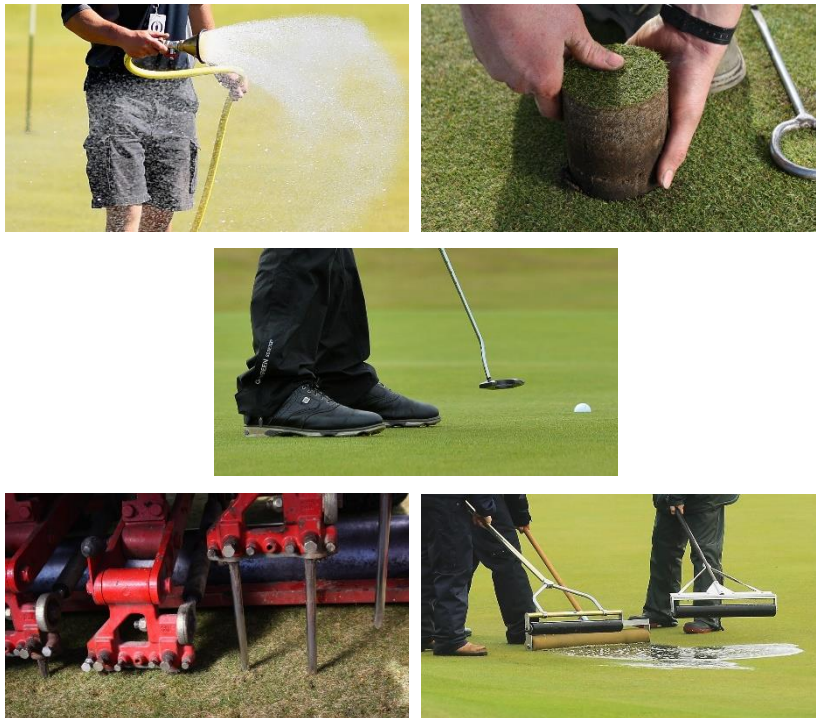


GOLF COURSE 2030



Singapore



An industry roadmap addressing challenges from, and taking opportunities presented by, the changing climate, resource constraints and regulation to secure optimal golf course condition and playability for current and future generations.

February 2020

INTRODUCTION TO GOLF COURSE 2030



Golf Course 2030 was initiated by The R&A in 2018. The R&A governs the sport of golf worldwide, outside of the USA and Mexico, on behalf of over 36 million golfers in 143 countries and with the consent of 156 organisations from amateur and professional golf. The R&A is committed to investing in developing golf and supports the growth of the sport internationally, including the development and management of sustainable golf facilities. The R&A continues to lead the Golf Course 2030 initiative, supporting stakeholders to develop the initiative in their own country or region and investing in research, education and other activities to prepare the sport for what may be challenging times ahead.

The main objective of Golf Course 2030 is for industry stakeholders to agree on a roadmap that secures optimal golf course condition and playability for current and future generations by addressing challenges from, and taking opportunities presented by the changing climate, resource constraints and regulation. The roadmap needs to meet strategic needs at regional, national and local level, and the operational needs at golf facility level.

The remit for Golf Course 2030 is the condition and playability of the main in-play areas on the golf course, from tee to green, including fairways, bunkers, green approaches and surrounds, and the primary rough. However, the roadmap will also need to highlight any impact of outcomes on biodiversity, the local community and the multi-functional capacity of the green space.

Golf Course 2030 seeks to bring the golf industry together to clearly identify the challenges and opportunities facing those developing, designing, building and managing golf courses with regards to the changing climate, increasing resource constraints, and the regulations agenda.

Golf Course 2030 centres on a range of realistic scenarios, from business as usual to, effectively, a doomsday prediction of disruption from extreme weather, water scarcity, high resource costs and limited chemical availability. In this challenging environment it is impossible to see how we can maintain the playing conditions we enjoy today without technological breakthroughs, and changes in attitudes and behaviours amongst many of the sport's stakeholders, including golf club owners, golfers, managers and green staff.

In addition to the production of the roadmap, Golf Course 2030 aims to prepare the sport for what may be difficult times ahead; to help ensure that current strategies and solutions

are effective; to uncover new solutions which can mitigate some of the challenges; and to make the most of opportunities that arise to enhance course condition and playability.

The process for achieving the objective of Golf Course 2030 will bring stakeholders together to:

- raise awareness of the potential impact of the challenges and opportunities on course condition and playability
- agree priority issues within a region or country
- undertake analysis of current strengths and weaknesses in knowledge and understanding; practitioner education; tools for information dissemination, club engagement, knowledge sharing, tracking of progress, consumer awareness and external relations
- devise and implement forward plans across key areas of strategy
- review progress on agreed priorities and goals, and once successfully addressed, move on to other issues
- engage with decision makers at golf facilities to ensure that proposed solutions are implemented
- highlight the key role to be played by course management staff in delivering an optimal standard of golf course condition and playability.

In this way, Golf Course 2030 will build upon and guide the future development of existing industry solutions and association initiatives, including those that:

- disseminate engaging messages and raise awareness
- engage and support clubs through the provision of best practices, analytical tools, golfer engagement materials and recording of key performance data
- enable credible reporting of evidence of industry best practice and industry progress
- facilitate knowledge sharing
- recognise credible leadership activity in course management.

What is optimal course condition and playability?

Optimal course condition and playability is a subjective and variable term. It reflects the potential for any golf course to provide year-round access to firm playing surfaces which are fit for purpose. The potential of any course will be limited by many factors. Optimal condition and playability could be considered as:

Optimal course condition and playability = Potential x [Site conditions + Design + Construction + Resources (machinery, manpower, materials) + Quality of Decision-Makers/Management + Weather + Golf Objective + Amount of golf/maintenance traffic + Revenue + Regulation]

The Golf Objective in this equation reflects the target market of the course and this can range from Championship standard (challenging), through Recreational standard (appealing to all golf handicaps), to Beginner standard (introductory level to the sport, with limited challenge), or any combination of these standards.

Optimal performance delivers the potential of a course for as much of the year as possible and as consistently as possible.

The optimal performance in terms of the condition and playability of any golf course will vary through fluctuations of the limiting factors, e.g. seasonal weather. Different types of

courses will be more or less prone to some of the fluctuations, e.g. thanks to their natural drainage qualities, links will tend to retain greater consistency in terms of optimal performance than will parkland through periods of wetter weather.

GOLF COURSE 2030 STAKEHOLDERS

The industry stakeholders to be engaged in Singapore's Golf Course 2030 process are:

1. Sports Singapore
2. R&A (Singapore)
3. Singapore Golf Association
4. Asian Golf Industry Federation
5. Asian Tour
6. Club Managers Association (Singapore)

The initiative also needs to engage with external stakeholders, such as other sports (including the Olympic movement), Government, NGOs, the general public and non-golf media.

DRIVERS FOR ADAPTATION



There are considered to be three main drivers impacting on our ability to secure optimal golf course condition and playability for current and future generations; climate, resources and regulation. Golf Course 2030 must assess how the impacts of climate change, availability of resources and increasing depth of regulation will affect day-to-day operations at the golf facility.

1. Climate

Changes in the climate and more climatic extremes cause problems for course managers. Turf does best in an environment with limited variability, and changes in weather patterns will result in the need for course management to adjust to such circumstances.



Climate predictions for Singapore suggest that the Island is heating up twice as fast as the rest of the world – at 0.25 degrees Celsius per decade, according to the Meteorological Service Singapore. Singapore's maximum temperatures could reach 35 to 37 degrees C by year 2100, if carbon emissions continue to rise at the same rate.

In addition, sea water levels are expected to rise and by year 2050 potentially inundating parts of coastal Singapore. The challenge for golf courses in Singapore will be to prepare for such extremities in weather. This includes ensuring adequate water supply for Singapore's golf courses through the use of technology, choice of turf and building larger or deepening existing water storage bodies on the golf courses; as well as raising the elevation of golf holes most susceptible to tidal inundation.

2. Resources

The resources considered essential for today's golf course are likely to become scarcer and cost more. This applies to water, pesticides, fertilisers, sand, energy, labour, etc. Resource use on the golf course varies dependent on the type of course, e.g. links or parkland, and on the intensity of management related to the area of the course being treated. A golf hole (see image to left) is made up of a number of different areas, which tend to receive different levels of treatment.

The greens (1 on image) are the most intensively managed part of the golf course, yet only take up around 1 hectare of the 60 hectares of an average 18-hole golf course. Fairways (2) are less intensively managed but cover around 16 hectares, so any single input will amount to a greater quantity than a similar application to greens. The teeing grounds (3) and green approach/surround (4) are each of a similar area as the greens and generally receive an intermediate level of management between that of the greens and that of the fairways. The bunkers (5) are a sand-filled hazard, whose number can vary on any individual golf hole. The maintained rough (6) receives very limited management, mainly mowing. Up to 50% of the area of a golf course can be natural habitat, providing a haven for wildlife.

Under this driver, the golf facility itself needs to be considered as a resource in how it contributes towards issues such as community (multi-functionality), health/well-being, and biodiversity.

3. Regulation

Often directly related to resource issues, water, pesticide and biodiversity regulations are already having an impact on course condition, playability and cost. Regulation on other issues such as fertilisers, energy and waste will also influence the future management of our golf courses. As with the other drivers, the impact of regulation will vary dependent on the type of course, e.g. links or parkland, and on the intensity of management related to the different parts of the course.

Legislation in Singapore will need to be considered when assessing impacts on course condition, playability and cost and in devising potential solutions to regulation-led limiting factors.

The main legislation in Singapore likely to impact on golf course condition and playability has been transposed from the European Union Directives on Water¹ and the Sustainable Use of Pesticides². These are:

Water

With an area of about 710 km² and growing urban areas, Singapore lacks the space to collect and store all the rain that falls on it. Through a network of rivers, canals and drains, rain that falls on two-thirds of Singapore's land area is channelled to 17 reservoirs.

Singapore has two separate systems to collect rainwater and used water.

1. Rainwater is collected through a comprehensive network of drains, canals and rivers and channelled to the reservoirs before it is treated for drinking water.
2. Used water is collected in a network of underground sewers that lead to a water reclamation plant. Separate systems ensure that the waterways are free of pollution

Minimising pollutants from the catchment is important for maintaining good water quality in water bodies. Nutrients from sources (e.g. pet waste, food waste, fertilisers, detergents and sediments) in the catchment can have an impact on the reservoir's ecosystem. These nutrients are food for algae, which are microscopic aquatic organisms. These nutrients coupled with favourable conditions such as warm water and sufficient sunlight may encourage rapid algae growth.

Singapore's Public Utilities Board and National Environment Agency work as a team to monitor and control water pollution in the catchment. Through regular inspection and water quality testing, the team has built up a database that helps them identify potential pollution sources. If an area or a facility is found to be polluted, recommendations on better housekeeping practices and proper pollution control measures are provided to the venue owner.

During pollution incidents such as oil or chemical spills, the team will move in quickly to contain and remove the pollutant. Subsequently, with the help of observations from inspections and water quality data, steps are taken to trace the source and enforcement action may be taken.

In terms of water supply to golf facilities, regulation is contributing to:

- increasing cost of public mains and abstraction sources
- abstraction licences being more difficult to obtain and on less generous terms
- restrictions in supply and use increasing during periods of shortage
- monitoring of water quality is increasing, in part as a measure to tackle pollution.

Pesticides

Singapore's *Control of Plants Act* regulates the use of pesticides in plant cultivation. Pesticides may only be used in cultivation of plants if the pesticide is registered with the Director-General National Parks and the individual who uses it is a certified pesticide operator or the use is supervised by such an operator. These operators must also make sure that the pesticides are properly stored, disposed appropriately, and the pesticide residue on the cultivated plants must be below the prescribed level.

For pesticides, regulation is contributing to:

- greater focus on Integrated Pest Management
- the chemical option in the Greenkeepers toolkit is limited
- more controls over the sale, storage and use of pesticides.

Golf Course 2030 also has to take a global perspective and its objectives are aligned with the UN's 2030 Agenda for Sustainable Development³. The United Nations Sustainable Development Goals (UN SDGs) provide a valuable reference and golf can contribute directly to the following goals:



6 Clean Water and Sanitation
Water quality and pollution prevention. carbon



7 Affordable and Clean Energy
Transition to cleaner and renewable energy.



9 Industry Innovation and Infrastructure Habitat
Innovation to mitigate against challenges.



12 Responsible Consumption and Production
The industry working together resources speaking with one commonality of language and messaging.



13 Climate Action
Adaptation, ecosystem services and sequestration.



14 Life Below Water
Protection of water bodies and their wildlife, pollution prevention.



15 Life on Land
protection, enhancement of biodiversity and pollution prevention.



17 Partnerships for the Goals
so it is safe and responsible use of voice, to ensure that there is

¹ Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing

a framework for Community action in the field of water policy

² Directive 2009/128/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for Community action to achieve the sustainable use of pesticides

³ Transforming our world: the 2030 Agenda for Sustainable Development

FUTURE SCENARIOS



To produce a roadmap that secures optimal golf course condition and playability for current and future generations, there needs to be a consideration of what might be. The drivers for adaption pose many potential scenarios. Presented here are three 2030 scenarios, from business as usual to a potential doomsday prediction of extreme weather, water scarcity, high resource costs and no chemical availability. These scenarios should be related to the current optimal performance of golf courses. It should also be borne in mind that there is a sliding scale between the two extremes cited in scenarios 1 and 3:

Scenario 1. Limited change from the environment that now exists as alternative technologies, management solutions and behavioural change address the challenges posed by climate, resources and regulations and optimal golf course condition and playability is secured.

Course condition and playability is comparable to that available today. Drivers for change are weak and opportunities to enhance the potential of golf courses, their performance and environment will not be realised. There could be extra costs for golf businesses that position themselves as early adopters of new technologies, which may be passed on to the customer, so golf could be more expensive.

Scenario 2. Severe restrictions in the availability and use of synthetic chemical plant protection products, together with 50% less water being available for irrigation compared with current levels. Alternative technologies, management solutions and behavioural change partially address the challenges posed by climate, resources and regulations.

More months of the year will see greater course closure due to extreme weather events, notably flooding, and more damage and scarring to turf from water and pesticide restrictions, related to hotter summers and wetter winters.

The condition and presentation of surfaces will see periodic troughs, with golfers having to accept a different style of golf and course performance, notably in terms of reduced green speed. There is also the prospect that course condition will improve as turf naturally adapts and firmer surfaces become the norm. Golfers will appreciate and enjoy the seasonal change in course appearance and playability.

There will be increasing pressure on golf facilities to survive as the cost of maintenance increases. This will lead to opportunities for a greater flexibility in course design, e.g. fewer

holes, less maintained turf, and an increase in diversification to provide multi-functional green space.

Golf businesses will need to spend more on new technologies and more expensive resources to sustain course condition and playability. Golf will be more expensive to play. Golf facilities will also see a decline in income as deteriorating conditions reduce the attractiveness of the sport, though those that embrace the opportunities for a different type of golf and diversification of land use will thrive.

There will be some course closures, notably those wholly reliant on water and synthetic chemical plant protection products to keep a grass cover, and this will impact on the contribution of golf to the local, regional and national economy.

Scenario 3. The banning of all chemical plant protection products and fertilisers, together with 75% less water being available for irrigation compared with current levels. Alternative technologies, management solutions and behavioural change fail to address the challenges posed by climate, resources and regulations.

There will be longer periods of course closure, damage from extreme weather events and disease/pest/weed incidence and the high cost of resources results in loss of customers and permanent closure of many facilities. There are serious consequences for the contribution from golf to the local, regional and national economy.

The combination of hotter summers and less water being available means that only those with sustainable sources of water for irrigation can retain a reasonable cover of grass. Only those that can afford course renovation, a secure water supply and significant levels of extra labour or automation of certain maintenance practices will be able to cope with these pressures and, even in such situations, golf will be regularly played on inferior surfaces compared to what we enjoy today. The use of artificial turf increases for those that can afford it as the problems in managing natural turf become insurmountable.

PRACTICAL ACTION

Guiding Principles for resilient and sustainable golf courses



The main objective of Golf Course 2030 is the production of an industry roadmap that secures optimal golf course condition and playability for current and future generations by addressing challenges from, and taking opportunities presented by, the changing climate, resource constraints and regulation. There are, however, a number of fundamental, universal practical principles for golf course development and management which extend across the decision-making culture, agronomic practices, and broader considerations of golf's impact on and contribution to nature and local communities. The following is offered as a guide to those in decision-making positions.

1. Plan over the longer-term and operate under consistent policies, which are documented.
2. Prepare for future challenges. Consider the predicted impact of the changing climate (such as flooding, coastal erosion or drought), the availability and costs of vital resources and the constraints placed by regulation.
3. Recognise the professionalism of well qualified course managers and their staff. They will play a vital role in securing optimal course condition and playability.
4. Safeguard the reputation and well-being of employees, employers, golf facilities and the sport itself through strict compliance with the law. Decision makers at golf facilities must support their greenkeepers in adhering to this policy.
5. Create the right environment to produce healthy turf, which is fit for purpose, with adequate access to light and air, and good drainage and a biologically rich growing medium. Select and manage for grass species best adapted to local conditions.
6. Water scarcity and cost are going to be increasing issues for golf. Golf courses should be designed, built and managed to conserve water, using the least required to produce healthy turf and firm playing surfaces. Where feasible, water for irrigation should be generated in situ, through recycling drainage, rainwater harvesting, irrigation reservoirs and other technologies. Where feasible, water derived from non-potable sources should provide the irrigation source. Grass selection should be targeted at species which are fit for purpose, but which require the least amount of irrigation water.
7. The trend is for increasing pressure on pesticide availability and use. It is likely that they will continue to be removed from use. Eliminate reliance on pesticides, identify and

transition to alternative solutions to prevent and manage disease, pest and weed problems. Select and manage for grasses which are fit for purpose and which have the greatest natural resistance to disease infection, pest attack and weed ingress.

8. Fertiliser use is likely to be regulated as part of pollution prevention measures. Select grasses which are fit for purpose with minimal nutritional input and use products which offer the greatest protection to the environment.
9. Excessive organic matter accumulation creates weak turf, prone to stress and susceptible to disease infection, pest attack and weed ingress. Management practices used to control organic matter accumulation, e.g. various forms of scarification and top dressing, cause stress to turf. Select and manage for grasses which are fit for purpose, but which have a slow natural rate of organic matter accumulation and implement management practices, i.e. irrigation and fertiliser, responsibly in a manner which minimises organic matter build up.
10. Cutting height has a major influence on turf health and the requirement for maintenance, with over-close mowing inducing turf stress which requires greater water, fertiliser and pesticide inputs to correct. Mowing heights should be implemented to sustain grasses which are fit for purpose, but which are inherently healthy.
11. Energy derived from fossil fuels is going to become more expensive and golf facilities should be transitioning to cleaner, renewable sources of energy. Course design, construction and maintenance should be focused on energy efficiency, utilising grasses which are fit for purpose, but which require the least input of maintenance resource.
12. Disposal of waste to landfill will become increasingly expensive and socially unacceptable. Course design, construction and maintenance should focus on preventing waste and maximising reuse and recycling.
13. Biodiversity loss is a major global concern and golf courses have the potential to conserve and protect wildlife. Golf courses should be designed and managed to provide quality habitat for as wide a variety of native wildlife as possible.
14. Golf has a responsibility to wider society and the design, construction and maintenance of facilities should focus on making a positive contribution to local communities, such as by providing a multi-functional venue for wider community integration and recreation.
15. Objective assessment of the condition of playing surfaces, particularly the putting surfaces, on the golf course is required to monitor the impact of the challenges facing greenkeepers, the implementation of research outcomes and adaptations in management. This could include firmness, smoothness, trueness, reliability, speed, etc.
16. The recording of key resource metrics for course management, e.g. water, chemicals, energy, waste and biodiversity. Sustainability reporting on course operations is required on a facility, country, region and international level. This is necessary to monitor the impact of the challenges facing greenkeepers, the implementation of research outcomes, adaptations in management and compliance with regulations.

PROCESS

The main objective of Golf Course 2030 is to help stakeholders develop a roadmap and specific action plans that will help those developing, designing, building and managing golf courses to address the challenges and opportunities from the changing climate, increasing resource constraints, and the regulations agenda facing the industry over the coming decade.

There will be a number of necessary steps in the roadmap towards the production of action plans. The detail of this process will vary depending on the nature of the challenges and opportunities faced by any region, country or facility. Pulling this together should be a collaborative industry effort.

The following process is suggested as a guide:

1. Bring together (or further develop) stakeholder group to ensure the initiative is relevant to the region or country. Ensure group membership is balanced with strategic and technical representation of people focussed on the long-term interests in the future of the sport.
2. Stakeholders identify the challenges and opportunities and agree on priority issues to be addressed over the next 3-5 years.
3. An action plan to be produced which outlines activities to address priority issues. The activities could be awareness raising/communication, campaigns, stakeholder education, research, demonstration projects, etc.

4. Implementation

Action Plans to be taken forward over an agreed time period (3 to 5 years is suggested), with regular (annual) review. Progress should be monitored using Key Performance Indicators.

5. Communicate and educate

Ensure that all stakeholders are aware of the implementation plan and monitoring process. Provide education and interim communications as and where necessary to achieve ongoing stakeholder buy-in.

6. Reporting

Report on progress and level of success in addressing priority challenges. If the priority challenges have been addressed at the end of implementation, return to Step 2 in the Process.

ANALYSIS OF GAPS, STRENGTHS AND WEAKNESSES



For golf to prepare itself for the future, possibly the immediate future, there is a clear need for stakeholders to consider how the sport can address the challenges and opportunities to how we perceive and enjoy the sport today. An analysis of gaps in knowledge, and strengths and weaknesses of approach and solutions should be undertaken to identify what needs to happen in relation to the identified drivers of climate, resources and regulations, if we are to maintain playing surfaces in line with those we enjoy today. This process should include a review of the likely scenario(s) over the next 50 years, so that the gap analysis can list priorities for identifying solutions. The devised solutions should include the adoption of known best practice, technological innovation, greenkeeping adaptation, attitudinal approach by stakeholders, behaviour change, research, education, etc.

The strengths and weaknesses analysis can inform the structure of pathways for innovation, research, behaviour change and education, as well as ongoing development of club support programmes - together with stakeholder roles, responsibilities and accountability

PRIORITY ISSUES

Golf has many a times been misunderstood by the wider population in Singapore. It is imperative for the golf industry to educate and share information on the sport's contributions to environmental sustainability, biodiversity, employment and its overall relevance to Singapore.

The agreed priority issues for Singapore golf over the next 10 years revolve about:

1. Relevance of Golf and Young Golfers – Singapore golfers are aging and golf remains an expensive sport to undertake when compared to popular millennial activities such as gym workouts and Mixed Martial Arts (MMA), etc.

Access to golf courses and driving ranges is increasingly limited as the Singapore Government closes more golf facilities for alternative uses. As a case in point, the land owned and operated by Jurong Country Club and Raffles Country Club has been taken over by the Singapore Land Authorities. In 2021 and thereafter, two

more golf courses will disappear – Keppel Club will become a new housing precinct and Singapore's most popular public golf course Marina Bay Golf Club may become part of Singapore's next financial district. In 2030, Orchid Country Club could lose its land to residential development. By 2040, it is a real possibility that Singapore, once home to 13 clubs may only have 5 golf clubs. Growing the game now and to proof of its economic relevance is critical to secure the sport's longevity.

2. Economic Benefits of Golf - Golf owns a compelling global stature with 61 million registered golfers, 31 million recreational golfers of which 10% of golfers travel overseas to play.

Sentosa Golf Club (SGC) with about 1,600 members plays close to 90,000 rounds of golf on an annual basis to support golf tourism. An estimated 20% of spectators to the two major televised golf events on Sentosa Island and SGC are visitors from overseas. They contribute to Singapore by way of outright tourism receipts (hire of rooms, restaurants and visit to attractions) and investments made via net working opportunities provided at these golf events.

SGC is also well known as the home to Singapore's business fraternity and takes pride of place amongst members and industry leaders who host and entertain their local and international client base at the club. There is a continued need for the club showcase this relevance economic relevance to decision makers within the Singapore Government.

3. Health Benefits of Golf – Showcase the health benefits of the game and that golf course land can co-exist with nature. Growing junior participation will lead to a healthier and better-rounded lifestyle for Singapore residents, entrenching the game's positive traits with the next generation Singaporeans.
4. The Environment - The need to raise awareness around sustainable practices in golf is imperative. Climate change in Singapore is likely to result in extreme weather conditions (rising temperature, humidity, unpredictable intense rainfalls followed by drought conditions) in the next 20-30 years. The challenge will be for Singapore's golf courses to adopt technology and the innovative golf agronomic practices to overcome climate change and future restrictions with pesticide use and resource availability (sand, water, land availability, water etc).
5. Solid waste management - Growth in Singapore's population and economy have contributed to an increase in the amount of solid waste disposed of by about seven-fold from 1,260 tonnes a day in 1970. With waste quantities projected to continue increasing with growing affluence and population, Singapore's main challenge in solid waste management is the setting aside of land for waste disposal in view of the limited land stock in Singapore.

Singapore needs to follow through with the strategies encapsulated in the diagram below for a more sustainable solid waste management system.



SGC's ongoing KeepItGreen and sustainability efforts are aligned with the Singapore Government's environment and green policies. The club is taking a lead in sustainability and encouraging like-minded golf clubs to do the same as we recognise that the collective industry can do better in showcasing the relevance of golf and golf courses in Singapore and make a positive impact to climate change.

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