

GC2030



University Centre  
Myerscough  
INSPIRING EXCELLENCE

# Golf Course Condition and Playability:

Sustainability Guidelines and Support for Clubs



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The R&A facilitates and funds an international research programme, Golf Course 2030. It focuses on key sustainability priorities including- sustainable agronomy; resource management; biodiversity; and climate - to create evidence-based best practices and solutions within the golf industry.

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# Foreword

The R&A is a leading body within the world of golf and engages and supports activities to ensure the sport is thriving for all. They help to enhance the golfing experience of golfers across the world through initiatives such as Golf Course 2030.

Golf Course 2030 provides is an industry programme to support clubs in maintaining Course Condition and Playability in the context of wider pressures, such as changing climate, resource constraints and regulation.

It is clear those working in golf must be ever resourceful and innovative in managing areas of the golf course for sustainability and resource efficiency, while also satisfying demands from players and maintaining the course character.

This unique report brings together, for the first time, the findings of existing academic and industry research with individual expert views from experienced members of the golf industry, to help identify and analyse the ways in which Course Condition and Playability can be maximised even despite such constraints.

There are a number of useful practical recommendations for clubs up and down the country, no matter their individual circumstances, that help ensure courses are presented at their very best.

The report also highlights the positive opportunities sustainability can offer, such as golf clubs beginning to return to their historic roots, and original rugged styles, with an increased focus on course character and the authentic 'experiences' this can offer.

This is a well-researched and thought-provoking report. It provides actions and guidance that can lead to tangible, positive outcomes for the golf industry and thus important to help safeguard the future of the sport.



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# 1. Introduction and aims

There have been many great achievements in the world of golf during recent times, such as inclusion in the Olympic Games, showcasing the sport on a global platform, and record spectator attendance at various major golf events.

However, such accomplishments have been achieved amongst a landscape of increasing pressures which threaten the sustainability of the game, including falling participation numbers and a series of environmental concerns. It is important, therefore, the industry recognise the pressures affecting the game, and take the appropriate steps to secure the future sustainability of the sport.

Golf Course Condition and Playability is the cause of much debate between agronomists, designers, architects, greenkeepers, and, of course, the players themselves. The purpose of the Golf Course Condition and Playability report is to provide a series of best practice guidelines for various areas of the golf course beyond the greens – including: teeing areas, fairways, first cut rough, bunkers, and green aprons.

Much of the current research focuses on the greens themselves, and there is little known about other areas of the course. This is particularly important given the amount of land dedicated to such areas.

The golf sector will be increasingly required to manage areas beyond the green and there requires a greater awareness of what can be delivered sustainably in the context of wider environmental pressures.

Various people across the golf industry have been involved in the production of this report, which has led to a number of practical guidelines, action points, and case studies to help support clubs in the context of challenges including climate change, resource constraints (such as water shortages) and regulation.

**THIS REPORT AIMS TO SUPPORT GOLF CLUBS TO:**

1. Establish course condition and playability quality standards
2. Develop best practice guidelines to manage course condition against quality standards, for:
  - i. Teeing areas
  - ii. Fairways
  - iii. First cut rough
  - iii. Bunkers
  - iv. Green aprons





# How to use this report

This report offers golf clubs a roadmap to help overcome some of the challenges associated with course condition and playability. Readers are encouraged to 'dip in and out' by using the chapters most applicable to their own priority areas.

For some, this will start by establishing what 'quality' actually means for their club, or how to manage player expectations, before identifying how to reach their specific goals. While others, with a clear idea on what aspects of the course they wish to focus on, will head direct to the sections on these specific course areas.

Academic and industry research are accompanied by numerous action points and practical case studies, that provide clear and detailed guidance and direction for considering all issues of course condition and playability.

Readers are encouraged to 'dip in and out' of this report by using the chapters which most centrally relate their own circumstances regarding course condition and playability – whether that be:

p17	Teeing areas
p25	Fairways
p35	First cut rough
p39	Bunkers
p47	Green aprons

## 2. Research methods

An extensive review of academic evidence was conducted via searching abstract and citation databases of peer-reviewed scientific articles, including; Scopus, SPORTDiscuss, PubMed, PsycINFO, Taylor & Francis Library, and Google Scholar. This combined strategy covers more than one million citations of academic peer-reviewed research papers. This was supplemented with industry publications and market research documents, either publicly available or accessed via contact directly with the relevant bodies.

The academic and industry literature was supplemented with surveys and semi-structured interviews from a number of industry representatives. These encompass a range of key industry stakeholders, people working various golf club roles, and players themselves.

All participants were invited to take part and briefed on the nature of the research. Responses remain anonymous and participants given free and impartial choice for each question. Participants were given the guarantee all data will remain confidential, that contributes to overall validity levels. The project was commissioned by The R&A and granted ethical clearance by University Centre Myerscough's Faculty Research Ethics Committee (FREC).

The results were subjected to a number of statistical tests, via a process of thematic analysis, where reoccurring points of significance and emergent trends were identified.

### KEY INDUSTRY STAKEHOLDERS

British and International Golf Greenkeepers' Association (BIGGA)

Club Management Association of Europe (CMAE)

European Institute of Golf Course Architects (EIGCA)

Golf Club Managers Association (GCMA)

Association of Turfgrass Professionals Ireland (ATPI)

Professional Golfers Association (PGA)

### 3. Golf club self-assessment: Establishing what 'quality' means

Firstly, it is important to establish what 'quality' means for your golf club. No two clubs are the same and, consequently, their approach to course condition and playability will vary depending on a number of factors.

The purpose of this section, therefore, is to help clubs equip themselves with the tools to understand their place in the wider market, and thus ensure their golf offer accurately reflects this.

#### 3.1 Identifying core market and aligning the golf product

**Industry voice**

"Golf course maintenance programs must innovate and adjust to changing demographics and economic conditions"

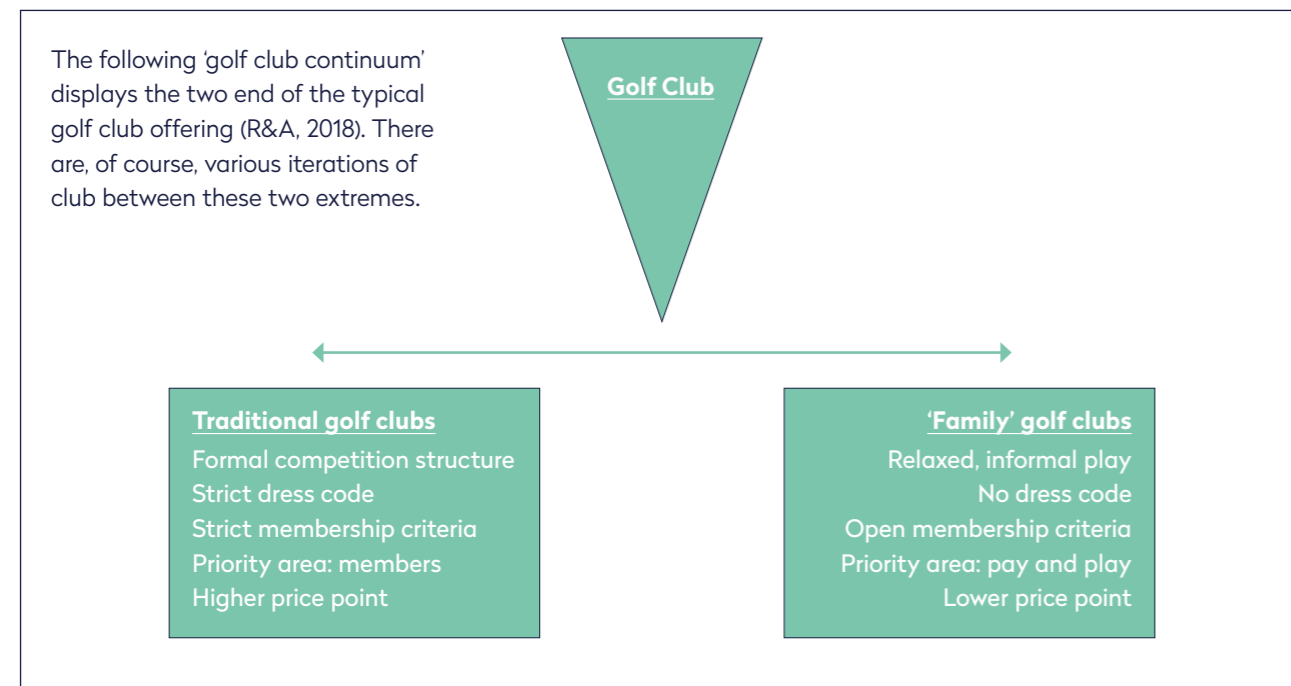
**Research quote**

"If we make a few good decisions today, we can buy ourselves 'ecological time'"  
(Breitbarth et al., 2018)

It has become increasingly important that golf clubs assess their place in the market and do not attempt to be a club that offers 'everything for everybody'. Rather, clubs should look to identify their core market and build the golf product appropriately. One of the benefits of the sport of golf is the rich mix of facilities nationwide, across a range of offerings, from 'top end' private clubs through the local council run municipal clubs.

**Industry voice**

"There has to be a balanced approach. This is an open championship venue, and people want that experience but you've also got to get people round, and it not be impossible. It's about balance and listening to feedback"



**Action Point:** Golf clubs should seek to establish where they sit on the golf club continuum.

Club managers should take this opportunity to effect change in their club, by building an identity and strategic vision. This requires imaginative and creative strategies to develop and promote the club brand, accompanied with an engaging marketing campaign promoting what is on offer. Such activities will better help clubs to understand their approach to course condition and playability.

It is also acknowledged that a key challenge facing the game of golf is broadening its appeal without alienating those for whom the current marketplace works as it is. This said, the data indicates that the numbers of people in the traditional golf marketplace is declining, and as a result clubs are much more likely to be required to consider what their target market it.



**Action Point:** Golf clubs are encouraged to assess their internal facilities (size and type of course, clubhouse) and external market factors (demographics of players), and tailor club offerings appropriately.

There are also a number of typographical considerations which are part of this dynamic. Golf courses are subject to a variety of external factors that impact course condition and playability standards, including: climate, weather, landscape, and soil type. All of which will have a significant effect on greenkeeping practice and resultant surfaces for play.

**Industry voice**

"Golf courses in different areas and regions will each have different optimal conditions... better to concentrate on sustainable environmental standards that provide optimal course conditioning for courses' unique environment and region"



**Industry voice**

"Context is critical in this regard. Quality and performance cannot be considered without other considerations. For example, weather, golf course design, willingness to develop the course, maintenance strategy, constraints such as budget, usage levels"

**Industry voice**

"All golf courses are different, for the simple reason they are part of the natural environment located in different places. The optimum 'condition' of a green in one location will be different to another"

Furthermore, for some clubs this may signal a move away from maintenance of the course. Buksted (2019), for example, found that the majority of golfers did not prioritise course condition beyond the 'minimum reasonable level' and rather focused on the quality of the club and social environment. It is argued that revenue expenditure allocated to the course in some typical clubs (around 80% of overall expenditure) is far too high, and a larger percentage could be redistributed more social activities (Buksted, 2019). Social relationships were described as being the 'glue' of a golf club, and focus therefore should be made on building relationships and new member integration.

**Research quote**

"It is much easier to leave a good quality course, than it is to leave a good quality social community that a golf club can facilitate"  
(Buksted, 2019)



### 3.2 'Back to the future': New directions in course condition and playability

The visual appearance of the golf course has traditionally been a key indicator for playing conditions. Aesthetic appeal, though, is highly subjective and it is not uncommon for golf courses to be criticised without reference to the criteria which reward skill.

Furthermore, issues such as climate change, resource constraints, and regulation are likely to make it increasingly difficult for courses to be maintained in a pristine condition free from blemishes.

It is argued here, therefore, that the future trends of golf are towards more 'rugged and natural' courses which are more akin to the traditional layout. There is a trend towards firmer, faster turf and increased demand on creativity and shot making.

#### Research quote

"It's starting to happen already: the hot courses are not as dutiful apostles of Augusta: they are unique, wild, and woolly-looking layouts... [like] the rugged natural links of the British Isles, where the game began. That's where we're headed: back to the future" (Barton, 2008)

#### Research quote

"One of the main things you see now is less manicured, irrigated, or groomed space, because we're paying attention to what environmental issues are – protection of the habitat, woodlots, animal homes, and buffer strips by the waterways. The focus is trying to keep more acreage in its natural state. That means less chemicals, pesticides, and water, which is good for everyone" (Hudson & Hudson, 2014)

#### Industry voice

"We try and be a lot more natural with things, if things brown off then we're ok with that, its all about the playability"

#### Industry voice

"Everything we are looking at now is, can we do it quicker? Can we do it better? These are the important questions for course maintenance, quality, and sustainability"

Such design features align with the trend to reduce the dependence on artificial agents such as chemicals, with a focus on more natural products and less inputs. In the right conditions this can improve overall quality levels while also reducing financial commitments.

#### Industry voice

"We have gone from a monthly fungicide to doing three a year. This is better from a financial point of view, but also an environmental point of view. We are replacing these artificial agents with more natural products where we can"

As golf courses trend towards more traditional design features, it is becoming more important to manage players' expectations of what courses will look like. Certain groups will be open to such changes, whereas other groups less so. The results presented here reveal that 'core' golfers, typically lower handicap and regular players, are enthusiastic about such changes. Whereas 'casual' golfers, those that do not play regularly and tend to have higher handicaps, may not like these changes.

### CASE STUDY

#### Barnbougle Lost Farm Golf Club, Tasmania, Australia

Barnbougle Lost Farm Golf Club has reputation for minimalist course design and a philosophy that traditional, strategic golf is the most rewarding. The result is a focus on creative design around the natural surroundings. Unlike most standard courses, Lost Farm features 20 quirky holes offering alternative designs, with greens that are dispersed amongst the dunes and along the dramatic Anderson Bay coastline. There is importance placed on course features will change as the natural surrounding changes. Head architect, Bill Coore, explains how the "bunker left of the fairway on the 8th at Lost Farm has evolved from wind effects. The high, square part was not originally there" adding that the "owner called asking what to do. I replied leave it as is and continue playing golf. Bunkers evolve... often times for the better."



### 3.3 Managing player expectations: Rise of the 'Experience Economy'

The most important stakeholders in regard to course condition and playability is the golfers themselves. They are the paying customers of the game, and without them there would be no golf industry. They rightly have their own views as to what the course condition should be (Buksted, 2019).

Difficulties arise, however, when golfers do not always appreciate the practice of golf greenkeeping, understand what is achievable, or the limitations greenkeepers are increasingly required to work under. Furthermore, one golf course cannot be easily compared to another given environmental differences, amongst other things.

Player expectations, therefore, needs to be aligned with level of provision so golfers know the quality level of product they are buying. Managing these perceptions is going to become an increasingly necessary activity going forward.

#### Industry voice

"Player feedback is challenging, as it's highly subjective and is without objective measurement. But it is significant, because of the impact it can have... A crucial part of GC2030 will be helping golfers to understand the realities of the future challenges the game faces, and raising their understanding of what changes are needed in the management of golf course elements"

An impacting factor on the success or not of design changes lies in how they are 'marketed' and 'communicated' to the players themselves. This should be presented as an opportunity to return to the traditions of playing the game, a true test of skill by challenging yourself to a contest against the natural elements. While, at the same time, promoting the benefits of this approach to the environment, cost reductions through less inputs, and securing the overall sustainability of the sport.



**Action Point:** Golf clubs should look to reinvent the game as opportunity to play golf in its traditional form.



**Action Point:** Ensure changes are communicated with key stakeholders, particularly members, at all stages of maintenance strategy development.

#### Industry voice

"Effective communication throughout the golf network, including the engagement of visible professionals and administrators is very important"

#### Industry voice

"Vital that we find compelling and effective ways to help the golfer understand that it's [course changes] are essential, and that some pain during the process is inevitable, but worth it in the long term... We need golfers (and many in the profession) to accept that these challenges are real, and that fighting them through ever more intensive applications of water and chemicals is not the way to go. Challenging, but essential"

#### Research quote

"In established markets such as Portugal and Spain, and in developing markets such as China, water scarcity is an increasingly significant issue... For golf this will mean moving from thinking as sustainability as a threatening compliance issue to a positive opportunity that enhances the game's image" (Hudson & Hudson, 2014)

#### Research quote

"As water becomes scarcer, as organic management practices increase, as environmentalism and environmental legislation start to bite more than they have, and as the economy struggles, we come to appreciate the aesthetic of golf courses in all their many natural beautiful hues" (Barton, 2008)

A focus on offering a more traditional and unique golf experience aligns itself well with the rise of the 'experience economy'. Indeed, recent research has found the experience economy has replaced the traditional service economy (Chang, 2020). That is, businesses are increasingly required to offer memorable events for their customers, and that memory itself, or the experience, becomes the product.

There is an increased desire for more meaningful economic offerings, where consumers have begun to replace the trend of collecting items and now aim to fill boxes with memories, stories and worthwhile experiences (Morton, 2017). In golf, therefore, the value of the playing experience that is becoming more important.



**Action Point:** Golf clubs are encouraged to consider their unique 'story', based on, for example, the history and traditions of the club or local area, and how this is played out through the course offering.





**CASE STUDY**

**Princes Golf Club, Kent, England**

Prince's Golf Club redesigned the Himalayas, Shore, and Dunes nines with a focus on quality, playability and aesthetics. The design brought the course back to the natural, rugged terrain of the south-east Kent coastline and traditional character of open sand-scrub areas, natural wetlands, and rare species of flora and fauna. The club retained GEO Certified status for its outstanding sustainability measures and work supporting the community during renovation works.

The designs also sought to tell the history of the club, with the 'Sarazen bunker', 'Bloody point', and 'Smugglers' Landing' holes. The railway sleeper clad Sarazen bunker is named after Gene Sarazen, who won the 1932 Open Championship at Princess and is said to have invented the first sand wedge, which he used to extricate himself from said bunker on the way to five shot victory. 'Bloody point' and 'Smuggles' bay' are themed holes that tell the stories of a vicious and bloody naval battle of AD851, and the fight against smuggling in Sandwich Bay.

**CASE STUDY**

**Golf Course Perfection and the 'Wonky Veg' Revolution**

Parallels can be drawn between golfers returning to more natural courses and the wider public approach to food production and agriculture. Changes in consumer attitudes and behaviours to the cosmetic standards of fruit and vegetables have led to increased sales of so called 'wonky veg' (Stöckli & Dorna, 2021). People are recognising that perfectly formed blemish free products might look better, but they are often less nutritious, lack taste, rely on heavy chemical use during production, and have long lead times before they reach the supermarket shelves. Customers are becoming increasingly aware of the value of purchasing produce in their various natural forms.

Similarly, golf customers are becoming more aware of the relationship between the course and its natural environment, and should be encouraged to recognise the benefits of less inputs. Research by Wheeler and Nauright (2006) originally used the term 'Augusta National Syndrome' to explain how, in the same way as fruit and veg, perfectly manicured golf courses that look green and lush require intense chemical and water inputs thus can have significant environmental impacts. These standards are often nurtured by the media and create unrealistic expectations of what a golf course should look like. Managing public perceptions of courses presented in their natural guise, therefore, is crucial for the future sustainability of golf.

**Research quote**

"The demand might come from playing a course in an increased natural environment or the simple personal satisfaction of knowing that the course is environmentally friendly ... wearing a badge of certification [such as environmental sustainability] may be a signalling device used to convey quality, certain ideas, or attitudes"  
(Limehouse et al., 2010)

Research has shown a process of standardisation over the past 100 years has significantly reduced differences between courses, and, consequently, reduced the creativity of shots required (Fry, et al., 2015). A return towards a natural, rugged, and traditional course would seek to test the true skill of the golfer its raw and unrefined environment.



**Action Point:** Clubs should look to develop marketing strategies to promote golf in its natural, rugged, and traditional format as the game's 'true test of skill'

**CASE STUDY**

**The Women's Open Championships – 'Master the Elements' Marketing Strategy**

The Women's Open is hosted each year and typically staged at a links golf course.

Traditionally scheduled slightly later in the golfing year, previous events had been beset by inclement weather and a difficult course layout. Under the slogan 'master the elements', the tournament committee engaged in a process to brand the event as an opportunity to return to the skill and shotmaking requirements of the traditional game. The imagery promotes the event as a true test of golfing prowess and character which seeks to find the champion golfer of the year – the person who can excel in the face of numerous on course vagaries.

**3.4 Minimum standards for course condition and playability**

The evidence shows that importance placed on quality of course condition and playability varies considerably given the skill level of the golfer involved.

Buksted (2019) has collated 1.3 million survey responses from existing, new, and lapsed golf club members and guests across 1,500 golf clubs in 12 different countries. Participants were asked questions about player satisfaction of the course, clubhouse, management, food and drink, facilities, lessons, and membership options.

Results show that players of all levels appreciated a 'reasonable' minimum standard of course quality, which, should conditions fall below this there would be cause for members to complain. It is, of course, difficult to quantify what is viewed as 'reasonable' in this context, but for this research a course condition benchmark ranked as 72/100 was identified (Buksted, 2019). When the data was interrogated further to take into account skill level, however, importance on course quality varied.



### 3.5 Course condition and playability: Regular and committed golfers

**Industry voice**

“Assessing and measuring the condition and playability depends on level and experience of players. The problem with player feedback are the other psychological factors that will influence experience”

It was those golfers who were playing off a handicap of 10 or less who placed high importance on the quality of course condition and playability. Specifically, the following areas were viewed as critical for a good golfing experience:

- Course well maintained
- Course varied and exciting to play
- Fairways are excellent
- Greens are smooth and ball rolls as it should

This argument is supported by market research conducted by Syngenta (2014, 2016), that found that best course conditions are demanded by 80% of people who described themselves as ‘committed golfers’.

Syngenta (2014, 2016) collected 14,000 surveys with golfers (female and male), female non-golfers, lapsed female players and women who had tried golf a couple of times. Survey responses were supplemented with qualitative data and face-to-face focus groups. Regular golfers identified the following five factors as the most important aspects of on-course condition:

- Greens roll smoothly
- Course design
- Golf course is visually appealing
- High probability of finding ball in the rough within a reasonable time
- Course blends naturally into its environment

A good minimum level course condition and playability, therefore, is a particularly critical factor for regular golfers of a higher skill level, and a club’s ability to provide an enjoyable and memorable on-course golfing experience is likely to define a club’s reputation with this group.

Research has gone so far as to suggest that course condition and playability can have significant positive impact on a golf club’s total revenue, particularly in relation to number of guests becoming repeat consumers (Buksted, 2019; Shmanske, 1999).



### 3.6 Course condition and playability: Social golfers

The important point raised by Buksted (2019) and Syngenta (2014, 2016), however, is that those golfers who prioritised high quality standards in course condition were often very in small number, however, they tended to be those who “shout the loudest”.

The reality is such that most golfers do not prioritise course condition beyond the ‘minimum reasonable level’ and rather focused on the quality of the club environment and social activities. Buksted (2019) argues that the revenue expenditure allocated to course maintenance in a typical club (around 80% of overall expenditure) is too high, and larger percentage should be redistributed social activities and creating a ‘club feel’.

When asked what would encourage golfers to play more, ‘course condition’ ranked relatively low, as the 11th most important factor, identified by 9% of respondents (Syngenta, 2016).

**Research quote**

“Social relationships are described as being the ‘glue’ of a golf club and focus therefore should be made on building relationships and new member integration” (Buksted, 2019)

**Research quote**

“It is much easier to leave a good quality course, than it is to leave a good quality social community that a golf club can facilitate” (Buksted, 2019)

### 3.7 Considerations in course set-up

Interestingly, the quality of course condition was not cited as a reason for non-participation by golfers who had previously played and now given up the sport (Syngenta, 2016). This group did, however, explain that course ‘set up’ in relation to areas beyond the green itself was a factor, where facilities tend to be arranged in a way to challenge experienced golfers rather than for beginners (Syngenta, 2016).



**Action Point:** Golf clubs are encouraged to consider the relative skill level of their typically player, and ensure course set up adds to the overall customer experience.

Research by Forbes (2014) supports this viewpoint and reveals that course design has a direct impact on membership retention, predominantly by affecting player enjoyment levels. The reality is many golfers are at a novice or intermediate skill level, but most golf courses are designed for experts, and thus are too difficult.

Via interviewing a number of golf course architects, results show that the following aspects of course design can deter the majority of golfers: forced carries, difficult water hazards, deep bunkers, greens surrounded by rough.

Design features that can deter golfers of intermediate and low skill levels:
Forced carries
Difficult water hazards
Deep bunkers
Greens surrounded by rough

Conclusions reveal that courses with an interesting and variable layout that aims to accommodate all levels, through strategic placement of tees, for example, is far more likely to satisfy golfers rather than one of high difficulty and increased length – which would appeal to a relatively small demographic.

# 4. Teeing areas

Research conducted by Huth and Kurscheidt (2018) compared course condition and playability differences between golf club members and nomadic golfers (who would pay and play at different venues rather than remaining loyal to one), and also took into account the skill level involved.

Results show golfers of a higher skill level, both club members and nomadic groups, place value on the difficulty level of the course. However, there was distinct difference between how members and pay and play golfer's interpreted 'difficulty'.

Pay and play golfers measured the difficulty level of a course by referring purely to the average length of holes and overall course length in total. Members, on the other hand, placed importance not just on course length, but rather careful and considered placement/number of design features including bunkers, water hazards, trees, and overall general topography.

**Industry voice**

"Club members are increasingly looking for a variable and interesting design at their club"

Some courses are perfectly placed to accommodate a particular standard of golfer, due to their current design

features. Research by Lyu and Hwang (2017) aimed to rank golf courses into 'difficulty levels' associated with several specifications, including length, fairway width, and hazard placement. Courses were graded as 'low', 'medium', and 'high' based on the importance placed on design featured by different skill level golfers.

**LOW:** Short course length, few sand bunkers and water hazards, easy green speed and undulation (intrapersonal constraint associated with lack of golfing skills and abilities)

**MEDIUM:** Moderate course length and fairway width, some sand bunkers and water hazards, ordinary green speed and undulation

**HIGH:** Long course length, narrow fairway width, many sand bunkers and water hazards, difficult green speed and undulation.

Results show 'casual' golfers showed the strongest preferences for easy course set-up, and demonstrating their dislike for the high levels of difficulty. These golfers tended to be less skilled and thus preferred easier course specifications, to help negotiate the constraining factor associated with their limited golfing abilities and increase overall enjoyment levels. Conversely, the intermediate and committed golfers indicated less dislike for the most difficult course settings (Lyu & Hwang, 2017).



The teeing area is the starting point for every golf hole, often referred to as 'the tee'. Rules of Golf (R&A, 2022) describe the teeing area as a rectangle defined by tee markers front and side, with a depth of measuring the length of two clubs.

Tees are generally presented as raised rectangular areas, which on an average 18-hole golf course typically occupy 0.6-1.2 hectares land (Beard, 2002; Popovich, 2020). Despite tees often being presented in a similar 'standard' way, the reality is they can be offered in a variety of ways and with a range of different materials, depending nature of the project.

## 4.1 Tee size

**Industry voice**

"Maximizing teeing areas is important, as wear can take from 14-28 days to recover dependent on local conditions and resources"

Tees can be subject to intensive treading, causing compaction and wear, which can lead to turf wear and unfavourable impressions (Grossi et al., 2019). It may be that they are not sufficiently large enough cope with the volume of play and, as a consequence, require inclusion of alternative tees increases in size. At the same time, too many tees or ones that are too large, can lead to increased labour inputs. In this scenario, using a grass type appropriate to the site location is increasingly important.

**Industry voice**

"Consider potential of increasing tee size for par 3s, and decreasing size for par 4s and 5s, given the differences in types of play from those areas. Typically a par 3 tee would be 25% larger than the others"



**Action Point:** Measure teeing areas and bring in line with average sizes to increase efficiency.

It is important to consider how the amount and intensity of usage, as well as the type of golfer, impacts on the size of teeing area required. An average par 3 hole should aim for over 400m<sup>2</sup> of teeing area, whilst a par 4/5 hole should aim for over 300m<sup>2</sup> of teeing area.

Research by Beard (2002) advocates an alternative way to calculate the size of tees, based on the typical number of rounds played during an average season. Specifically, it was found tees be sized based on 9.3m<sup>2</sup> (Par 4/5 holes) and 18.6m<sup>2</sup> (Par 3 holes) per 1000 rounds, respectively.

**Industry voice**

"Long narrow tees can provide the most flexibility for in course set-up"



Furthermore, tees which attract unusually high traffic, such as the 1st and 10th where players will typically start their rounds, would benefit from being larger than the minimum requirements (Beard, 2002).

**Space on a large single teeing ground should be considered in regards to:**

- 50% used for middle tee (played by most golfers)
- 30% used for forward tee
- 20% used for back area

## 4.2 Number of tees

Care must be taken to ensure the most efficient amount and location of tees, based on type of course and target market demographic. Changes to amount of tees can have a significant impacts on course playability and maintenance practices. On most occasions this will be reducing the amount of tees in play, however, can also be increasing the number where demands require.

### CASE STUDY

#### Westchester Country Club, US

Westchester Country Club tee renovation project reduced the sets of tees for each hole from five to three. The resultant 'hybrid tee system' decreased the number of tee markers that had to be moved and maintained by staff, and made it easier to spread out wear on the tees.

There will, of course, be implications for the type of the shot required between different tees on the same hole, such as 'championship' and 'regular', which is an important factor for consideration. Considerations also include any features which would be brought 'into play', such as trees and streams, and safety implications of course. Consultation with members and the club professional can help to form a perspective on this, and reduce chance of dissatisfaction arising later.

#### Industry voice

"We are looking to integrate forward tees where possible. For when people get older, or for juniors, this is important for participation and enjoyment. We don't want to spoil the game for them. Particularly where the fairway is not immediately obvious from the tee"

#### Industry voice

"A championship layout, for example, may require up to five or six different sets of tees to cope with all types of player, from the professional golfer in competition playing from the back tees, through the society day playing from the daily or middle tees, to a beginner's on-course lesson playing from the front set of tees. A good design will test all of those golfers equally"



**Action Point:** Assess the teeing requirements for each hole, in line with course priorities and target market.

<b>TEE MARKERS:</b>	30 labour hours saved by moving two fewer sets of tee markers
	16 labour hours saved on sanding and painting
<b>TOTAL ANNUAL SAVINGS:</b>	£750 saved by recycling surplus markers
	46 labour hours and 750 for replacements and supplies

(Adapted from: USGA Green Section, 2017)

## 4.3 Tee elevation

Given the significant level of traffic, it is important tees are designed in way which helps maintain condition with minimum inputs. Quality irrigation is seen as an important, and often expensive, feature of optimal tee performance.

#### Industry voice

"The build cost for the materials for a new tee are low, it's the irrigation which is expensive. Could be 70% of the cost of the new tee"



**Action Point:** Creating an irrigation strategy is a key feature of development and maintenance of tees.

Elevating tees from surrounding land can help shed water and facilitate drainage. Research has found surface gradient of 1-2% (or 1:70/80 to 1:100) falls front to back, left to right, or right to left – depending upon the contours of the surrounding land – is optimum for facilitating drainage (Beard, 2002). It is also important that slope of tee is made to the surrounding ground, so as not to trap water from above.



**Action Point:** Consider where tee elevation and slope can help facilitate drainage on holes subject to waterlogging.

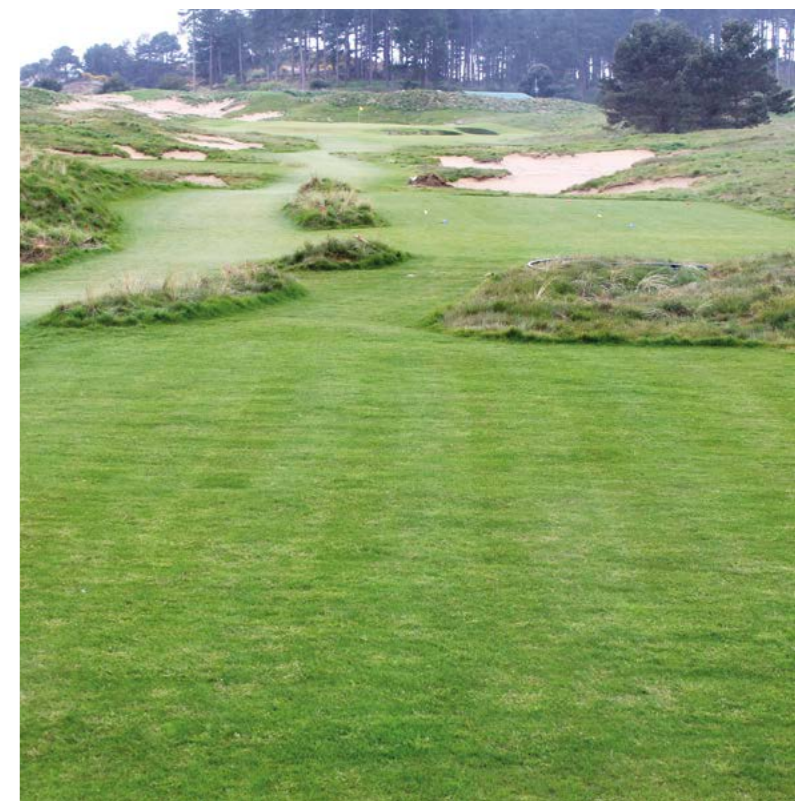


**Action Point:** Tee gradients can be easily assessed with surveying equipment, or more simply by use of a digital spirit level.

Tee elevation also gives the player a platform for visibility of the hole and direction of play (R&A, 2018). It is recommended, therefore, that tees should align with the intended direction of play, where players themselves then tend to stand parallel with the tee sides (Beard, 2002).



**Action Point:** Tee alignment can be checked by staking out the direction for play and using string lines, especially at any turning point on that hole. The axis for any free form tees should still point towards the landing area or green.



## 4.4 Tee surface

### Industry voice

“Optimum tee surface should be smooth and firm, allowing for the golfer to have a level and balanced stance”

### Industry voice

“We are looking for teeing areas to be pretty level, so you can get a good stance. There should be a nice coverage, and enough room to move the tee placements”

### Industry voice

“My biggest bits of advice would be get the basics right. Get the standards right, and then you can start developing from there. Good uniformity on surfaces – that is our ‘bread and butter’”

The optimum tee surface should be smooth and firm, with a full cover of dense grass, allowing for the golfer to have a level and balanced stance (Beard, 2002). This can be difficult to achieve, however, given the significant amount of traffic teeing areas command (Beard, 2002; Pacini, et., 2016). It is important then that grass species on tees are selected that thrive in local conditions and thus tolerant to wear and close mowing, allowing for turf recovery.



### Industry voice

“Dwarf rye grass is a massive help for us. On tees, practice tees, and down on the range because you can get it to grow so quickly and it’s so strong. I was ‘anti rye’ grass at one point, but I’ve seen it used a few times now. Its very fine now, the new ones. We are getting germination in 5 days, which was unheard off. We will use on heavily used tees and other big ware areas. And the good news is golfers don’t know the difference. There is more maintenance, yes, but it is very high ware, and so the positives outweigh the negatives”



**Action Point:** Tee flatness and smoothness can be easily checked by placing a ‘straight edge’ on the surface.

Aesthetic appearance can be an important consideration for tee surface, given this is the starting point for the hole and the first impression a golfer gets of the course. A good cover of grass and freedom from weeds or unsightly patches from wear or disease is therefore desirable.

### Tee surface grass species selection is dependent upon:

- Course type
- Location
- Management practices
- Soil type



A general rule is that there should be at least 80% of the intended species on areas not under repair. Less than 5% of the teeing ground should be covered in weed or other undesirable species.

Mowing height for tees tends to be at a level in between the fairway and green, typically around 12-18mm. There is some flexibility in cutting height, but it is important the golf ball sits clear of the grass when teed up correctly (Beard, 2002). Furthermore, mowing height can affect sward composition and should be commensurate with species type and local ground conditions.



**Action Point:** Sward composition can easily be assessed by visual means including use of quadrats if available. A prism gauge can effectively check grass height against mower settings at that course.

Surface firmness is an important consideration for tees, where importance has been placed on freedom from soft areas and foot printing. A key factor determining surface firmness is soil type and drainage. The United States Golf Association (USGA) offer a system for building greens which encompass a high sand content to facilitate rapid surface water infiltration. This is generally used for ‘high end’ course.

### Measurement criteria can be recorded to establish benchmarks for tee surface quality, including:

- Water infiltration
- Soil moisture
- Surface firmness

Divots can be a significant determining factor on overall tee quality levels, particularly on par 3 holes. It is important, therefore, to ensure adequate tee size to vary playing position and engage in player campaigns to protect tees.



**Action Point:** Ensure tee size is adequate to accommodate varying playing positions.

### Industry voice

“We use a part seed and sand divoting mix, and it is done once per week. We need to be careful sometimes because heavy rain can wash some of it out, so be vary for this”



**Action Point:** Engage in player campaigns to protect tees – such as replacing divots and use of divot mix.

### 4.5 Furnishing tees

Over time, tees have become areas of the course which are increasingly furnished with variety of accessories – including ball washers, benches, tee caddies/bins, cleat brushes, divot mix containers, and even ornamental plantings (Oatis & Vavrek, 2017).

These accessories might add to convenience or decoration, however, buying, installing and maintaining them can require considerable expense and labour. There is a growing trend towards removal of some or all accessories – which can free up time and money to focus on tasks which improve playing conditions – while also leading to ‘cleaner’ course preparation, especially when these accessories start to age (Oatis & Vavrek, 2017).



**Action Point:** Consider usage, role, and cost of on course furnishings in relation to price point and target demographic.

Ornamental plantings and flower arrangements around tees are, ultimately, ‘out of play’ areas and thus weeding these landscapes can be removed without direct impact on the playability of the course (Oatis & Vavrek, 2017). There will, of course, be visual impacts that will have to be taken into consideration.



#### CASE STUDY

##### The West Course at Westchester Country Club, US

The West Course at Westchester Country Club had a number of man-made accessories along with numerous ornamental plantings. These increased maintenance costs, took up staff time, took focus away from playing areas. Observations also showed that some accessories were rarely used.

The green committee approved removing the majority of golf course accessories, plantings and unnecessary paths were removed during a renovation project, and they were not replaced.

Westchester Country Club were able to reduce the time and money spent on course accessories and direct those resources elsewhere. Turf quality was improved by the reduced need for rope and stakes to manage traffic during maintenance activities.

The largest benefit, however, was cited as improving the overall appearance of the golf course by eliminating man-made clutter making the course look bigger, more natural and cleaner.

<b>Benches, tee caddies, divot buckets</b>	434 labour hours saved by not moving, trimming and cleaning daily
	120 labour hours saved on sanding and staining
	16 labour hours saved by not bringing them in for the winter and putting them back out again in the spring
	£1,500 saved on replacement costs
<b>TOTAL ANNUAL SAVINGS:</b>	570 labour hours and £1,500 for replacements and supplies

<b>Ball washers</b>	180 labour hours saved on sanding and painting
	120 labour hours saved on filling and cleaning
	48 labour hours saved on trimming and cleaning around them
	32 labour hours saved by not bringing them in for the winter and putting them back out again in the spring
	£1,000 saved on purchasing replacements and parts
	£1,000 saved on purchasing washer fluid and tee towels
<b>TOTAL ANNUAL SAVINGS:</b>	380 labour hours and £2,000 for replacements and supplies

<b>Flower beds</b>	150 labour hours saved on maintenance
	£3,000 saved on plant material
<b>TOTAL ANNUAL SAVINGS:</b>	150 Labour Hours and £3,000 for plant material

<b>TOTAL ANNUAL SAVINGS:</b>	1,100 labour hours and £6,500 for materials and supplies
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(Adapted from: USGA Green Section, 2017)

### 4.6 Conclusion: Teeing area quality considerations

QUALITY CONSIDERATIONS	
<b>Gradient</b>	<ul style="list-style-type: none"> <li>• Drainage</li> <li>• View of the hole and intended direction</li> <li>• Player set up position and impact on ball direction</li> <li>• Ground levelness and player balance</li> </ul>
<b>Firmness</b>	<ul style="list-style-type: none"> <li>• Stability of player stance</li> <li>• Ability to hold tee peg and markers</li> <li>• Player balance when swinging</li> </ul>
<b>Aesthetic appearance</b>	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Golfer perception of presentation</li> <li>• Psychology of presentation and design</li> </ul>
<b>Grass cover</b>	<ul style="list-style-type: none"> <li>• Grass species and tolerance</li> <li>• Golfer perception and visual appeal</li> <li>• Suitability for mowing height and tolerance to wear / damage</li> <li>• Impact on quality of strike – particularly on par 3s</li> <li>• Ball on club contact and associated spin rates</li> </ul>
<b>Grass height</b>	<ul style="list-style-type: none"> <li>• Grass species and tolerance</li> <li>• Tee peg and ball position</li> <li>• Quality of strike</li> </ul>
<b>Size</b>	<ul style="list-style-type: none"> <li>• Amount and variety of acceptable playing areas</li> <li>• Room to move tee markers and impacts on wear and tear</li> <li>• Differences in tee size between par 3, 4, and 5 holes</li> </ul>
<b>Alignment</b>	<ul style="list-style-type: none"> <li>• Position in relation to hole direction</li> <li>• Allow fair view of direction of play</li> <li>• Safety of play considerations</li> </ul>
<b>Freedom from weeds, pests, and diseases</b>	<ul style="list-style-type: none"> <li>• Impact on grass growth and aesthetic appearance</li> <li>• Maintenance input considerations</li> </ul>



## 5. Fairways

### Industry voice

"An instant positive impact can be made for golfers before by ensuring fairways are up to required standard"

Fairways are all the ground between the tee and the putting green, except hazards and rough, and also referred to as 'through the green'. They make up the largest area of maintained turf on a golf course, upwards of 20 hectares in total, and are where the majority of shots are played (Beard, 2002). An instant positive impact can be made for golfers before by ensuring fairways are up to required standard, with fewer bare patches and weeds seen as desirable characteristics (Syngenta, 2012).

### 5.1 Cutting pattern and frequency

#### Industry voice

"Frequency of cut will vary according to growing conditions and standards, however, 1-2 occasions per week would be typical"

Mowing is important in maintaining desired height of fairway grass, while also defining the intended playing area for golfers. Specific mowing patterns are varied and numerous, and ultimately down to club choice, however there are several factors which can be taken into consideration.



Striped mowing patterns are less efficient than 'half-and-half' mowing pattern in terms of labour, fuel consumption, and equipment wear (Oatis & Vavrek, 2017). Furthermore, Oatis and Vavrek (2017) found that many players preferred the traditional appearance of the classic cut pattern rather than an overly complex stripe.





**Action Point:** Assess mowing height in situ with a prism gauge, and compare with mower settings respectively.

**Industry voice**

“Half and half cutting we generally get the job done quicker. And this means we can get staff out on the course to do other things. Being efficient with staff and resources is increasingly important”

**Industry voice**

“Cutting half and half can be more traditional, while also helping with reduction of nap. You can cut it clockwise direction one week and then anticlockwise the next. It helps with quality of the fairway and playability”



**Action Point:** Consider how varying mowing direction can reduce possible issues with ‘grain’ or ‘nap’ impacting on ball roll.

Removal of grass cuttings is also another consideration. Some courses will opt for collection and removal of cuttings, but the costs associated with doing so have increased significantly (Oatis & Vavrek, 2017). A growing number of courses, therefore, are now not collecting cuttings on areas of the course in favour of dispersing them.

## 5.2 Fairway width

The width of a fairway has implications for both course condition and playability. Research has shown widths typically vary between 25 and 55 metres, with the average being 41 metres (Beard, 2002).



**Action Point:** Fairway width can be easily widened or narrowed by altering mowing lines.

Courses are faced with decisions on whether to reduce fairway width, which can lead to savings on inputs like mowing frequency, however, also negatively impact on speed of play by increasing difficulty levels. Alternatively, widening the fairway might increase inputs, but may lead to quicker rounds of golf and thus increased footfall.

REDUCING FAIRWAY WIDTH		INCREASING FAIRWAY WIDTH	
▼ INPUTS	▲ DIFFICULTY	▼ DIFFICULTY	▲ INPUTS

Reducing the width of fairway can impact play by increasing difficulty levels, while also reducing elements of strategic design as players will be forced to aim down the centre. Increasing the width of fairway, on the other hand, has been found to increase the pace of play and compensate for increasing number of rounds played by affording the spread of wear (Adams & Gibbs, 1994).



**Action Point:** Golf clubs should consider how increasing or decreasing fairway widths may help contribute towards their personal goals and objectives

FAIRWAY WIDTH AND SKILL LEVEL CONSIDERATIONS		
<b>Narrow</b>	Under 30 yards (28 metres)	Suitable for higher skill levels – professional golfers and those with low handicaps
<b>Medium</b>	35–45 yards (32–42 metres)	Suitable for most players – allows for competitive and strategic play
<b>Wide</b>	More than 45 yards (42 metres)	Suitable for lower skill levels – players without handicaps and ‘family play’ courses

Fairway width does not need to be consistent throughout its length, and can be affected by design features and typography. Specifically, careful consideration should be paid to parts of fairway which might be redundant of use given how the hole plays (Fry et al., 2015).



**Action Point:** If reducing the area to be mown is the goal then consider starting the fairway further from the tee, while still ensuring the ability to adequately hit the fairway from the tee.

It has been recommended that fairway ‘landing areas’ (where a typical drive would end up) measure 40–45 metres wide for drives of 160–200 metres, but are then narrowed to 30–35 metres for golfers of a higher skill level who can hit the ball further (R&A, 2018).



**Action Point:** Consider how fairways have been altered over the years from the original planned design by the architect, and how this might impact on mowing decisions.

The remainder of the fairway width and shape is often determined by following the line of trees, bunkers or other aspects of natural landscaping which offers an informal edge to both sides (Hacker & Sheils, 1992). Establishing a ‘crisp’ line between the fairway and adjacent semi-rough can provide visual appeal and definition if presentation is an important objective for the club in question.



### 5.3 Fairway surface

**Industry voice**

“I would put grass type as very important ... You can't separate root zone from grass type ... My view is that if you make good decisions on grass type, the other factors can fit in well”

Consistent ball bounce and lies have been cited as desirable fairway characteristics, that can be achieved via surface firmness (Beard, 2002; R&A, 2018). Player preference for a firm fairway surface stems from its ability to help facilitate shot control by promoting club 'bounce' and forward roll. Adequate drainage is an important and related factor, which also helps maintain year-round place.

**Research quote**

“Divot size is a good indicator of fairway condition with soft, lush and wet fairways typically associated with larger divots”  
(Beard, 2002)

COMMON PROBLEMS ASSOCIATED WITH FAIRWAYS INCLUDE:		
Weeds	Moss	Bare patches
KEY CONTROL MECHANISMS:		
Divoting	Damage repair	Overseeding
Drainage	Good cultural practice	Mowing height

Regular aeration, top-dressing, and divoting can help ensure levelness quality of fairway surfaces, by helping the promotion of deep-rooted grass swards.

There is no standard prescription for turfgrass species on fairways, as this is dependent on local soil and environmental conditions (Watkins, Hollman, & Horgan, 2010). It could be suggested that clubs should be aiming for at least 80% coverage of the desired grass species, with an overall sward of 95% grass content.

Weeds adversely affect ball lie as well as aesthetic appearance and should be less than 10% of the total sward composition. Grass and weed specie populations can be determined by surveys although this may be confined to localised areas where weeds are most prevalent.

**Industry voice**

“It's vital that the approach taken is founded on a properly sustainable approach... For example, looking at moving to more sustainable grass species and management, which can cope with shortages of water, increasingly hot and dry summers, and tougher regulation on chemical products, rather than trying to find ways to get more water, and so on”

**Industry voice**

“I think we need to look hard at the coming pressures from hotter, drier summers; reduced availability of water for irrigation; and increased restriction on previously widely used chemicals, and move towards more sustainable approaches. This will likely mean transitioning towards grasses which are better adapted to these conditions, and one of the greatest challenges is going to be how we do this with the least possible impact on conditioning during the transition”

Mowing is one of the most basic yet important management practices for providing quality fairway surfaces. Mowing height is determined by a variety of factors, such as grass species, climate, type of player, and time of year.

FAIRWAY MOWING HEIGHT CONSIDERATIONS		
Climate	Type of player	Time of year

Fairways can be cut to different heights. Lower mowing increases number of plant shoots and leaf density, and provides 'tighter' playing surfaces. Conversely, higher mowing practices facilitate a more cushioned ball lie. The regular perception is that players prefer fairways that are not cut too short, which also helps reduce the stress to grass and improve overall quality levels.

**Industry voice**

“Players generally prefer fairways not to be too tight, so they can get an improved connection with the ball on impact. We need to remember that the majority of golfers are beginner to intermediate standard, and not advance, so these should be the priority in most cases

**Industry voice**

“Fairways will be cut at 10mil. But for tournaments we will reduce the height slightly, as this can be favoured by better players”

Summer months bring warm, humid conditions that cause the turf to grow at an accelerated pace, where some facilities will benefit from slightly lower mowing heights to improve aesthetics and playability. Alternatively, mowing heights can be increased during winter as temperatures and associated growing conditions decrease and turf 'thins' out.



**Action Point:** Develop strategy for mowing height, based on player demographics, surface conditions, and seasonal changes.

### 5.4 Drainage

Maintaining a relatively free draining surface throughout the year is important for healthy root development and improved fairways. Furthermore, given the growing pressure on golf clubs to facilitate all year round play fairway drainage is becoming increasingly important.

'Inland' or 'parkland' courses are most often constructed on heavy clay dominated soils which, as a consequence, have much lower levels of water infiltration and drainage rates. This is further compounded when soil has been compacted by traffic, both through play and maintenance practices, and on holes in 'low lying' wet areas.





**Industry voice**

“Because we are wet course we’ve started taking drainage seriously. We did have drainage, but it’s been shallow drainage. We need the course to be open longer to promote sustainability and longevity of the course. We’ve also had a lot more uniformity to fairways too from improving the drainage. Managing water is one of the most important aspects of course maintenance, and with more extreme weather this is becoming more important”



**Action Point:** Review fairway drainage during periods of rain and identify holes which require remedial work.



**Action Point:** Soil moisture and surface firmness levels can be assessed with the use of moisture probes, instruments like the Clegg Hammer, or more simply visually during course inspections.



**Industry voice**

“We have worked hard to identify the areas of the course that prone to flooding from a brook that passes through the course. We have worked with an external consultant to produce plans for flood plain creation and water management around such areas”

Soft fairways can impact various aspects of the golf offering, by affecting movement of players around the course in addition to impacts on how shots are played and the golf ball reacts. Golf balls generally ‘plug’ into wet turf and therefore impact on the ability to hit the ball cleanly. In these scenarios a player would be negatively affected when hitting the fairway, which would be against the ethos of the game.

**CASE STUDY**

**Assessing ball lie on fairways**

Ball lie can be determined visually by throwing a set number over an area and recording the amount of ball visible above the surface. This method can be repeated over several different locations on a fairway to give an overall indicator of ground conditions – thus allowing wetter areas to be identified when there are no obvious indicators such as standing water after rainfall. This technique can be used to identify concerns, monitor conditions, and assess improvements after remedial works have taken place.



**Action Point:** Consider which is the most appropriate drainage for each facility, depending on staffing and financial resources – such as pipe, slit and chisel tining, and sand capping.

**CASE STUDY**

**Pipe drainage systems**

Pipe drainage systems can help reduce waterlogging on fairways by bypassing the presence of impermeable clay soil, and even other blockages such as tree roots, which tends to be more common on established courses. Pipe drainage specifications are available in a variety of specifications, with different degrees of efficacy and associated cost.

Where installed, pipe drainage systems require ongoing maintenance and should be inspected regularly to assess their efficacy. Drainage systems may need repair or replacing especially in localised wet areas.

**CASE STUDY**

**Slit and chisel tining aeration**

Aeration processes can help with the drainage of fairways. Slit and chisel tining, for example, introduces air into the soil profile whilst causing minimal surface disturbance, and can be carried out periodically depending upon local weather conditions and the soil type. Typically, spiking or verti-draining of fairways is beneficial at the beginning (March / April) and end of the growing season (September / October). Surface compaction can be quite considerable in some areas, such as narrow traffic routes and popular areas around tees and greens, so these areas might be prioritised.

**FAIRWAY AERATION**

Beginning of growing season  
March/April

End of growing season  
September / October

**CASE STUDY**

**Sand capping drainage systems**

Further options that exist for improving the fairway playability and performance include ‘sand capping’. This is a process whereby several inches of sand or a high-sand mix are added to fairways to improve the turf growing conditions by increasing the drainage of the surface (Thomas, 2021). Once finished, the turf is more resistant to compaction thus allowing the water to dissipate. The process can deliver more consistent surfaces, with increased drainage capability, meaning the fairways remain firmer in wet conditions.

Sand capping can be an extremely effective tool, however, results are only possible when all parameters have been well established and are monitored regularly. The process can come at a high cost and be demanding of resources – such as the close monitoring of local conditions and selection of appropriate sand quality and quantity.

Where installed, all drainage systems require ongoing maintenance and should be inspected regularly to assess their efficacy. Drainage systems may need repair or replacing especially in localised wet areas.

**Industry voice**

“Redevelopment of areas prone to being waterlogged are an integral consideration to the future sustainability of golf courses. Initiatives such as the restoration of a pond creating an accessible safe habitat for wildlife, also acts as being a floodplain in a low-lying area of the course”



**Action Point:** Where it is not possible to install adequate drainage, consider options to re-route fairways around areas prone to waterlogging or convert such areas completely, into natural hazards or ditches and ponds.

Drainage is also an important consideration on paths that run along fairways, which can become particularly prone to washouts. Paths are often an area of high maintenance and cost, thus it is important to develop appropriate strategies in this regard.

**Industry voice**

“Paths can be pretty high maintenance when it comes to drainage and washouts, particularly the sloping ones. We now use a grid underneath to give more strength and that helps. Its to try and reduce the pressure on staff”



**Action Point:** Assess the impact of waterlogging and drainage on other aspects of the fairway – such as paths.



**5.5 Divoting**

‘Divoting’ plays an important role in maintaining an even and dense surface from the fairway. A regular cycle of divoting a certain number of fairways each week can therefore help maintain a suitable playing surface



**Action Point:** Identify and prioritise course areas prone to receiving higher numbers of larger divots.

Those golf clubs positioned with more staff resources should aim to carry out devoting on a regular basis, where divots should be repaired regularly with a soil mix and grass seed suitable for that site.



**Action Point:** Divots should be repaired regularly with a soil mix and grass seed suitable for specific site.



**Action Point:** Engage in player campaigns to protect fairways by replacing divots and use divot mix cycles.

**Industry voice**

“Artisan members give 100 hours a year worth of labour in exchange for doing various jobs around the course. Things like raking bunkers, fairway divoting, patrolling the boundaries, along with other jobs. It helps take the pressure off our staff. They get access to the course at certain times of the day, early in morning and evenings during the summer. This is really important, and there is no reason all clubs shouldn't have something similar”

**Industry voice**

“We've got a good volunteer group now. They help out in many aspects of the course. This is a really important part of what we do, but you've got to work out what is in it for the volunteers too. It has to be a two-way process, and that's the key”

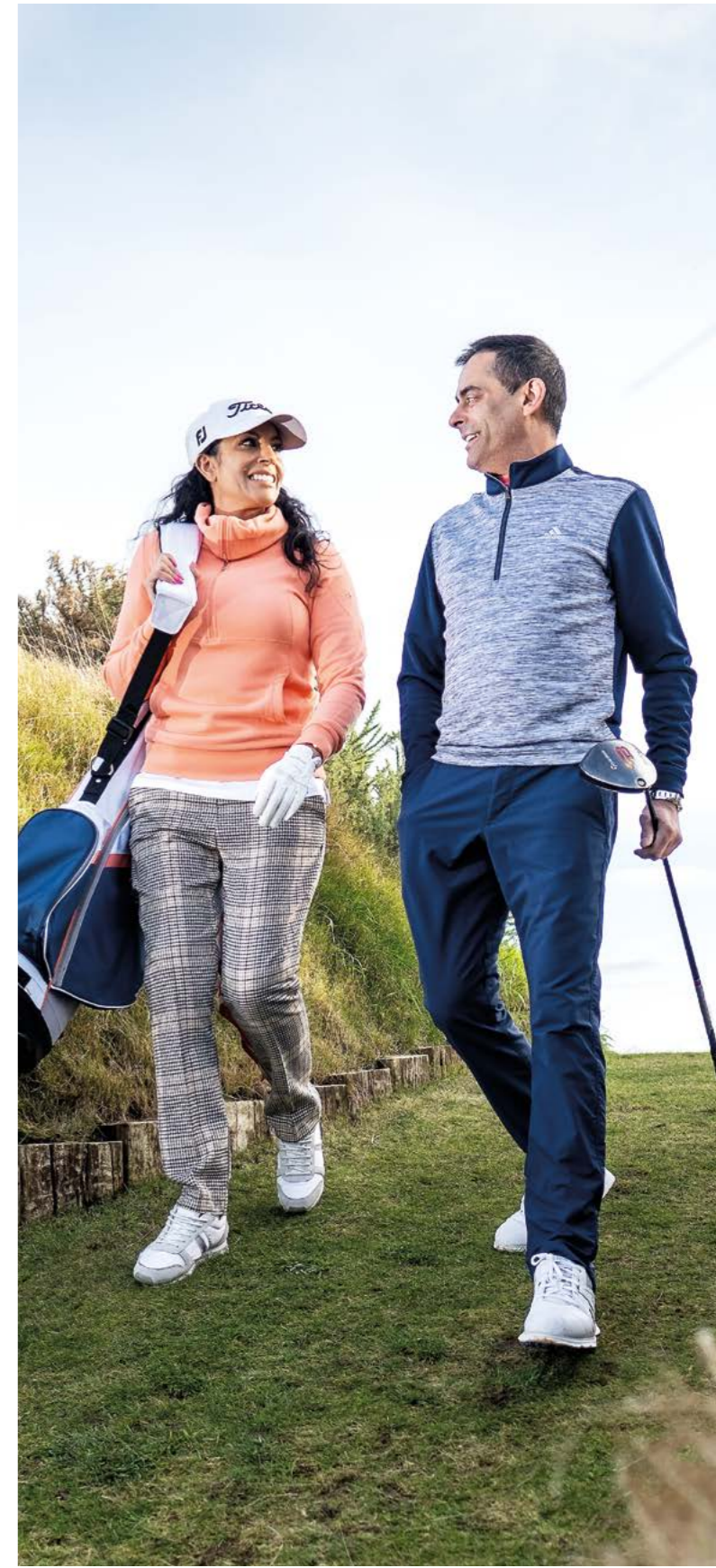


**Action Point:** Utilise artisan members or club volunteer events to support tasks such as devoting, thus freeing up resources and staff to focus on other priority areas.

Priority can also be paid to areas of the fairway which are more likely to be affected by amount and size of divot taken. This tends to be where second shots on par 4s and third shots on par 5s are played. Type of shot played is also associated with this dynamic, where more lofted clubs are likely to take larger divots. Of course, there will be some variation of divot placement due to factors like playing level, tee placement, and hole landing areas, but staff should look to identify course areas prone to divots and prioritise attention where appropriate.

**5.6 Conclusion: Fairway quality considerations**

QUALITY CONSIDERATIONS	
<b>Firmness</b>	<ul style="list-style-type: none"> <li>Impact on player stance and ball lie</li> <li>Impact on ball reaction upon landing – amount of travel on ball roll</li> </ul>
<b>Drainage/ Moisture</b>	<ul style="list-style-type: none"> <li>Free draining – particularly on problem areas/holes</li> <li>All year round play</li> </ul>
<b>Aesthetic appearance</b>	<ul style="list-style-type: none"> <li>Definition between fairway and rough areas</li> <li>Uniformity between fairways</li> <li>Golfer perception of presentation</li> <li>Psychology of presentation and design from tee</li> </ul>
<b>Grass cover</b>	<ul style="list-style-type: none"> <li>Grass species and tolerance for wear/damage and mowing height</li> <li>Golfer perception and visual appeal</li> <li>Impact on club and ball interaction – quality of strike / spin rate</li> </ul>
<b>Grass height</b>	<ul style="list-style-type: none"> <li>Grass species and tolerance</li> <li>Impact on ball lie and ability to execute preferred shot</li> </ul>
<b>Width</b>	<ul style="list-style-type: none"> <li>Impact on style of play due to size of target landing area</li> <li>Visual and psychological impact on approaching the tee shot.</li> </ul>
<b>Freedom from weeds, pests, and diseases</b>	<ul style="list-style-type: none"> <li>Impact on grass growth and aesthetic appearance</li> <li>Maintenance input considerations</li> </ul>





## 6. First cut rough



The original versions of golf made no distinction between 'fairway' and 'rough' areas, however, modern version of the game may have as many as three progressive heights of grass from the fairway to unmown areas. The term 'first cut' is typically used to describe the strip of mown grass between the fairway and the wilder parts of the course

The first cut rough represents a significant area of most golf courses. Even though they are not usually maintained intensively, general mowing and equipment costs can soon add up because of their large size (Oatis & Vavreck, 2017).

The cost of maintaining rough areas may also increase as temperatures increase over the long term, which may require increased irrigation and water. There are already examples in more arid regions where rough in peripheral areas has been removed out of necessity, to cut down on water usage and save money.

### 6.1 The role of first cut rough

#### Research quote

"First cut rough can be difficult to maintain, and many golf courses produce excellent playability and aesthetics without it"  
(Oatis & Vavreck, 2017)

Players consider the role of first cut rough to both to impose a slight penalty for a wayward shot that narrowly misses the fairway, while also preventing the ball from rolling the more severe and longer grass rough areas (Syngenta, 2012).

It is becoming increasingly important for golf clubs to consider the role of first cut mown rough, and whether it could be replaced with naturalized or unmown rough. The reality is, few courses maintain primary roughs at a high enough mowing height to justify having first cut rough, so the overall playability benefit is negligible.



**Action Point:** Determine ball lie in the first cut rough visually by throwing a set number of golf balls over an area and recording the amount of ball visible above the surface.



**Action Point:** Review the need for semi-rough within current maintenance priorities.

Given that first cut involves a separate mowing operation of either one or two mower widths at a different height to the fairway and long rough, there is an argument that dispensing with it all together can reduce inputs without significant implications, by negating the need for another operation with a different mower.

It has been argued that more naturalized roughs with less inputs can have some dramatic positive visual and strategic impacts for the overall golfer experience (Oatis & Vavreck, 2017).

Widening the fairway would allow a broader target from the tee, thus improving playability for lower skilled golfers, and increasing speed of play. Similarly, more regular mowing of rough will help maintain low sward level facilitating quicker ball retrieval and facilitating speed of place.



**Action Point:** Consider the type of player who plays the course most regularly, and the role that the first cut rough plays in their golfer experience.

CONVERTING FIRST CUT ROUGH TO FAIRWAY		CONVERTING FIRST CUT ROUGH TO REGULAR ROUGH	
▼ DIFFICULTY	✓ Lower skilled players	▲ DIFFICULTY	✓ Higher skilled players

**Industry voice**

“We’ve got to be careful, because we are a championship course, that we don’t go and scalp the rough down. But we do need to listen to the players. If there’s a problem area, then we might focus on that, go in and thin it out a bit. You’ve got to react to what we see”

**Industry voice**

“It’s so busy now this golf course that you’ve got to keep the rough short. You’ve got to keep the pace of play up. We are under pressure now for this. At the same time, out of play areas or very wayward shots should be penalized. There is definitely a balance to be made”

Reducing mounding in these areas, especially in severity, will enhance mowing productivity where present the semi-rough can be used effectively to frame the fairway and of course is less penal than long rough.



**Action Point:** Reduce mounding to enhance mowing efficacy where appropriate it does not significantly impact on the design and playability of the hole in question.

**6.2 Mowing height and cutting width**

The degree of difficulty will be dependent on the grass species present and height of cut. A thin wispy sward, free from weeds, is preferable as it will allow golf balls to be found and played more easily, thus contributing to improved pace of play (Syngenta, 2012).

The crucial factor, then, is mowing height and frequency. Typically, the height would be cut at a length intermediate between the fairway and the coarser rough

Research has shown that during the growing season first cut rough would be cut once or twice a week, at height ranging from 25mm – 50mm (Albrecht et al., 2010; Beard, 2002). The width of first cut typically varies from 2.5m to 4m, which is one or two runs with the mower respectively.

**6.3 Mowing frequency**

Reducing mowing can also generate significant cost savings, by reducing the need dedicated and expensive pieces of equipment. However, it is very important to manage golfers expectations in respect. Should players insist on maintaining pristine, thin, wispy and weed-free conditions in unmown rough areas then any cost savings can quick disappear due to the extensive inputs required.

**Research quote**

“The savings can be significant, negligible or nonexistent depending on the level of maintenance desired by golfers”  
(Oatis & Vavreck, 2017)

Where present first Cut or Semi-rough should be considered with the fairway against which it sits. Primarily it exists to provide a transition from the fairway to the longer managed rough grass as a component of the “turf corridor” from tee to green.

A good cover of grasses, often similar species to the fairways, should be present with minimal weed content. Vegetation cover and height of cut can be analysed in the same manner as that used for fairways if necessary.

**6.4 Conclusion: First cut quality considerations**

QUALITY CONSIDERATIONS	
<b>Degree of penalty</b>	<ul style="list-style-type: none"> <li>• Balance between offering degree of penalty and ease of finding ball</li> <li>• Implications for speed of play and overall golfer experience</li> </ul>
<b>Aesthetic appearance</b>	<ul style="list-style-type: none"> <li>• Definition</li> <li>• Golfer perception of presentation</li> <li>• Psychology of presentation and design</li> </ul>
<b>Grass cover</b>	<ul style="list-style-type: none"> <li>• Grass species and tolerance</li> <li>• Golfer perception and visual appeal</li> <li>• Impact on club and ball interaction</li> </ul>
<b>Grass height</b>	<ul style="list-style-type: none"> <li>• Grass species and tolerance</li> <li>• Impact on ball lie and ability to execute preferred shot</li> <li>• Ability to find ball</li> </ul>
<b>Width</b>	<ul style="list-style-type: none"> <li>• Considerations as a 'buffer' before full rough</li> <li>• Number of levels of first cut rough</li> </ul>
<b>Freedom from weeds, pests, and diseases</b>	<ul style="list-style-type: none"> <li>• Impact on grass growth and aesthetic appearance</li> <li>• Maintenance input considerations</li> </ul>





## 7. Bunkers

Original bunkers were eroded areas of sand on links golf courses formed by animal scrapes and enlarged by the wind. As courses became standardised, bunkers were stabilized and became accepted as hazards for play.

### Industry voice

“If were talking about maintenance, more hours go on bunkers than anything else. You’re at them every day. A crucial part of strategy and planning”

Bunkers have been identified as one of the golf course features which demand intense maintenance, however, it has been shown that significant budget cuts can be made without a noticeable change in course conditioning (Oatis & Vavrek, 2017).

### 7.1 Size and number

Bunkers are an integral part of golf course strategy influencing players’ line of play and punishing wayward shots. They also provide an aesthetic quality for the course and catch shots which might otherwise end up in unplayable lies, such as in thick rough or out of bounds areas (Soldan, 2009). Bunkers typically should be of a style and shape appropriate for the hole and the character of the overall landscape.



**Action Point:** Consider the role of specific bunkers across the course facility in regards to playability and strategy.

Bunkers are present on most golf courses as an integral feature of their original design and strategy. Due to course changes over the years, however, many have become redundant in terms of actual influence on play. Research has shown a growing trend whereby clubs are reviewing the design and number of bunkers in view of modern player strategies (Oatis & Vavrek, 2017). As a result, their removal, remodelling, reconstruction, or replacement have become commonplace.

### Industry voice

“The club are about to embark on a course development programme, with all new bunkers being a major part of this. Bunkers will be removed or moved for strategy – where many existing ones are not really in play. It will reduce bunker numbers from 70 to less than 50”

Many bunkers can easily be reduced in size too without significantly affecting their purpose of functionality. Furthermore, removing those that rarely come into play can provide significant long-term cost savings. Bunkers can be made more maintenance friendly reducing the slopes in and around them to help improve drainage and minimise washouts (Oatis & Vavrek, 2017). Bunkers without any play unnecessary duplicates or those that impact on speed of play can easily be removed. It is important, however, careful consideration is made to the impact of bunker changes on framing, visual effect, depth perception, and hazard or safety.





**Industry voice**

“From a playability perspective a bunker should afford a degree of penalty without being unplayable”

It is becoming increasingly important to manage golfers' expectations of the role bunkers in their playing experience. There is a growing resurgence of the notion that bunkers are, in fact, hazards and should be treated as such. Research has shown that, for some time, bunkers have lost their original purpose of being a hazard as players are so more adept at recovering from bunkers that are more manicured than ever.



**Action Point:** Consider reducing bunker inputs and promoting as a natural hazard.

Bunkers presented in a more natural state with reduced levels of input can offer significant cost savings and help return to a traditional way of playing the game (Oatis & Vavrek, 2017). This 'naturalistic' appearance has less managed edges and immediate surrounding grass. The use of longer grass at the rear of the bunker can also reduce mowing frequency. This approach should be in keeping with overall course strategy and objectives, with a strive for consistency throughout.

GRASS BUNKERS		
Less troublesome than regular bunkers	Still offer penalty compared with fairway and rough	Less maintenance and inputs

In some scenarios, particularly clubs that do not have large budgets, converting a regular bunker to a 'grass bunker' can be the best option. Grass bunkers can be a conscious design inclusion, but, in reality, many exist where sand bunkers have been filled-in and converted to grass depressions or swales. Grass bunkers tend to be less troublesome for average players than sand bunkers, while, at the same time, still offer a penalty so can be a viable strategy option. Grass bunkers with machine mowable slopes of less than 33% are less expensive to maintain than their sand counterparts.



## 7.2 Aesthetics

For course aesthetics are a key priority, bunkers should be well defined and presented. Bunker edges specifically have been found to enhance the aesthetic appeal, where they are closely mown and well defined.

Sand colour can also be important where course aesthetics and visual quality are a key priority. Providing a contrast between sand and grass can improve course presentation. Colour should also be in keeping with course type where possible. For example, a tan colour is more desirable for parkland courses (Hacker & Sheils, 1992). In all respects, sand can be procured to suit local conditions, bunker style, and maintenance requirements.

## 7.3 Drainage

Drainage should be key consideration in any bunker redesign work. “Wash-out” of sand, for example, can become an issue on courses in wet climates or with heavy ground. The reduction of internal sloping, whilst keeping the bunker visible, and attention to drainage especially uphill from and within the bunker, should be the priority in this scenario. Flattening internal slopes to less than 20% within the bunker, while raising the surrounding ground, can allow for water to disseminate appropriately.

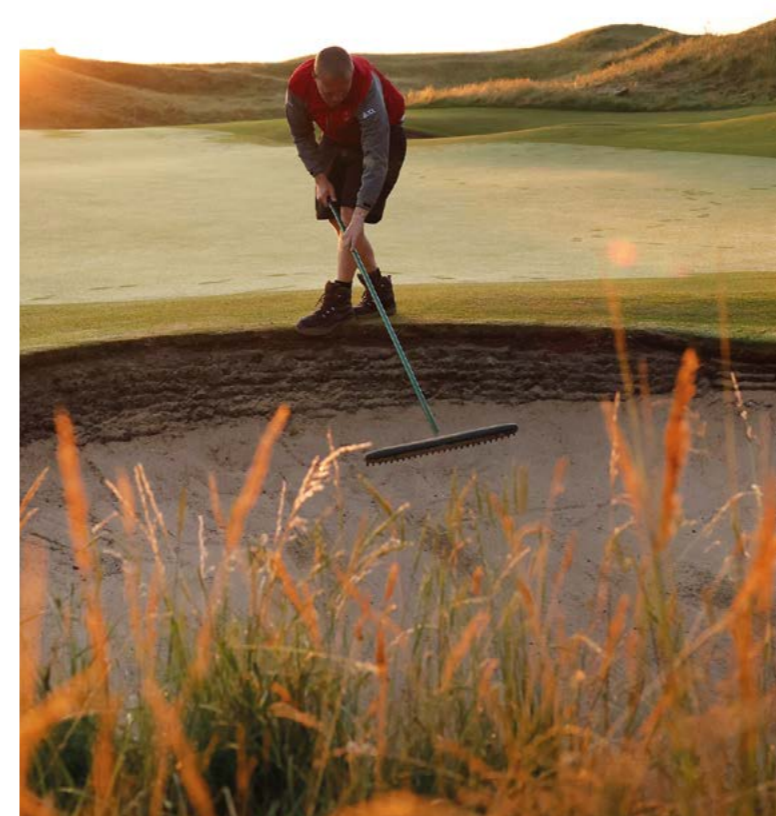
'Bunker liners' have been offered as a solution to drainage issues. They have been available for over 20 years and evidence is showing increasing usage at golf clubs. There are a wide variety of options for liners, including: Geotextile fabrics, polymer coated porous aggregate blankets, and synthetic turf spray-on polymer soil binders. Each method has its own merits and management issues and so careful research of which is best for the course locality is advised.

**Industry voice**

“We have had success with bunker liners. They help retain sand by preventing washout and contaminations, while still allowing adequate drainage and ventilation”

**Industry voice**

“We are in the process of reconstructing bunkers across the course with liners and revetted faces, so we can lengthen their life and reduce management costs and maintenance requirements”





The rationale for introduction of bunker liners is that the initial cost can be offset by reduced maintenance, especially in regards to sand replacement. Estimates have shown that sand replenishment can be reduced from once every 3-5 years to once every 8-12 years by installing a liner, depending on local climatic conditions, leading to savings of around £36,000 per annum. There might also be aesthetics and playability benefits too given greater consistency between bunkers.

**Industry voice**

“Liners can also stop the stones coming through, improving the quality of the bunkers. Now and again some players might complain they hit the liner, but previously they would have hit the floor, so it’s the same really. They also have drip line irrigation on them to improve performance. It’s about £500 a bunker, which is much better value the returning to work on the bunker year after year”

Sand can also be lost from the bunker from climatic issues such as wind, particularly on courses prone to inclement weather. In such scenarios, water can actually be used to control sand particles where appropriate. Sprinkler systems can be set to cover bunker areas, but close attention must be made to weather.

**Industry voice**

“Using a sprinkler system can reduce sand loss in bunkers when the wind blows. You have to check the weather and take this into account. New sprinkler systems are more accurate and can link to weather forecasts, and depending on the type of club can be worth the investment”



**Action Point:** Utilize sprinkler systems to control sand particles during periods of high wind.

### 7.4 Sand type and quality

**Industry voice**

“Player concerns tend to be primarily around bunkers... insufficient sand in the bunker can be an issue. This is something that players place a priority on”

Improving sand quality in bunkers has been found to have a positive psychological effect on player experiences (Doak, 1992). However, sand used for bunkers can vary greatly depending upon the site where the course is situated, for example from links to parkland courses (Soldan, 2009).



**Action Point:** Consider using sand naturally occurring on site or from local region wherever possible.

Courses predominantly built on sand, such as links and heathland, are advised to use the naturally occurring sand in-situ where possible, which can reduce input costs and be maintained in a more sustainable way (Hacker & Sheils, 1992).

**Industry voice**

“We use local sands, we are lucky we have a quarry, and it’s a big area where we can get sand from. You’ve got this dilemma, do you use your own sand, or buy it in at £40 or £50 a tonne. But then you are introducing a non-native substance to the golf course. We’re not importing anything we don’t know about... There is also the sustainability impacts too, from an economic point of view. We are a small part of the sand industry compared to building, for example, so we are not their priority”

Sand quality and quantity are key determinants in bunkers. Sand quality can be assessed for particle size, shape, and colour. These will affect how it ‘stacks’ at the bunker face and overall course visibility.

BUNKER SAND CHARACTERISTICS	
<b>Sand particle size</b>	75% medium-fine particles 0.25–0.5mm
<b>Depth</b>	Base – 100mm Bunker face – 50mm

Where local sand is not available, it has been recommended that 75% medium-fine particles from 0.25-0.5mm as optimum. These characteristics have been found to provide best all-round conditions for play including ball lie, firmness of footing and drainage capacity (Beard, 2002). Where it is unrealistic to target such tolerances then a range of 0.125-1mm should be aimed for. Furthermore, sand particles of an angular shape, with having one or more sharp angles rather than being spherical, can help facilitate stacking at the bunker face as they are less likely to move.



Depth and firmness of sand is key consideration in reducing the ball depth within the surface, also known as ‘plugging’ (Adams & Gibbs, 1994). A depth of sand of at least 100mm for the base and 50mm for the bunker face has been advised (Beard, 2002). When firmed, a minimum depth of sand should be maintained at 25-38mm to facilitate player stance and reduce the ball plugging too deeply.

It has been recommended that the sand should allow a ball to rest approximately half its diameter on hitting the surface directly without bouncing (Beard, 2002). Commonly referred to as the ‘fried-egg’ lie, this result facilitates a penalty while also ensuring the ball can be played. Sand that sets the ball up too firmly provides little or no penalty, whilst that which is too soft will allow the ball to become embedded within it.



**Action Point:** Test sand depth and properties using visual observation of golf balls in situ by recalling actual depth of golf ball.

A final consideration especially for greenside bunkers on parkland courses is that the sand be lime-free as sand splash on greens may encourage disease, as too much lime can impact the grass’s access to vital nutrients by promoting high soil alkalinity (Adams & Gibbs, 1994; Hacker & Sheils, 1992).



### 7.5 Raking

Bunker faces are often smooth raked and firmed to allow a ball to roll into the bunker better to assist easier recovery shots to be played. A simple change courses can make to reduce inputs is to decrease the frequency of bunker raking, where bunkers are completely raked only once or twice per week. On the other days, only those bunkers that have been disturbed were raked (Oatis & Vavrek, 2017).

For some courses, investment in a mechanical bunker rakes can enable one employee to complete what four or five employees could accomplish when raking by hand (Daniels, 2020). At the same, it is important to recognise use of mechanical bunker rakes can be limited by design and construction issues – such as those which are deep, have steep faces, are irregular shapes, or have certain types of liners (Daniels, 2020).

#### CASE STUDY

##### Trinity Forest Golf Club in Dallas, Texas, US

Trinity Forest Golf Club utilizes mat liners to protect their bunker edges. Each mechanical bunker rake has a piece of drainpipe that is mounted on the front which holds the rubber mat for easy transport. This inexpensive upgrade is both creative and effective. Although slipping and edge damage can be prevented by using a perforated rubber mat on entry and exit.

#### CASE STUDY

##### 'Aussie method' of bunker raking

This approach is where courses rake the floors of bunkers by hand or with a mechanical bunker rake and the sides of the face bunker faces are then groomed by hand with the smooth side of a rake, a paint roller or a squeegee. This strategy requires less labour than hand raking entire bunkers alone.

For the many courses where the capital investment required for a mechanical bunker rake is not possible, other alternative raking techniques can be adopted. This could be asking players to rake the bunkers themselves, either by taking a rake with them or using their back of their golf club.

### 7.6 Conclusion: Bunker quality considerations

#### QUALITY CONSIDERATIONS

<b>Aesthetic appearance</b>	<ul style="list-style-type: none"> <li>• Definition – particularly bunker edge</li> <li>• Sand colour and contrast to grass</li> <li>• Golfer perception of presentation – particular from tee</li> <li>• Psychology of presentation and design</li> </ul>
<b>Size and number</b>	<ul style="list-style-type: none"> <li>• Review the amount of and need for bunkers</li> <li>• Impacts of decreasing bunker size</li> <li>• Management of player expectation as a hazard</li> <li>• Number of inputs required</li> </ul>
<b>Drainage</b>	<ul style="list-style-type: none"> <li>• Impacts of raising bunkers in areas impacted by waterlogging</li> <li>• Consider use of bunker liners</li> </ul>
<b>Sand type and quality</b>	<ul style="list-style-type: none"> <li>• Use of locally sourced sand</li> <li>• Particle quantity, size and shape</li> </ul>
<b>Sand depth and firmness</b>	<ul style="list-style-type: none"> <li>• Impact on ball lie, roll, and golfer stance</li> </ul>
<b>Raking</b>	<ul style="list-style-type: none"> <li>• Frequency / complete removal</li> <li>• Use of mechanical equipment</li> </ul>
<b>Ball lie</b>	<ul style="list-style-type: none"> <li>• Impacts on ball and club contact</li> <li>• Offering a level of penalty while also being playable</li> </ul>





## 8. Green aprons and approaches R&A

The 'apron' is the area immediately in front of the putting green, where a ball may land and then bounce onto the green. It is also referred to as the 'approach', and typically extends outward from the centre line of the green to an acceptable distance from hazards such as greenside bunkers (Beard, 2002). The primary aim is to provide a smooth transition from the fairway, where present, to the green itself.



### 8.1 Apron surface

Typically, grass species on the apron are the same as the adjoining fairway, should provide a similar texture, density of turf, and surface smoothness to facilitate a variety of shots in approach play (R&A, 2018).

A healthy and vigorous turfgrass cover will minimise the occurrence of undesirable weeds and disease which would otherwise affect ball roll and bounce. Dry and firm surfaces are desirable here to minimise plugging of golf balls and freedom from wear patterns.



**Action Point:** Smoothness can be assessed by observing golf ball roll over the area in question.



**Action Point:** Firmness, where measured, should achieve comparable results to the green between 80–130 gravities with a Clegg Hammer.

Differential cutting heights from the green and fairway are the means in which such approaches and aprons are delineated for the player. Cutting heights will vary with turf grass species, degree of contour, and course management policy but can be from as low as 7mm and up to 16mm. (Beard, 2002)

Furthermore, it is important to see the apron as a feature of green design and manage it in such a way. For example, where intensive use is foreseen as part of the design process, then construction of the apron should be comparable with the actual green itself. (Adams & Gibbs, 1994)

#### Industry voice

"Green aprons should be mowed by hand where possible to improve standards. Its more pleasing to the eye and should be treated as an extension of the green. It can be done with a machine, but its been better to hand mow, with not much extra time"

Excessive compaction in these areas is often a result of concentrated traffic from players and maintenance machinery accessing the green itself, arising from initial poor design or construction.

Drainage is key to achieve the desired firmness for greens and their surrounding aprons, where a herringbone design with 3% slope has been suggested. Furthermore, sprinklers need setting to avoid overwatering on the approach area itself, and the associated impact this may have.

Equipment such real-time soil moisture probes can be used to measure water levels on approaches, in the same way as they are used on greens themselves. Such technology can provide more accurate and consistent moisture tracking, and thus help make better maintenance practices and improve quality, however, are generally only available to those courses with increased resources to hand.

#### Industry voice

"We occasionally use a Field Scout TDR 350 to measure moisture on approaches... and investment in a POGO System can be useful for mapping course areas, measuring soil moisture, etc."

Grass cover should be at least 99% with a sward cover of desirable grass species of at least 90%. Actual sward composition often compares favourably with the green itself. There should be minimal weed specie content, less than 5%, or damage from disease or other agents. Grass species and weeds in the sward can be readily assessed visually or objectively by use of quadrat equipment where necessary.



## 8.2 The role of green aprons

It has been argued that certain grasses, such as *Poa Annua*, do not perform well as green aprons when subjected to the amount of traffic and overregulation they often receive. As such, some courses have reported success by removing aprons completely, allowing either the fairway or rough to grow directly to the edge of the green.



There are three main justifications for this approach. Firstly, the agronomics and turf health can be improved by removal because aprons require a disproportionate amount of inputs to achieve satisfactory results (Elliot, 2020). Even despite the best mitigation strategies, there is still the potential for turf decline due to the sheer amount of traffic.

### Research quote

“Removing collars simplifies maintenance, establishes a classic look, and provides better definition between putting surface and rough ... it is a low-risk effort that can return a lot of benefit to the bottom line and eliminate one of the most frustrating areas of the course to manage”  
(Dowling, 2020)

Removing green aprons have been found to improve the overall architectural and visual appeal of the course by re-establishing an older, classic look to the green complexes (Elliot, 2020). In some cases, aprons can at least be partially replaced with putting surface that enlarge the greens and potentially create new hole locations. Features around the green like collection areas, mounding and bunkers may also be brought more into play.

There are economic benefits too, given that costly labour intensive techniques required to maintain aprons to a reasonable standard can be avoided. Changing aprons to either putting surface or rough simplifies maintenance by removing additional tasks.

### REMOVING GREEN APRONS

Improves agronomics and turf health by removing inputs	Re-establishes older, classic look to green complexes	Removes labour intensive maintenance practices
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## 8.3 Conclusion: Apron quality considerations

### QUALITY CONSIDERATIONS

<b>Firmness</b>	<ul style="list-style-type: none"> <li>Impact on player stance and ball lie</li> <li>Impact on ball reaction upon landing – amount of travel on ball roll</li> <li>Affects selection of shot / quality of strike</li> </ul>
<b>Smoothness</b>	<ul style="list-style-type: none"> <li>Impacts on ball roll and ability to putt if desired</li> <li>Ability to read slope direction green and judge pace</li> </ul>
<b>Aesthetic appearance</b>	<ul style="list-style-type: none"> <li>Definition between green and fairway</li> <li>Golfer perception of presentation</li> </ul>
<b>Grass cover</b>	<ul style="list-style-type: none"> <li>Grass species and tolerance for wear/ damage and mowing height</li> <li>Golfer perception and visual appeal</li> <li>Impact on club and ball interaction – quality of strike around green</li> </ul>
<b>Grass height</b>	<ul style="list-style-type: none"> <li>Grass species and tolerance</li> <li>Impact on ball lie, ability to execute shot, and ball speed</li> </ul>
<b>Freedom from weeds, pests, and diseases</b>	<ul style="list-style-type: none"> <li>Impact on grass growth and aesthetic appearance</li> <li>Maintenance input considerations</li> </ul>
<b>Purpose of apron</b>	<ul style="list-style-type: none"> <li>Consider complete removal if required</li> </ul>

# 9. Conclusions

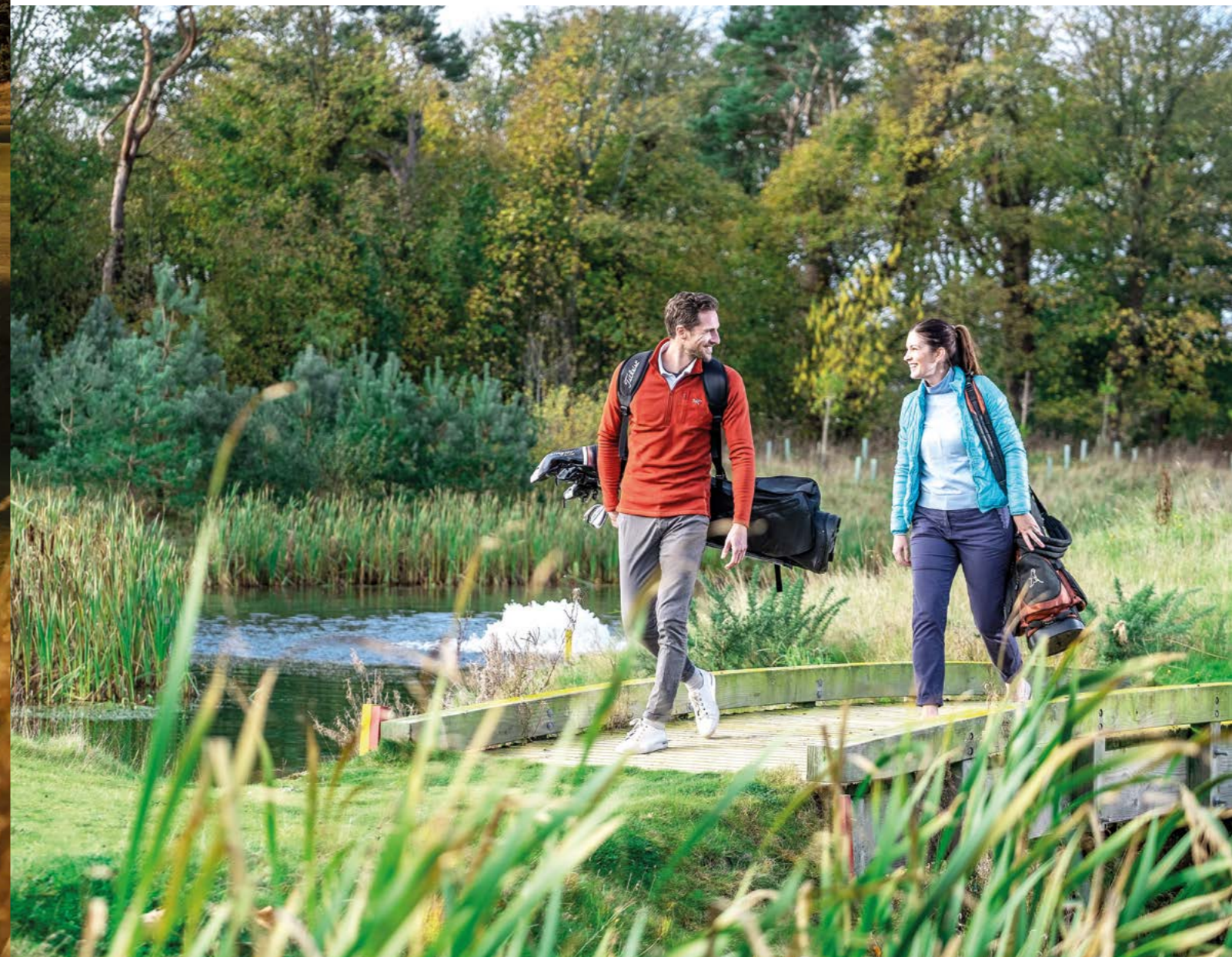


Emerging environmental and economic challenges means that the golf sector is increasingly required to evaluate the nature and role of their course management practices. This represents a difficult but necessary process to remain viable in a volatile environment with consistently changing demographics and economic conditions.

This report has sought to provide a roadmap whereby clubs are equipped with the skills to assess which programs are essential to their individual strategy and culture, which they could do without, and where they can innovate on current practices. Courses are encouraged to regularly evaluate what aspects are a key part of their golf experience offering, and how inputs can be managed and identifying the opportunities which can enhancing the overall experience.

**Research quote**  
"If we make a few good decisions today, we can buy ourselves 'ecological time.'  
(Breitbarth et al., 2018)

**Industry voice**  
"The golf industry needs to understand that we are just custodians of the land. We need to hand the land back in better condition than when we started. If we focus on this, everybody wins"



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The R&A group of companies was formed in 2004 to take on The Royal and Ancient Golf Club of St Andrews' responsibilities for governing the Rules of Golf, staging The Open, golf's original championship, and developing the sport. The World Golf Museum in St Andrews is part of The R&A Group.

Together The R&A and the USGA govern the sport of golf worldwide, operating in separate jurisdictions with a commitment to a single code for the Rules of Golf, Rules of Amateur Status and Equipment Standards. The R&A, through R&A Rules Ltd, governs the sport worldwide, outside of the United States and Mexico, on behalf of over 41 million golfers in 144 countries and with the consent of 159 organisations from amateur and professional golf.

The R&A has responsibility for running a series of world class amateur events and international matches in women's and girls' as well as men's and boys' golf. The R&A stages the AIG Women's Open and works with the DP World Tour to stage the Senior Open presented by Rolex.

The R&A is committed to investing £200 million over ten years in developing golf and supports the growth of the sport internationally, including the development and management of sustainable golf facilities. For more information, visit [www.randa.org](http://www.randa.org).



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