rate for the site. The discharge rate from a pitch drainage system is normally quicker than the greenfield run-off rate. Therefore there will be a requirement to attenuate drainage water prior to discharge into the river.
- The proposed location of the playing-field appears to be outside of the river floodplain and is presently appears to be at low risk from surface water flooding.
- The topsoil has high silt content and the surface of the field was soft and moisture retentive. Sand will need to be added to the topsoil to improve drainage and surface durability. Water infiltration rates are relatively good but these will deteriorate unless the topsoil is modified with sand.
- Ground-water was found to be present near the surface of the proposed development area. This may have an impact on the feasibility of installing water attenuation features. Cut off

drainage around the playing field may also be required to help to divert groundwater around it. It is recommended that groundwater monitoring wells are installed as soon as possible to monitor ground water over the winter period

- Trees will need to be removed and it needs to be checked if there are any preservation orders on them. Replanting scheme may be required.
- Works, as more widely described, would fall within the scope of the Construction (Design & Management) Regulations 2015 (CDM 2015).
- The proposed development site has a number of issues which have costs and risk implications. These relate primarily to the

Restricted site width

The presence of an underground gas main,

The presence of groundwater near to the ground surface,

Construction access through a residential area,

The need to attenuated drainage water,

The need to import a sustain quantity of earthworks material reduce falls across the proposed pitch area.

It should be possible to overcome these issues, but this may result in increased costs and a longer than normal development programme.

Although the pitch size produced will be compliant in relation to the Laws of the Game, it may not be compliant with local league requirements now or in the future. These requirements should be checked prior to proceeding with the project.

It would also be advisable to undertake further geotechnical site investigations and obtain geotechnical advice at an early stage, as the presence of groundwater on the ability to attenuate pitch drainage water needs to be fully understood prior to the proposed development proceeding. This may have an impact on the feasibility of the project.

7.0 CONTACT DETAILS

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8.0 ADDITIONAL POINTS

This report does not constitute a detailed Specification or Bill of Quantities, and as such, is not suitable for use in obtaining prices from contractors or as a formal construction contract document.

Successful implementation of the natural turf facilities at Tal-y-bont should involve the preparation of a full design and specification and the skilled implementation of the designed works. It must be appreciated that the preparation of good sports turf surfaces involves a great deal of skill and care. Materials, particularly soils on site, are variable. The way in which the works are implemented and especially the weather and ground conditions prevailing at the time are as important as the methods used.

Costs assume that spoil from drainage arisings can be used elsewhere on site.

Any work would best be carried out during the normally drier months of late spring and summer, with an aim to completion in autumn while some good growing conditions still remain.

All relevant Health and Safety Regulations must be observed and the works, as more widely described, would fall within the scope of the Construction (Design & Management) Regulations 20015 (CDM 2015).

Confidentiality

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APPENDICES

Appendix I	Pitch Location, Dimension & Outline Drainage
Appendix II	Approximate Existing Falls
Appendix III	Self Travelling Irrigation
Appendix IV	Outline Maintenance Recommendations
Appendix V	Additional Photographs

Appendix I – Pitch Location, Dimension & Outline Drainage

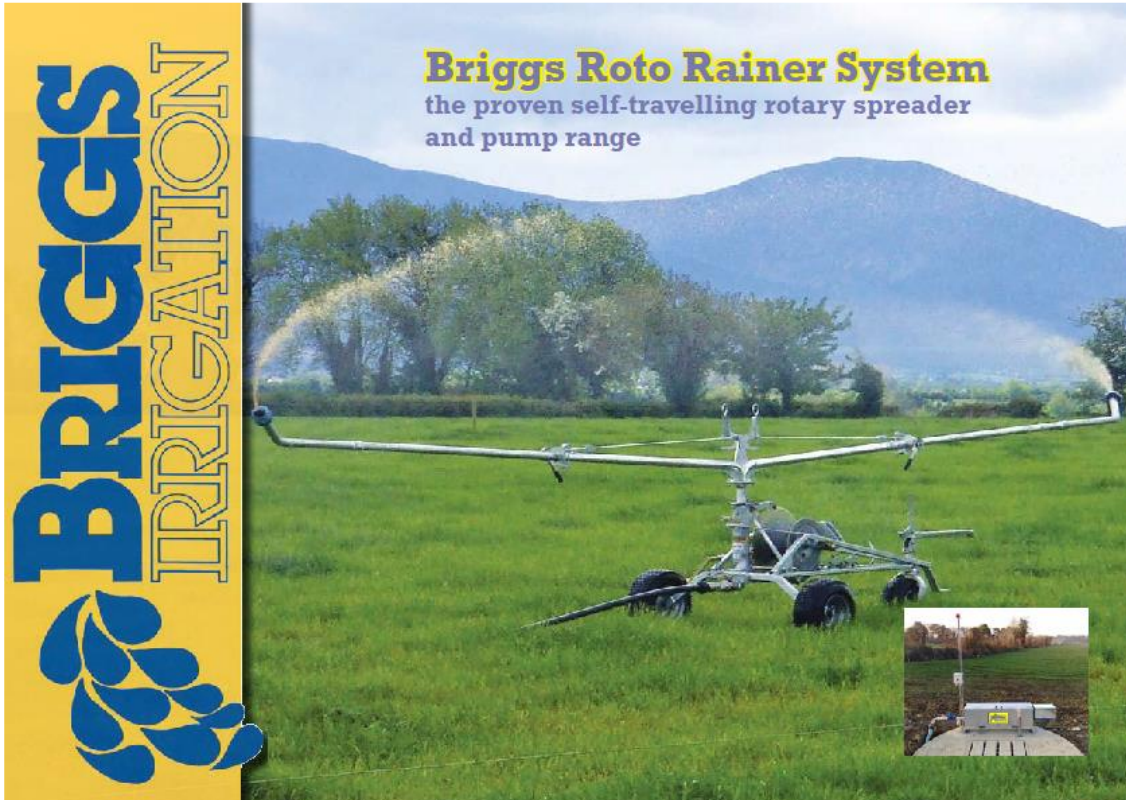


Appendix II – Approximate Existing Falls



Appendix III: Self Travelling Irrigation

Double left click image to open brochure.



Appendix IV: Outline Maintenance Recommendations

OUTLINE MAINTENANCE PLAN

Following construction works and completion of any contractual aftercare, it is important that the personnel responsible for ground maintenance implement appropriate maintenance. The following notes will assist in the development of facility to the required standard. Remember the aim is to manage the turf surface to produce the required Playing Quality Standard.

Mowing.

The grass should be maintained between a height of 25 - 40 mm using cylinder mowing equipment. The grass should never be allowed to exceed a height of 50 mm. If the grass does become too long, the height of cut should be reduced gradually over 3 – 4 cuts allowing some time for recovery in between. N.B. On no account should the grass height be reduced by more than 50% on any one occasion. Overall, approximately 40 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. Fertiliser should 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 (e.g. mid May) at the rate of 80t/ha. After each application, the sand should be worked into the surface with brushes or drag mats.

Overseeding.

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

Harrowing [Playing season as required].

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

Divot repair [Playing season].

After each match, divot and tread the divots back into position.

This will remove any bare soil which allows weeds and weed grasses to germinate. Filling in divots with seed/soil mix will help to maintain better grass coverage.

Renovation of worn areas [Playing season].

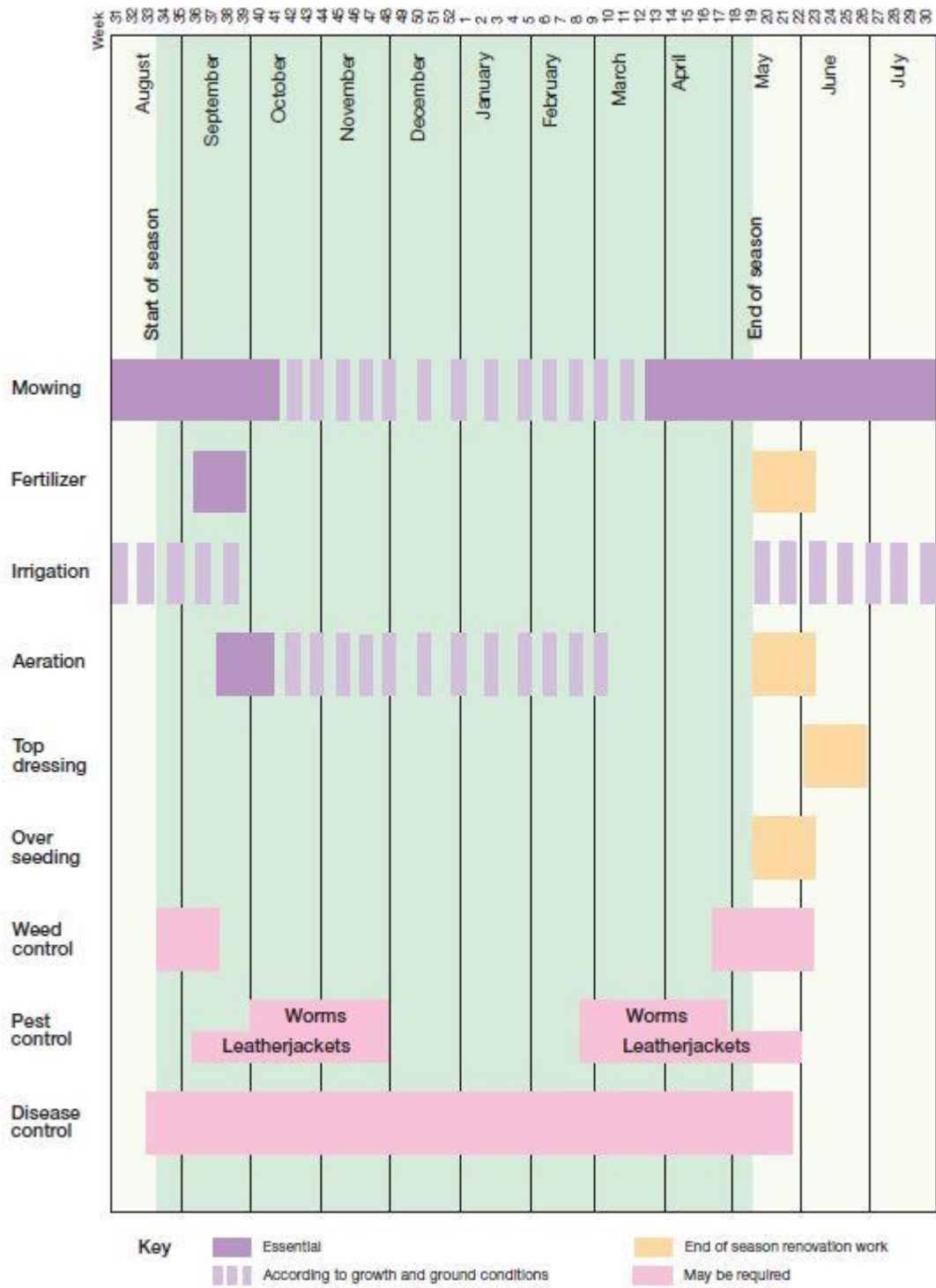
Areas of high wear, e.g. goal mouths, should be dressed and seeded using a divot repair mix (seed/rootzone) during the playing season as required in order to maintain good grass cover. These areas should be hand watered (if necessary) to ensure rapid grass germination and establishment.

Line Marking [Playing season].

Line marking should be undertaken on a weekly basis during the playing season.

Goalpost safety.

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



Winter Football and Rugby League: Summary pitch maintenance programme

Appendix V: Additional Photographs



Plate 10 – View north from river



Plate 11 View of river and potential pitch drainage outlet point at controlled discharge rate.



Plate 12 View of vegetation dividing the proposed development site .



Plate 13 View of vegetation dividing the proposed development site



Plate 14 – View of fence dividing the proposed development site



Plate 15 Southern section of proposed development site.



Plate 16 Southern section of proposed development site.



Plate 17 Gas main marker on northern site boundary .



Plate 18 Road leading to site access point.



Plate 19 Gate to site access.



Plate 20 View over site north to south.



Plate 21 Large culvert chamber on south eastern corner of Pitch 1.