

GC2030

Golf Course 2030 Sustainable Water Management

Context and Practical Solutions



Contents.

GC2030 Water Project	4	Practical solutions:	18
		Water sourcing –	
Climate change	6	Hard surface water harvesting	
Current water sourcing	8	Practical solutions:	19
		Water sourcing – Ground or	
Legislation and user restrictions	9	watercourse abstraction	
Practical solutions:	11	Practical solutions:	20
Planning and management		Water sourcing – Treated sewage	
		effluent / wastewater reuse	
Practical solutions:	12	Practical solutions:	20
Water monitoring		Water sourcing –	
		Desalination, greywater	
Practical solutions:	13		
Water use and application		Practical solutions:	21
		Water storage	
Practical solutions:	14		
Drainage		Summary	24
Practical solutions:	15		
Water sourcing – Landscape			
water harvesting onsite			
Practical solutions:	17		
Water sourcing –			
Water harvesting offsite			

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part of the Golf Course 2030
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GC2030 Water Project.

As part of Golf Course 2030, The R&A commissioned the **Golf Course 2030 Water Project**, which explored the challenges arising from climate change and legislation on water security for the golf industry in the UK. The project produced guidance on how golf courses can improve their water security, along with a series of detailed water security case studies from golf courses across Europe.

Given the range of different environments in which golf is played worldwide, there is no one-size-fits-all solution to sustainable water consumption. However, there are common challenges from which clubs can learn.



Access Golf Course 2030
Water Project website [HERE](#)

Climate change.

Extreme weather events are projected to change in frequency and intensity.

Whilst the UK has a reasonably temperate climate, there has been an increase in golf courses having to close due to flooding and storm damage. Many regions are also experiencing unprecedented pressure on water resources. UK climate change predictions forecast all areas of the UK to become warmer. By the 2070s, temperatures on hot summer days are expected to rise by between 3.8°C and 6.8°C in a high-emissions scenario, with more frequent and prolonged heatwaves. This will increase water demand for irrigation during concentrated periods.

Extreme weather events are also projected to change in frequency and intensity, with wetter winters, drier summers and more intense rainfall – especially in summer.

These changes will not be uniform across the UK and their effects will be most pronounced in the south and east. Abundant and insufficient water quantities present different problems, but they should be viewed in unison to create integrated and holistic plans.

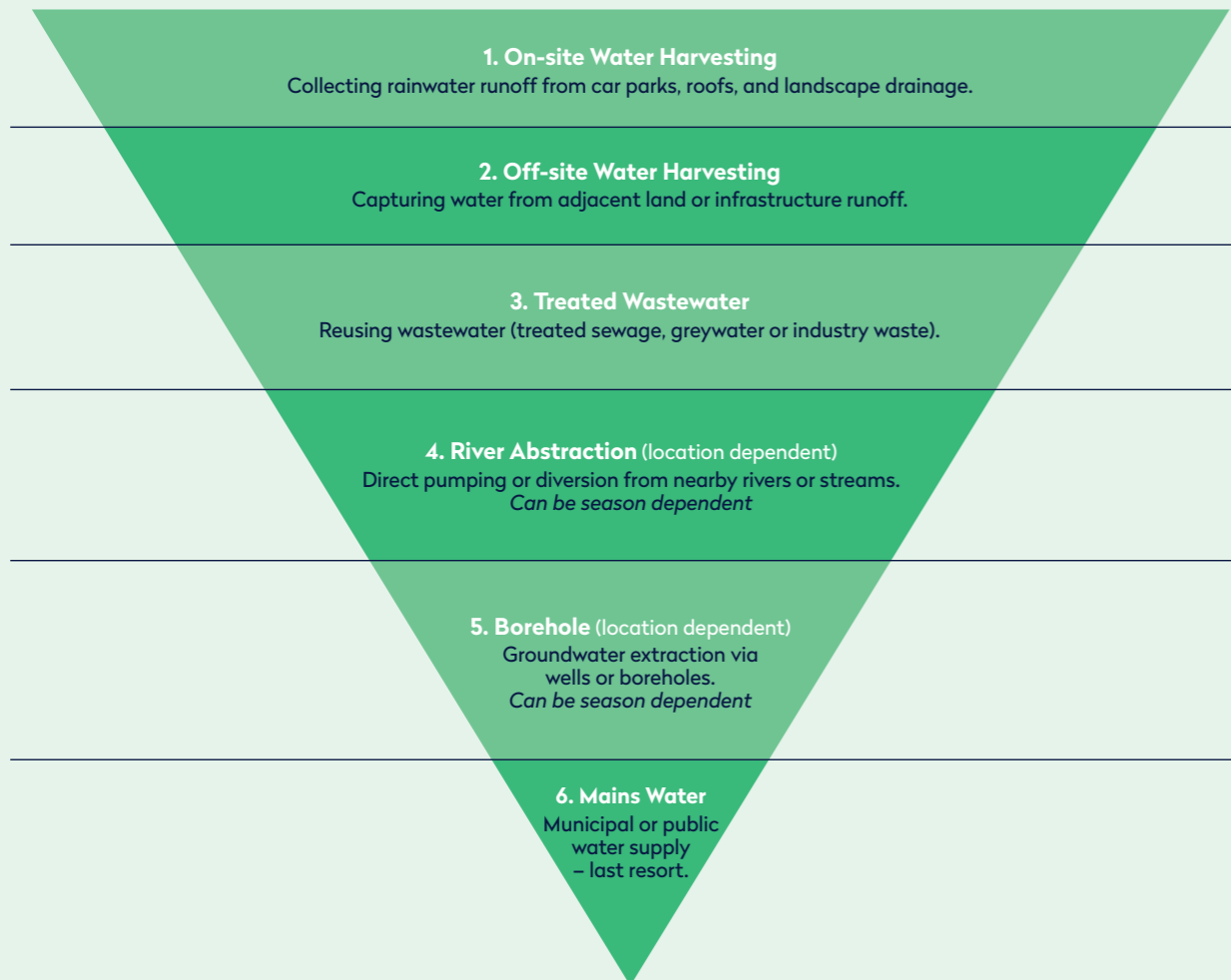
Read more about the [UK Climate Projection headlines](#)



Current water sourcing

The impacts of climate change, increased user expectations and historically short-term management practices have led to a rising water demand on golf courses, with many relying primarily on potable mains water or abstraction licences for irrigation. Using mains water is expensive, unsustainable and risky for clubs, as future access to potable water is not guaranteed. Meanwhile, abstraction licences are being reviewed nationwide due to historical over-abstraction.

Golf courses are advised to apply the following **water source hierarchy** when sourcing irrigation water:



While implementing the full hierarchy may not be feasible immediately, it should be a long-term goal. On most sites, a combination of the supply options is likely to be required, reducing over-reliance on unsustainable and insecure water sources.



Legislation and user restrictions

The Environment Agency (EA) in England is increasingly restricting abstraction licences due to historic over-abstraction, whilst some water companies, facing reduced availability, are unable to supply new customers. Water scarcity is becoming increasingly urgent. Key considerations for golf courses include:

- New infrastructure, such as drainage systems, must not increase flood risk either upstream or downstream
- Downstream flow volumes must not be reduced unless part of an agreed catchment-wide flood reduction strategy
- Water abstraction over 20m³ per day from a borehole or watercourse requires a licence, which may include strict conditions and limits on quantity, timing and aquifer status, with renewal not guaranteed
- Water storage structures must meet regulated construction standards; reservoirs with a capacity of over 25,000m³ must be designed by qualified engineers and include long-term safety management plans

- During periods of high demand, licensing bodies and utility companies may request golf courses to voluntarily reduce their water abstraction and potable water use; these requests are likely to increase, as domestic and industrial users will be prioritised over leisure sectors
- Water captured and stored for reuse must be treated appropriately, with treatment levels depending on storage duration and intended use.






Planning and management

Golf clubs should aim to use less water and create a sustainable, cost-effective supply year-round, starting with a review of current irrigation water sources and volume requirements. Ideally, clubs should maintain a continuously updated **site-wide water action and management plan**, enabling them to monitor water use, identify short-term improvements and develop a long-term strategy.

Golf clubs should also **educate and inform their members and visitors** about the challenges of maintaining a long-term water supply. Communication should focus on the outlook for water availability and climate change, aiming to adjust golfer expectations while clearly outlining what is achievable within the club's budget and under current environmental restrictions.

Agronomic turfgrass decisions should always consider the club's sustainable, integrated site water management action plan. This should include the appropriate use of irrigation practices, soil surfactants ('wetting agents'), aeration requirements, species and cultivar selection and construction materials.





 **CASE STUDY**

Hollinwell Golf Club

Hollinwell Golf Club (Nottinghamshire) upgraded its irrigation system to include valve-in-head controls with a modern computer controller, allowing precise and bespoke irrigation cycles determined by moisture probe readings.

In areas dominated by fescue and bentgrass, soil moisture is kept between 10-15%. Fairways receive no supplementary irrigation and are managed with a low-fertiliser programme, cultivating fine grass species that require little to no mowing in summer and remain resilient during droughts.

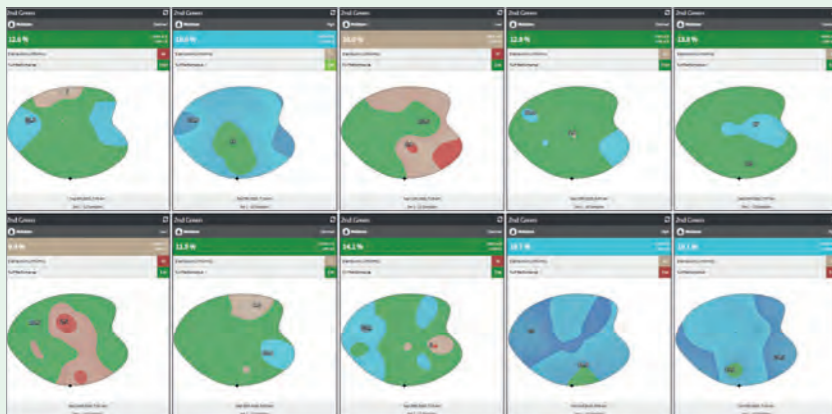


 **Hollinwell Golf Club**
Case Study [HERE](#)

Water monitoring

Water use monitoring and testing should be carried out to ensure an accurate and up-to-date record is available, helping to track usage, quality and any system leaks at an early stage. Monitoring methods can range from manual water meter or level readings to automatic loggers. Monitoring of soil moisture should also be used to help inform irrigation practices, which can have agronomic benefits as well as result in water savings.

Significant water savings can be achieved by improving **building efficiency**, for example, by reducing leaks, installing water-saving technologies such as low-flush toilets and automatic taps and changing use practices.



CASE STUDY

Darwin Escapes

Darwin Escapes manage 26 sites across the UK, ranging from golf resorts to holiday home parks, all of which have a large water demand.

An ambitious data logger installation programme across the group's sites was set up following several incidents of large water bills caused by undetected leaks, sometimes lasting up to six months. Currently, all 26 sites have automatic usage and flow sensors which continually upload data to a central cloud data point. Each site is split into zones with sub-meters, allowing leaks to be pinpointed much more accurately and rapidly.

Darwin Escapes
Case Study [HERE](#)

Water use and application

Most golf courses have forms of **automatic irrigation**, which can be modified and optimised to provide bespoke and site-specific irrigation schedules. These systems require a detailed and dedicated understanding, yet when managed well, they can save significant volumes of water and lead to improved agronomic performance.

Auditing existing irrigation systems at least once a year is key to maximising water use efficiency. Annual audits should involve a full system shutdown, if climatic conditions allow, and should also analyse and review water supply, water storage, the pump station, pipework, solenoid valves, sprinklers, control system, as well as system maintenance and operation. More frequent maintenance (every 4-8 weeks) is essential and should include head trimming and arc checking to optimise water application. Routine weekly and monthly maintenance will ensure that small problems can be identified and corrected before they lead to larger and costly issues.

Decisions made at the **design stage of irrigation systems** can impact long-term effectiveness and sustainability. It is recommended to consult irrigation professionals to prepare designs, specifications, scaled drawings and a bill of materials that set clear standards for materials and installation. These standards should be strictly followed by installers. Any new irrigation should be monitored and inspected by experienced personnel to ensure that design and specifications are adhered to. Manufacturers should also be consulted to provide guidance and training on servicing.

Alternative irrigation systems can be used in specific areas, such as on tees or landscape areas, to reduce water use. For example, in a sub-surface irrigation system, water is delivered directly to the base or midway up a rootzone, reducing evaporation losses and allowing roots to directly access water, improving supply consistency.



CASE STUDY

The Castle Course, St Andrews

The Castle Course at St Andrews (Scotland) realised water savings of 7% (or 45m³) on each irrigation cycle by upgrading and optimising the irrigation system.

Upgrades included installing a new pump set, updating the control system to allow individual head control via a mobile app, and replacing sprinklers with adjustable heads, along with detailed course monitoring. This involved labour-intensive checks on all heads and arcs to ensure optimal irrigation of in-play turf surfaces and minimal irrigation of out-of-play areas.

The Castle Course
at St Andrews
Case Study [HERE](#)

Drainage

Effective drainage is extremely important to achieve a well-maintained golf course, due to its ability to provide and manage resilient turf surfaces. However, there is rarely long-term planning involved in **drainage installation**, leading to disjointed, unconnected systems and sub-optimal performance. With an integrated water management plan, water should be seen as a valuable resource, with drainage designed to hold and slowly release water, to allow infiltration and reuse where possible.

Drainage installation on golf courses can be linked with a water harvesting system. Interception and infiltration ditches, swales, ponds and soakaways are ideal Sustainable Drainage System (SuDS) features. When incorporated into a coordinated drainage system, the volume of water passing through the drainage network will be minimised, reducing flooding and waterlogging, while increasing opportunities to harvest water. The **discharge hierarchy** should be reconsidered as follows:

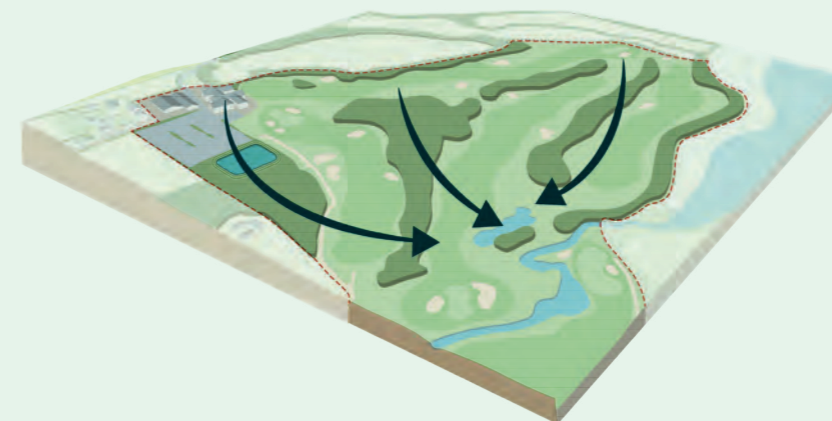
1. Store rainwater for future use
2. Encourage infiltration where possible
3. Attenuate rainwater in tanks or water features for gradual release
4. Discharge water directly to a watercourse
5. Discharge water to surface water or combined sewer.



Water sourcing – Landscape water harvesting onsite

Golf courses are large areas of land that act as catchments, with significant volumes of water entering and leaving each year. This water can be collected using existing drainage systems and stored for later reuse. Most landscape **rainwater harvesting systems** are designed to collect and store water during winter months for use in summer.

Golf courses provide an ideal opportunity to design a catchment-based source control system, managing water within smaller features and attenuation structures. These can also be incorporated into play, as natural features or hazards. Water can cascade into other downstream on-site structures through pipework and natural drainage features at a managed rate, being cleaned as it moves through the system. Upon reaching a low point of the course, the water can be collected and stored in a local storage feature or pumped to a high point of the site for later reuse.



Water sourcing – Landscape water harvesting onsite



CASE STUDY

Chorley Golf Club

As part of irrigation system upgrades in 1999, Chorley Golf Club directed drainage water from around 50 per cent of the site into a series of ditches, and then into an 8,000m³ storage pond.

Water is fed from this pond into a smaller 2,000m³ irrigation pond, making the club entirely self-sufficient in water.



[Chorley Golf Club Case Study HERE](#)



CASE STUDY

London Golf Club

On a much larger scale, London Golf Club was built in 1994 with landscape water harvesting at the heart of its design. The innovative design uses the site shape, landscaping and surrounding drainage works to capture and reuse water.

Eighty per cent of the site is drained into a site-wide catchment system; a series of eight lakes across the site act as temporary storage areas, while also adding water features to the course. The lakes cascade into one another and ultimately flow to the northern end of the site, from where water is pumped to a 100,000m³ reservoir, resulting in complete water self-sufficiency. It is estimated that this system saves the club £90,000-95,000 on average per year, generating approximately £2-3 million in savings since construction.

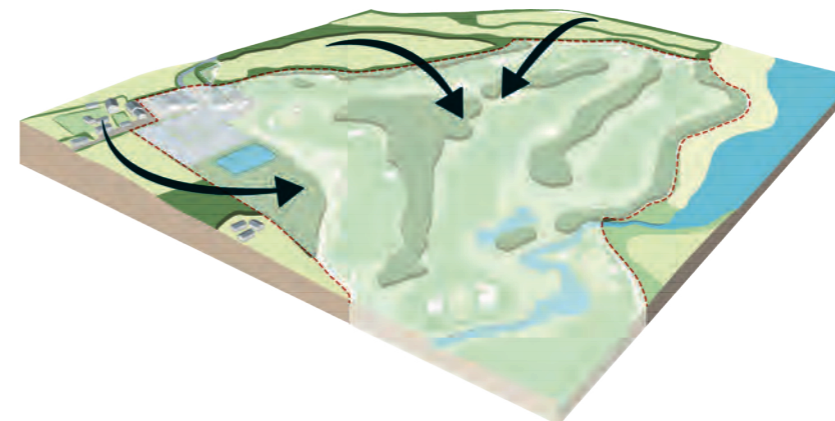


[The London Club Case Study HERE](#)

Water sourcing – Water harvesting offsite

Offsite drainage water can be captured and redirected onto a golf course for irrigation use. Achieving this requires detailed engagement with surrounding landowners and companies to understand any drainage issues and the potential for redirecting water onto the course.

Expert input and liaison with local councils, water authorities, surrounding landowners, developers and government agencies are critical to this process. This approach may provide a solution to others; for example, water companies are increasingly seeking to ease pressure on their drainage networks.



CASE STUDY

Brøndby Golf Club

At Brøndby Golf Club (Denmark), water from a railway and cycle path bordering the course is discharged into the club's lake system following treatment and filtration, providing 3,500m³ of water per year for the club and reducing construction costs for the local municipality.



[Brøndby Golf Club Case Study HERE](#)

Water sourcing – Hard surface water harvesting

Run-off from hardstanding areas and roofs can be collected locally in large containers or integrated into a site-wide harvesting system, providing a low-cost, low-tech method to supplement the water supply.

It is recommended that any surface used for water harvesting should be regularly cleaned and water filtered before use.



CASE STUDY

Killiney Golf Club

Sustainable water use on golf courses doesn't have to involve large, expensive projects.

Killiney Golf Club in Ireland harvests irrigation water from the clubhouse roof and onsite drainage ditches into a small 1,200m³ pond. This water reduces the need to top up the site's borehole water with mains water.

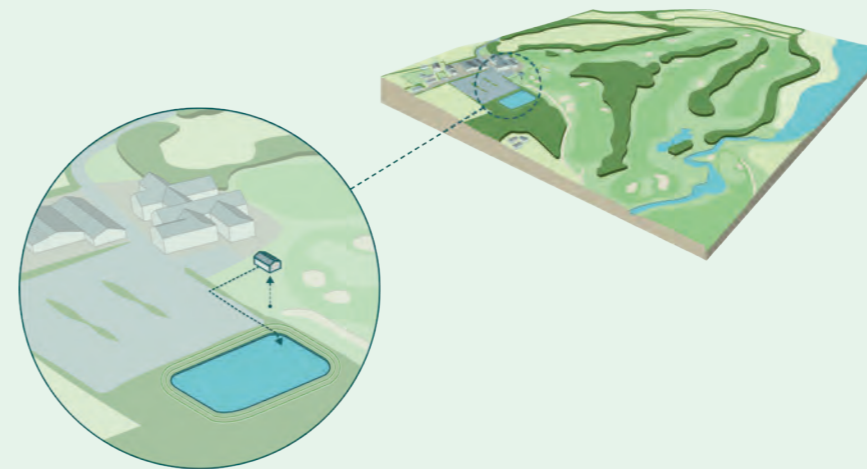
Killiney Golf Club Case Study [HERE](#)

Water sourcing – Ground or watercourse abstraction

To abstract groundwater via a **borehole** or from a **watercourse**, an abstraction licence from the Environment Agency is required. If the site is abstracting less than 20m³ a day, then an abstraction licence is not usually required. Water can be abstracted during low-demand periods, such as winter and stored for later use.

To install a borehole, the following is usually required: groundwater investigation, consent to connect, pumping tests and details of water use and timings. This allows the water licensing body to determine water availability and assess impacts on other users and the environment.

To abstract from a watercourse, details of surrounding landownership, water use and timings, flow records and additional ecological information may be required to prove that extraction will not be detrimental to surrounding habitats.



CASE STUDY

Romford Golf Club

Romford Golf Club installed a borehole in 2019 to reduce its reliance on mains water.

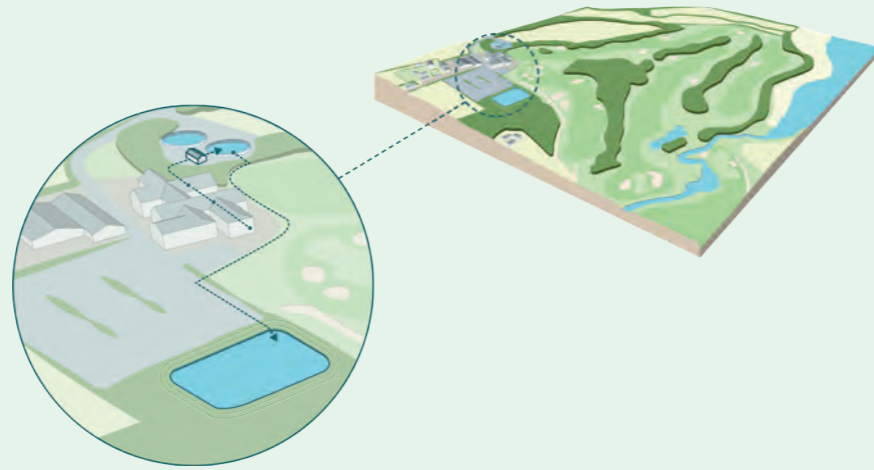
This has resulted in a significant annual water bill reduction of approximately £12,000 and a capital payback period of 5-7 years.

Romford Golf Club Case Study [HERE](#)

Water sourcing – Treated sewage effluent / wastewater reuse

If a golf course is near a sewage treatment plant, it may be worthwhile opening a dialogue to assess whether the use of treated wastewater for irrigation is possible.

This is currently not a standard practice in the UK, so obtaining the necessary agreements and licences may take time.



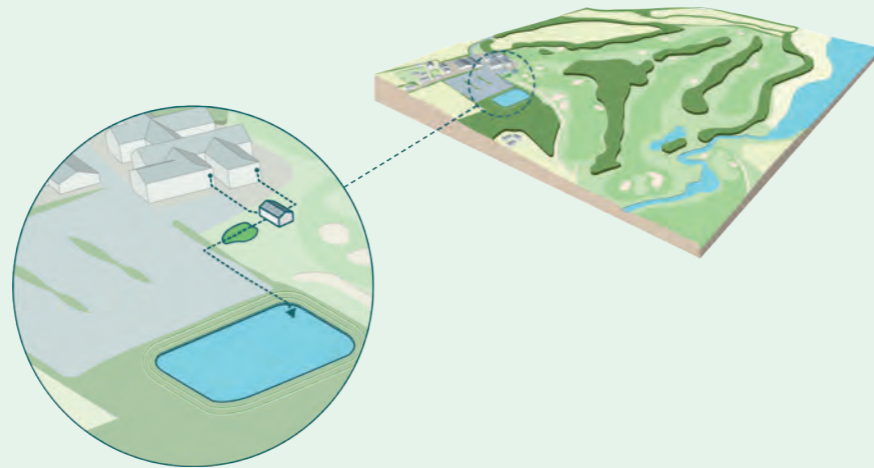
Water sourcing – Desalination, greywater

Portable desalination units are often pre-manufactured within containers, allowing on-site installation to provide between 50-1,000m³ of water per day.

The system treats saltwater by passing it through various membranes to remove the salt; this produces a concentrated brine waste product that must be carefully disposed of to prevent environmental damage. The process is energy-intensive and should be considered a last-resort solution.

78% of all wastewater created in an average building can be greywater (eg showers and sinks), which, with appropriate treatment (filtering, UV and biological), can be used to supplement non-potable water sources.

A greywater site review should be undertaken to evaluate potential volumes of greywater, treatment and storage requirements and cost-benefits.



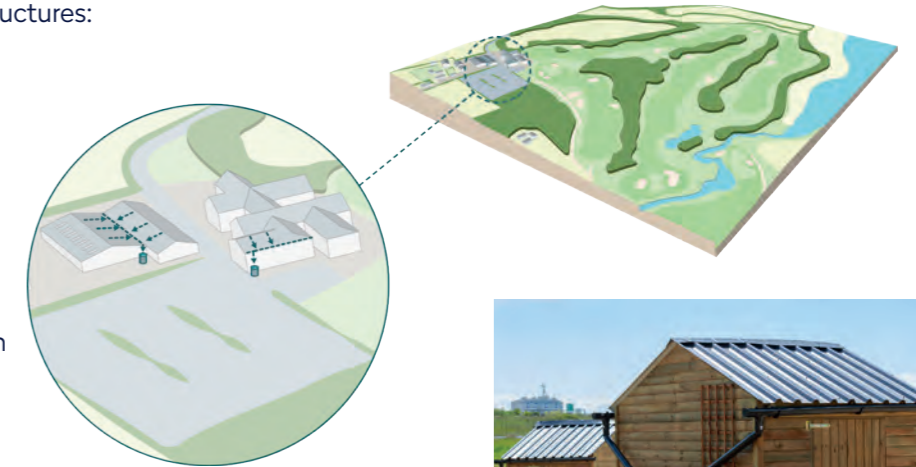
Water storage

Water can be stored in a variety of structures:

1. Above-ground tanks

The easiest option for small-scale water harvesting is to collect rainwater from existing buildings onsite and store it locally in small surface tanks (0.5-5m³).

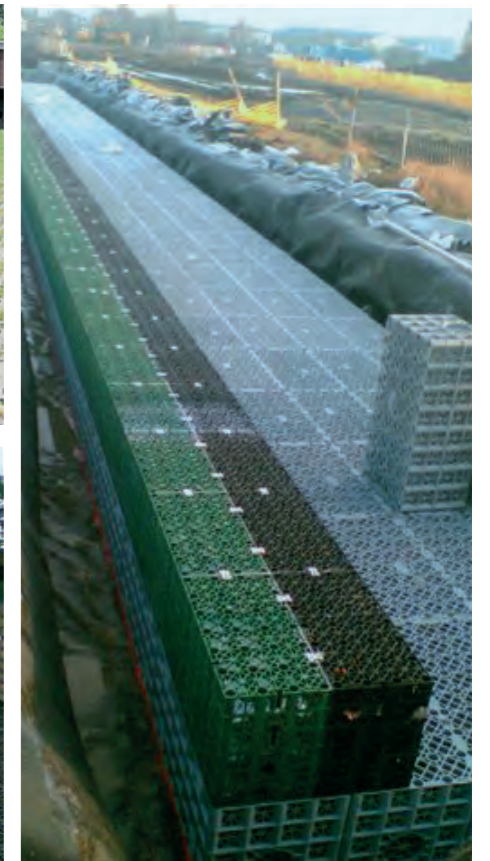
This is a low-cost, low-tech solution to supplement water supply for applications such as machine washing, spray tank filling and localised plant watering. Larger above-ground tanks (50-500m³) can store water from point sources and are generally used as day tanks to feed irrigation systems.



2. Below-ground tanks

Storage tanks can be constructed from plastic, steel, concrete, or more sustainable materials such as geocellular storage systems.

Below-ground tanks are generally more expensive than above-ground tanks, but they can be much larger and incorporated beneath surfaces such as car parks or landscape areas, allowing dual use. Underground storage can also reduce the risk of algal growth and overheating.

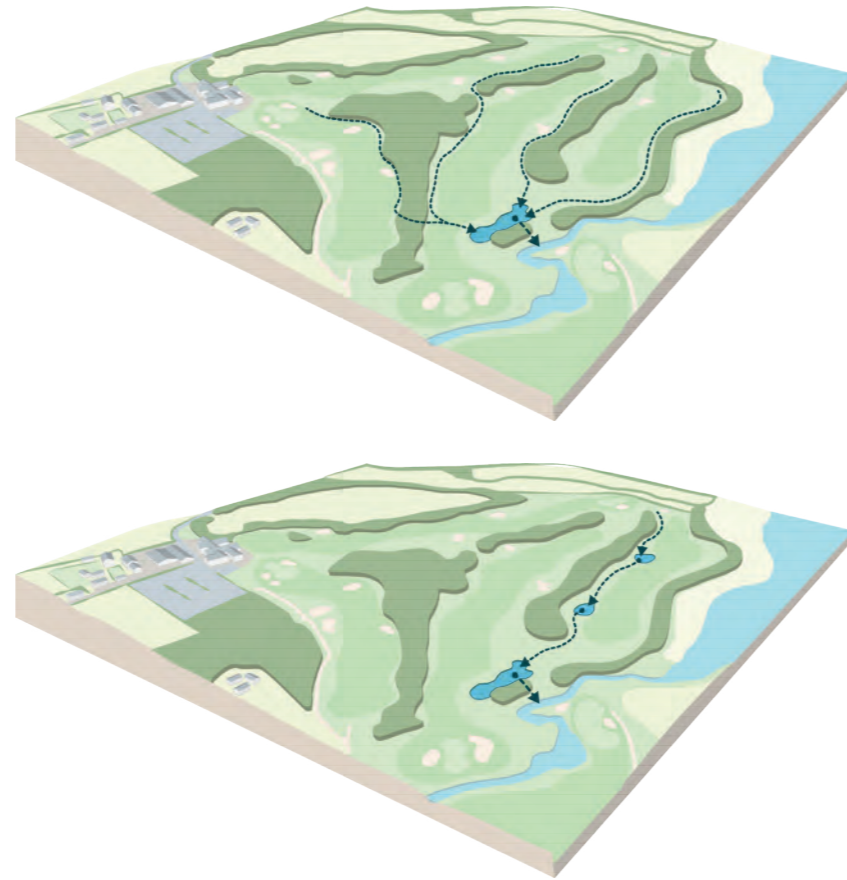


Water storage

3. Ponds

Ponds can be used as an irrigation source by drawing water from them directly or by pumping water from them into a day tank. Water treatment, such as filtration, is required before being used in the irrigation system. Ponds provide aesthetic and biodiversity value to the course, so potential impacts from low water levels during abstraction should be considered. As a result, the entire pond volume cannot be used for irrigation.

Ponds can be designed into a wider site drainage system. When connected in a cascade, they slow water movement and help treat it along the way. Ponds are most suitable for landscape harvesting schemes or smaller-scale abstraction.



Water storage

4. Reservoirs





Reservoirs are functional structures designed to store water efficiently for a long period of time. They are designed to allow maximum drawdown when irrigation water is required. A reservoir can hold a large volume of water, typically 5,000-25,000m³, but can be as large as 100,000-250,000m³.

The construction of a reservoir is more costly than a pond and requires input from more experts. However, if constructed correctly, they can provide a long-term, large-capacity water storage facility on-site.







Summary


Climate change and water availability are forcing the golf sector to think differently about water. Multiple options exist for golf courses to adapt to these changes:

-  **Planning and management:** Create a continually updated, integrated site water management action plan to guide decisive, long-term and well-planned actions on site
-  **Water use and application:** Maximise efficiency in how and when water is used
-  **Water sourcing:** Diversify water supply to reduce dependence on vulnerable sources such as mains water and abstraction licences
-  **Water storage:** Increase water storage to allow flexibility in water sourcing throughout the year.

Key actions golf clubs should take to improve water security are to:

-  Understand and monitor water use onsite
-  Upgrade and optimise irrigation practices
-  Complete a site-wide water management plan. This will allow a long-term master plan to be created for the club
-  Speak to neighbours to seek joint solutions; by working with other stakeholders and landowners, golf can become part of the wider sustainable water use discussion.

Learn more about the Golf Course 2030 Water Project and get inspired by the case studies at the link: golfcourse2030water.com

 **Access Golf Course 2030 Water Project website [HERE](https://golfcourse2030water.com)**



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.



RandA.org

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