



**ECO**  
**BUNKER**  
build it once

# Guide to Products and Services

Asia & Australasia Edition

# ECO BUNKER

build it once

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Welcome to EcoBunker Ltd, the natural home of resilient bunkers edges, where we are committed to converting maintenance liabilities into consistently beautiful assets.



I have a great passion for Golf Course Architecture. I can't remember exactly when the bug of golf course design bit me, but I have a clear recollection of the events that revealed to me a gap in the market for a new bunker edge product. I also recall the inventive moment when I understood the potential for constructing horizontal layers of upcycled artificial grass as a bunker edge. Furthermore, I cannot forget that exciting day when the attorney confirmed that the application for a Patent (GB2490637) had been granted, and that I was officially 'an inventor'. This gave me responsibility over ownership decisions, but more importantly it was now possible to control the quality of bunker build projects, critical in the long process of winning over 'hearts and minds' in the golf industry. Since then, I have been immersed in the challenging, but highly rewarding process of expanding the range of products and services offered by EcoBunker Ltd.

This guide which includes examples of our work in Asia and Australia is intended as an introduction to our main products and services, and also provides ideas and solutions for all manner of bunker challenges. Enjoy your read and we look forward to your feedback.

**Richard Allen - CEO & Inventor**

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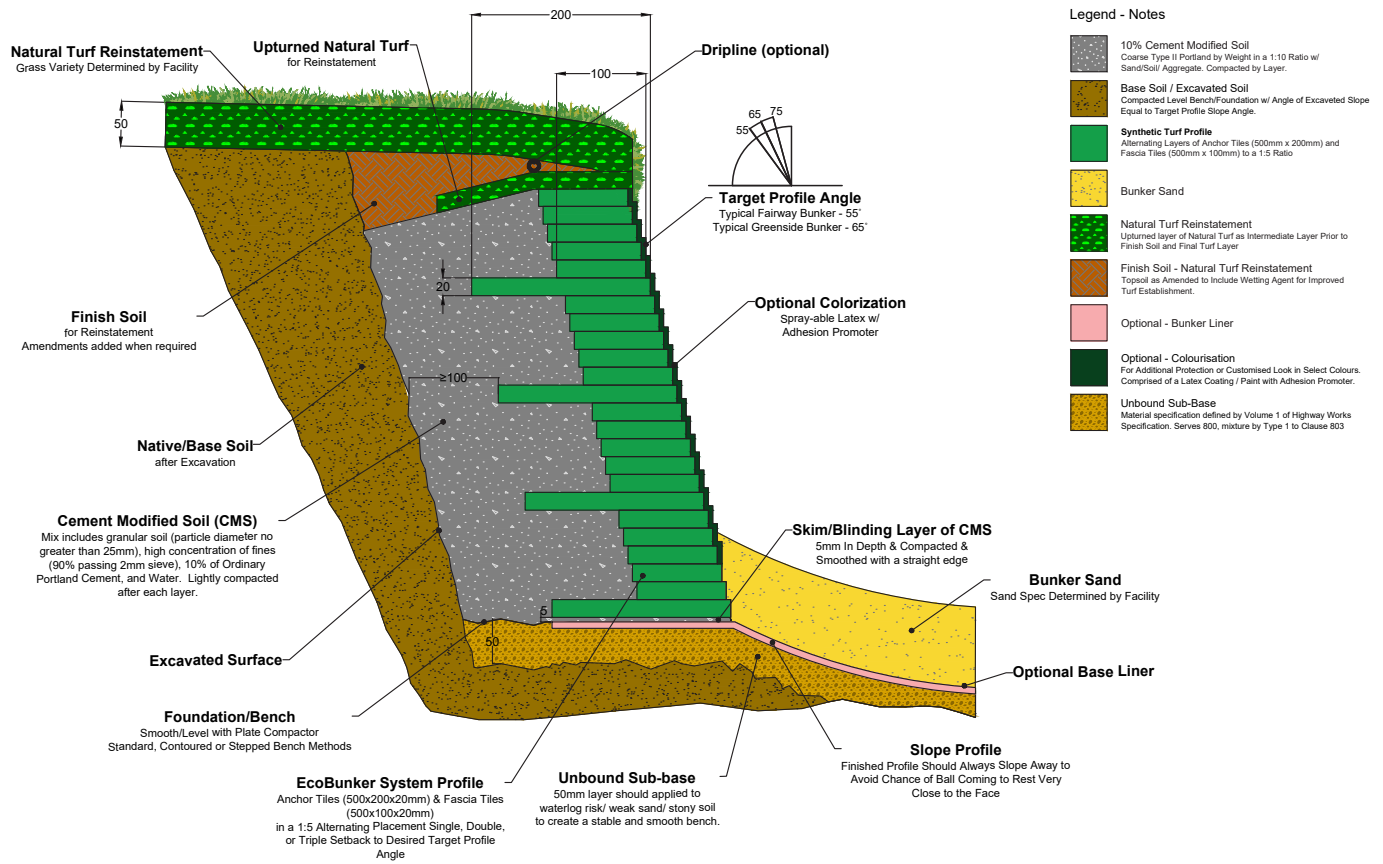


### **Note on Intellectual Property**

The EcoBunker original construction method was invented solely by Richard Allen. It is covered by granted patents numbered GB2490637 and EP2590717. The ownership of this patent is shared with one other individual. There is also a range of other granted IP in relation to Registered Designs (or Design Patent as this is described in the USA).

There is also a Patent Pending Application (Number WO2018/020266) for the EcoBunker Advanced construction method. If granted this Patent will be in the complete ownership of EcoBunker Ltd

# EcoBunker Retaining Wall System



The EcoBunker Advanced System (shown above) was invented and developed solely by EcoBunker Ltd. It is the only bunker edge system on the market that has stood up against the most severe Typhoons and Hurricanes. The system, which uniquely employs a cement modified soil backfill is Patent Pending in all major golfing countries, and offers superior structural stability and efficiency. World leading golf course designers (some of whom have witnessed failures in 'copycat' systems), now specify the EcoBunker Advanced system on new high profile projects.



# The Sand Belt Style



Killara GC, Sydney is one of the most historic golf courses in Australia, being founded in 1899. A traditional member's club, fiercely proud of their golf course, Killara recognised that their bunkers needed improving and decided to employ Harley Kruse (President of the Association of Australian Golf Course Architects) to advise. The outcome was a plan to redesign the bunkers in a style somewhat reminiscent of the Melbourne sandbelt courses such as Royal Melbourne and Kingston Heath. However local soils, clay based proved an obstacle, so an innovative approach combining ecobunker edges and capillary concrete bunker liner was selected to deliver the ambitious plan.

## Features and Benefits

Sandbelt bunkers with their extravagant capes and bays, high sand faces and razor sharp edges, biting in close to the putting surfaces are admired by golf enthusiasts all around the world. They are a product of the unique sandy soils found around Melbourne, which bind together strongly and have a high resistance to erosion. Golf clubs attempting to build these features with normal soils would soon be regretting their decision, having created a significant maintenance burden. Killara GC avoided this problem by commissioning a bunker design which combines the capillary concrete bunker liner which stabilises sand on steep slopes, and the ecobunker edge, which provides an erosion proof, natural looking edge. Since construction

of all the bunkers on the course in 2019, the golf course has been hit by some severe rainfall events, however the bunkers have remained virtually undamaged, saving Superintendent Ryan Fury a fortune's worth in man hours.

## Similar Projects

Projects with a very similar design style include Ellerston GC (NSW) and TPC Sugarloaf (Atlanta) – both Greg Norman Designs. At the time of writing, two other projects with a similar design style are underway at Clearwater Bay GC (Hong Kong) and Amata Spring GC (Thailand).

## Measurement

For a project similar to Killara, measure the

proposed perimeter length of each bunker and multiply by an average edge height of 400mm. Bunker Liner will also be required, so the surface area of the sand will also need to be calculated.

## Useful Tips & Ideas

This style of bunker could also be described as the MacKenzie style, after Alister Mackenzie, designer of Royal Melbourne, Cypress Point, Augusta and many others. Any course boasting a MacKenzie heritage, or indeed any other course with a desire to emulate the spectacular sandbelt style can now use this construction technique without the worry of introducing a significant maintenance burden.

# Traditional Links Style Bunkers



In early 2013, Donald Trump was discussing revetted bunkers with Jack Nicklaus. Trump wanted to renovate Trump National (Jupiter), and include Scottish style revetted, or sod wall bunkers. Nicklaus, the original architect was unconvinced and wary. He knew from years of experience in golf course design that revetted construction in hot climates was very difficult and expensive to maintain. Trump was determined though, and after some research the pair found Richard Allen's invention, which guaranteed low maintenance sod wall construction in all climates. 3 months later Richard and his colleague Llewellyn Matthews were on site in Florida, building the first synthetic walled bunkers in a semi-tropical Floridian environment.

## Features and Benefits

Our synthetic bunker walling system made this style of bunker feasible in semi tropical and tropical climatic zones. Previous attempts using natural turf we doomed to failure: Soils tend to be vulnerable to erosion, grasses are usually an aggressive creeping variety spoiling the desired wall aesthetic, and the frequent extreme rainfall events, hurricane and typhoons can wash away natural turf walls. The EcoBunker walls come with a 20 year warranty and have survived severe weather events including Category 5 Hurricanes and the recent Typhoon Mangkhut in South East Asia.

## Similar Projects

Hot climate bunker projects have been successfully implemented right across the globe and include The Medallist, Tiburon and The Floridian (Florida), Seccession (South Carolina), Shek O and Clearwater Bay (Hong Kong), Nine Bridges and Blackstone (South Korea), Santo Domingo (Dominican Republic), Long Reef and St Michaels (Australia) and the new Faldo Design course at Thanh Lanh (Vietnam). Coming Soon at The Links, Kennedy Bay near Perth.

## Measurement

This style of bunker edge clearly needs a larger quantity of revetting material than lower edge

designs. Because walls are relatively high it is important to take accurate height measurements at spacings no more than 4 metres apart. Then work out your average height and multiply by the perimeter length of your bunker to find the face area of material that you will need.

## Useful Tips & Ideas

For this style of bunker double or triple stacking (see page 11) is a must if you want an authentic finish. Its also a good idea to build a 'kicker' at the base of the wall to ensure that golf balls don't end up right underneath the revetted structure. A face angle of 65 degrees works well, and we recommend staying within the range 60 to 75 degrees.

# The Classic Parkland



Probably the most common edge treatment for bunkers around the world. Bunker edges provide the vital interface between sand and grass. It is not an easy zone to manage. Grass normally plays an important role in binding soil and preventing erosion, but the exposed nature of the cut surface between sand and soil means that it is easy for the effects of nature to cause rapid degradation of the edge. However, golfers desire a clean well-maintained edge, and this was Richard Allen's motivation when he set about searching for a new invention to address bunker edge erosion.

## Features and Benefits

The principal purpose of the EcoBunker Ltd classic edge is to provide a stable, neat, sharp edge that will form a long lasting, low maintenance interface between sand and turf. Added benefits include locking in the shape of the bunker (which can easily be lost during regular routine trimming), providing a deterrent to burrowing animals and preventing ingress of stones and silt which can contaminate the bunker sand. It is a very useful addition to bunker liners, as the classic edge prevents the edges of liners becoming exposed by careless maintenance work. The Classic Parkland Edge is providing to be particularly effective in tropical climates where

sandy soils can be exposed to torrential rain, resulting in damage that can take hundreds of man hours to repair.

## Similar Projects

There are many golf courses currently benefitting from EcoBunker's classic edge design and these include Amata Spring (Thailand), Lakeside (Thailand), Laem Chabang (Thailand), Royal Hong Kong GC, Mackay (Australia) and Toowoomba (Australia) and many more in the USA and Europe.

## Measurement

Measurement is simple: Decide how high you want to build the edge (remember to take

into account the depth of sand and at least 50mm of natural turf) and multiply by the proposed length of edge to get you square metre area of bunker face.

## Useful Tips & Ideas

If you are planning to install a bunker liner, think how you will maintain the position of your bunker edge over time. Natural turf bunker edges can 'retreat' outside the edge of the bunker liner, and this can cause serious problems if sand then starts to penetrate underneath. Installing a robust and resilient EcoBunker Edge will prevent this and extend the life of your bunker liner and sand.



Of all the hostile environments, Deserts surely present the biggest challenge for building and maintaining good golf courses. The scarcity of water is an obvious constraint, however, less obvious is the difficulty in maintaining bunker edges and faces without the benefit of cohesive soils and means of irrigating these steep banks.

### Features and Benefits

Until the advent of synthetic revetting (invented by our CEO Richard Allen) it was virtually impossible and certainly not advisable to build revetted bunker walls in desert style climates. However from an aesthetic viewpoint, steep revetted bunker faces really can help to add character to flat sandy sites, and break up the otherwise featureless landscape. The EcoBunker system provides the opportunity to build steep and high bunker faces that look natural, but without the worry of regular maintenance.

### Similar Projects

We have two stunning desert golf courses on our portfolio. At Rumanza, Pakistan, Sir

Nick Faldo has specified the EcoBunker system on a spectacular new Championship Golf Course. The EcoBunkers add a unique look. At Rancho San Lucas, Mexico, Greg Norman, a great fan of revetted bunker edge construction specified EcoBunker on his new course, and in 2019, EcoBunker built the first revetted bunkers ever seen in Mexico.

### Measurement

Measurement: These bunkers are generally large, with high faces often peaking at 2 or even 3 metres high. To measure the amount of face area simply measure the length of each wall and the average height. Be careful to take measurements at regular spacing to make sure your average height is accurate.

### Useful Tips & Ideas

It is a bold decision to incorporate these features onto a golf course. Therefore it is very important to employ a golf course architect to ensure that the bunkers are placed in the correct positions and with an appropriate wall height and angle. These very large bunkers can appear to be expensive, but they add great value to a golf development, in terms of beautiful styling and the excitement they generate in the golfers who play the course.





Singapore Island Country Club (SICC) underwent a major restoration in 2019-2020. With highly respected Golf Course Architect, Graham Marsh at the helm, the bunker strategy and styling had a major facelift, as befitting a golf course with world class standing.

## Features and Benefits

Precise shaping of the bunkers was critically important, but anyone who has experience of maintaining golf courses in the tropics, that are subject to extreme rainfall events will know how easy it is for those shapes to be washed away. At SICC the superior resilience of the EcoBunker Advanced edge, 120mm high around the bunker perimeter, anchors the bunker shape, providing a solid growing base for the natural sward. It will not get washed away in heavy

rain and another benefit is that as a result the bunker sand stays cleaner and more consistent for much longer.

## Measurement

This is very easy: Simply calculate the length of each bunker edge and multiply by the height of the edge, which is typically between 80mm and 120mm for subtle low edge treatments. This gives you the face area required.

## Useful Tips & Ideas

For the ultimate on low maintenance bunkers consider combining the EcoBunker low edge with a top class bunker liner. At SICC, Capillary Concrete, which is backed by strong warranties, was used.



Why 'Golden Age'? Prior to 1900 most golf course design was undertaken by well-meaning amateurs, or greenkeepers and golf professionals who did not possess the landscaping skills to effectively transfer links style features onto inland sites. The results were usually poor. Monotonous geometric, trench style bunkers with flat sand bases dominated. That changed when the first professional architects like Colt, Fowler, Braid, Mackenzie and many others entered the scene, starting what has become known as The Golden Age of Golf Course Architecture. Bunkers became far more imaginatively shaped, with irregular outlines, varying edge heights and flashed up sand faces. The EcoBunker system can be used very successfully to create these 'Golden Age' designs.

### Features and Benefits

To ensure minimal future maintenance the design of the bunkers includes a wide range of features. Low, varied height edges, not only aesthetically pleasing; they are carefully installed to divert surface water around the bunkers. The pronounced edges also enable sand profile to be sloped at no more than 25 degrees. This in turn facilitates the use of the cost effective ecosward liner, and the reduction of washouts. Ecosward liner is tough, resists animal burrowing and prevents sand contamination. Other liners, notably Capillary Concrete are also effective.

### Similar Projects

EcoBunker Ltd has worked on some classic parkland courses delivering bunkers like this on venues such as Clitheroe, Grimsby, Hartsbourne, Tynemouth, Upton by Chester, Lingdale, Cosby, Denham, Lee on Solent, Brickendon Grange, Boyce Hill, Romsey, Gillingham, The Glamorganshire, Morlais Castle, and Enfield. For best results, on many of these projects we have worked with golf course architects who understand the nuances of the classic architects.

### Measurement

This style of bunker edge needs a smaller than average quantity of revetting material.

Typically the edge height varies between a minimum of 50mm to a maximum of 400mm. To measure edging amount accurately it is important to obtain or predict the perimeter length of each bunker, and the average edge height on each bunker.

### Useful Tips & Ideas

For this style of bunker double stacking is strongly advised. Attention to detail is also very important, and the degree of complexity of these projects often means that employing a Golf Course Architect with a proven track record on similar projects and a knowledge of the original architect of your golf course is highly advisable.

## Introduction

'The Devil is in the Detail' is an oft used phrase, and this can be very true for bunker design and construction. Subtle design details can make big differences in the aesthetics or the maintainability of a bunker project. EcoBunker Ltd is driven by the invention and innovation and we lead the way in producing a range of design details, which ensure that we can adapt a project to suit every taste and budget. Some examples are shown below.

## Single, Double and Triple Stacking



Bunker aesthetics can be dramatically changed by the way our turf is stacked. Double stacking, which results in a typical revett thickness of 40mm (1.6 inches) is the default setting for most of our projects and works well on both inland parkland projects and seaside links. However there are times when a single stack is needed to create a beautiful smooth face (such as Killara GC) or a triple stack, very popular in Scotland, where a bold layered aesthetic is desirable.

## Bunker Steps

How steps are positioned and constructed can make a big difference to the aesthetics and safety aspects of the bunker.

Beautifully constructed steps, neatly recessed into the revetted walls can create an attractive feature on any golf course. Golfers love seeing care and attention to detail on their golf course.



## Bunker Face Colourisation

Take full control of your aesthetics by choosing exactly the right bunker face colour to suit your local site. EcoBunker Ltd pioneered the use of special external paint, customised to meet the requirement of Seclusion GC, South Carolina, and have since done several more projects including the very highly rated HS Colt masterpiece at Granville, France.

## Bunker Perimeter Dripline

Dry, windy weather spells trouble for all bunkers with natural turf edges, whether they have an ecobunker face or not. To provide a solution, EcoBunker Ltd worked in partnership with Irrigation Industry leaders, Rainbird. The result was a completely new way to use the existing Rainbird subsoil XFS system, fastened to the top of the EcoBunker revetment. Bunker edges are easily irrigated at the touch of a button, and the costs to install are surprisingly attractive.



# Edge Details & Bunker Surrounds

## Introduction

The bunker edges and liners invented, supplied and installed by EcoBunker Ltd are all made from robust, manmade materials, designed to resist erosion, last longer and ultimately save a fortune in maintenance costs. All this whilst not compromising aesthetics.

However, our bunkers are surrounded by the natural environment of golf courses, and how our products interface with fine turf grasses is very important design decision. Prior to any bunker construction work, the designer, very often a golf course architect, will need to assess the desired visual appearance, the

local grasses and soils and the golf club's maintenance machinery and manpower. EcoBunker Ltd has devoted considerable time and resources into Research and Development, and we have devised a wide range of options.

## Soil Edge

This option delivers a razor sharp edge, and maintenance is relatively straightforward with standard mowing equipment, as long as shaping is not overly elaborate. The specification of the turf is important however, (free draining, sandy sod should be avoided) and EcoBunker Ltd will provide the detailed specification



## Rolled Turf Edge

Where an exposed soil layer is not desired, the rolled turf edge detail provides an alternative and promotes a vigorous grass growth. It is often the choice on lush parkland courses where Rye grasses and creeping varieties dominate. This option does not require thick cut revetting turf, but construction is more complicated and cutting should be done with care, and avoid scalping which can damage the sward.



## EcoEdge

For the ultimate in low maintenance we developed the EcoEdge. If you own or manage a golf course with a small team, and a limited maintenance budget, but it's always important to present your bunkers in a clean, sharp and well maintained condition, then this could be the option for you. Our 'Bull Nosed' EcoEdge unit is manufactured from top quality artificial grass, and attached to a flexible backing. When secured to the bunker edge, it eliminates all awkward grass trimming, and edge irrigation and soil conditioning becomes a thing of the past.



We also can supply a whole range of other options including Marram Grass and Heather so that our bunkers can flourish on all types of golf course, across a full range of climatic conditions



## The Architect

"Our Nine Bridges track has been using EcoBunker since 2018 and we are pushing three metre high faces when appropriate. Great product and a cost saver in the long term."

**David Dale, Principal at Golfplan (Dale and Ramsey Golf Course Architecture)**



## The Agronomist

**The Singapore Island Country Club – Singapore**

To alleviate the erosion and contamination issues, we installed EcoBunker which solved the edge erosion issue with the added benefit of providing a secure interface between the Capillary Concrete and turf.

The EcoBunker material also allowed us with the opportunity to install several higher revetted faces on some of the bunkers which provided the look we were after without the sand washouts.

The result has been a vast reduction in erosion and washouts after heavy rain events, which in turn has reduced expenses, allowing the staff to focus on other important maintenance tasks.

EcoBunker has definitely reduced the resources required for bunker



maintenance, whilst improving the appearance, playability and longevity of the bunkers.

With success of the bunker renovation on the Island course, it was a straightforward decision to utilise EcoBunker on the New Course 27 hole rebuild.

**Chris Gray, The R&A Head of Sustainable Golf and Agronomy in the Asia Pacific Region**

## The President

"Because we have technology such as EcoBunker and Capillary Bunkers, I am very confident that the bunkers at Killara GC will perform very well for a very long time and with very little maintenance"

**Harley Kruse, President of the Australian Society of Golf Course Architects**



## The General Manager

## The Course Manager

"EcoBunker allows us to replace our old sand flashed bunker faces with revetted ones that dramatically reduce washouts and silt contamination (reduced maintenance).

Also, EcoBunker provides a stable bunker edge and one that we can confidently use ride-on equipment over allowing our staff to mow right up to the bunkers' edge (reduced hand mowing). "Overall EcoBunker is an affordable product especially if you factor in cost savings from reduced maintenance"



**Ross C. Grieve, Golf Course Manager, Shek O Country Club, Hong Kong**

"Bunker maintenance is very expensive, especially repairing washout damage caused by intense rainfall. The combination of the EcoBunker edge and Capillary bases at Clearwater Bay is a game changer, it will greatly reduce bunker maintenance and improve both the quality and consistency. In my opinion this is the new 'Gold Standard' of bunker construction. EcoBunker Ltd were highly proactive from day 1 and, among other things, helped us with the decision to commit not only to the Capillary liner, but engage with architect Harley Kruse. I would thoroughly recommend them."



**Peter Downie, General Manager at Clearwater Bay GC, Hong Kong**



Richard Allen, Founder of EcoBunker Ltd is a qualified Civil Engineer and a specialist in solving challenging technical problems in the sector of water management. His skills include land drainage, surface water drainage, foul drainage, flood alleviation, flood risk assessment, floodplain mapping, hydraulic modelling, sustainable drainage (SUDS), erosion control, highway drainage, pond and lake design and Expert Witness work. Richard has transferred these skills into the golf sector, and in 2010, his solution to a longstanding

waterlogging problem on a golf course was awarded the honour of being 'Water Management Project of the Year' by the STRI in the annual Golf Environment Awards. Not surprisingly we have tapped into these skills and this is reflected in the approach we take to building and maintaining golf bunkers, solving stubborn drainage issues and providing novel, but practical solutions for vulnerable areas such as lake and pond margins.

## Our Approach to Drainage: Take Out The Guesswork

When it comes to stubborn existing drainage challenges, it is highly advisable to take a structured approach to investigation, analysis, design and construction. All too often a drainage

problem (often in a bunker) is addressed by digging a bigger sump and filling with clean stone. Sometimes this works, but often the results are disappointing. Our approach is to take out the guess work by thoroughly investigating and analysing the problem before jumping to any design conclusion. Where necessary we are

able to conduct testing such as infiltration analysis using approved Building and Research Establishment (BRE) industry guidance. This approach invariably delivers the cheapest solution, that works and is easy to maintain. The table below provides a list of the products and services we can and do provide:

- ✓ Drainage Audit and Report
- ✓ Retrofit Bunker Drainage
- ✓ Permits and Planning Consents
- ✓ BRE 365 Infiltration Testing
- ✓ Maintainable Drainage Fixtures
- ✓ Drainage media and products
- ✓ Detailed Drainage Design
- ✓ Lake and Wetland Design
- ✓ Cost Estimation

**All our bunker projects benefit from an expert overview of existing drainage performance, and if this review reveals that the project would benefit from extra drainage measures we will discuss this with our clients.**

## Aquaedge: Addressing The Challenges of Water Margins

The margin where water meets grass is a challenge: Banks can erode and adjacent high footfall areas can become slippery and dangerous for golfers and maintenance staff. Furthermore, access is difficult for maintenance, and as a result these areas often become muddy and unsightly. There's also the rules issue. It is regularly difficult to determine what is in or out of a hazard. Contentious golfing rulings often result in dozens of red and yellow stakes, which in our opinion are very unattractive. Aquaedge is our response to this challenge. It is a civil engineering process which includes the initial investigation, the design and specifications, the planning, the supply of the various components and the installation. If you have a troublesome lake edge, contact us for a free initial consultation. for projects with a large total sand area.



# Delivery Options and Distributors



## Your EcoBunker Project: How do we get started?

If you are interested in the EcoBunker system, then you will be someone who cares deeply about your golf course and insists on the highest standards of service and quality. To ensure that we deliver the best possible results EVERY time, we have successfully developed tried and tested delivery methods. We recognise that golf clubs have differing preferences when it comes to procurement and as a result we have developed 3

### Self-Build Contracts

If you have In-House resources you can purchase all the construction materials from EcoBunker Ltd, and build the bunkers with your team.

Prior to any self-build construction we will provide a Training Project held at your club and led by one of our bunker construction experts. This is typically a 3-5 day hands-on structured learning experience when 2 or 3 ecobunkers will be built on your course. Your staff will learn useful new skills, gain CPD credits and become officially accredited ecobunker builders .

This is a very popular option.

### Managed Contract

In this option we provide all the ecobunker construction materials and a fully qualified, highly experienced bunker builder, supervising bunker construction on a full time basis. The client provides the plant and labour. Y

our Course Manager, or Superintendent is already a very busy person, and by providing a dedicated expert to manage and drive the project forward, you will not need to worry about putting too much pressure on your key personnel. This is a particularly good option if you are working to deadlines and it provides extra flexibility if you want to hire in extra staff or want to experiment with some different bunker styles. This option definitely provides the best overall value for money.

### Full Contract

This entails transferring all responsibility and risk of delivery to a dedicated external contractor. For the most skilled and highly experienced contract services you can opt for our own EcoBunker Ltd team.

We have successfully completed full contract services in 6 different countries so we are very happy to travel. Alternatively you can use one of our approved local installation contractors or a contractor of your choice provided that they have undertaken the structured training programme at the start of the project.



The best way to get started is to contact your local EcoBunker Representative who will be delighted to assist you to find the best bunker solution for your golf club. Please see below



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We will ensure that you are directed to the best person to deal with your enquiry.

The image features a large, scenic view of a golf course under a clear blue sky with a few wispy clouds. In the foreground, a large, curved bunker with white sand is prominent. The bunker's surface shows some tire tracks and footprints. To the right of the bunker, there is a small, shallow pond with green water. In the background, a lush green golf course stretches towards a dense line of tall, green trees. A white flag is visible on a green in the distance. The overall scene is bright and well-maintained.

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