



HOIANA SHORES GOLF CLUB, VIETNAM

Site Visit & Recommendations Report

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1. INTRODUCTION

This is a recommendation report created by (GEO) Sustainable Golf Foundation on behalf of Hoiana Shores Golf to support them on their journey to being the most recognised sustainable golf facility in the country.

The report should support the journey toward becoming a GEO Certified Facility by Q2 in 2025. There will be a visit by a independent verified from the sustainable golf community scheduled



Figure 1 - Indicative site photos (Source: GEO)



2. HIGHLIGHTS

As part of the continued support of Hoiana Shore by GEO, series of Sustainable Golf Highlights content has been assembled, with the help of the course management team at Hoiana Shores.

These will be uploaded to the sustainable golf leaderboard and will mean Hoiana has the most highlights of any Asian golf facility once completed.

Found and local materials re-used

Across the property we are using either found washed up driftwood - found during our beach cleans – or locally sourced wood from trades people to make our benches, furniture, signage and markers. The local driftwood it used on the course and in out of play areas where it blends and weathers well to fit in our native out-of-play areas. The local wood from trades people is very suited to the climate and resists the weathering – as it ages it blends well into the native landscape colours.



Reduce packaging in supply of materials

Through close collaboration with local distributor, we managed to arrange for larger sizes of containers for liquid fertilizer. This helped to reduce plastics, with one supplier now switching to a cardboard solution in bigger batches to reduce number of packages and remove hard plastics from the supply chain.



Local charity events

In 2023, we hosted a golf charity event which raised over \$10,000. Before the event we had visited local community nursery and primary schools that needed upgrades to their buildings. As a result of the fund raising, we were able to upgrade their toilet facility and provide new furniture for the classroom. We also have a wider Hoiana Cares charity that has annual fund to local health care charities focusing on paediatric care.



Recycle clippings for local staff and community

As part of the green waste generated by our habitat management program and routine turfgrass practices we generate a useful green waste product. That product is stored at our composting areas and then collected and taken away by, firstly our staff, for home growing plants and foods at home and then to local community.



Reduce water use through irrigation audits

Due to the high winds and course design, we have had to be very mindful of head placement, nozzle type and arc. We are assessing this every day to ensure we are minimising water waste and the water over throwing into the native rough. We are using the Rain Bird IC system to help us keep a close eye on the water amounts used and the individual head control allows us to be very precise about water use, especially in certain wind conditions.



Beach clean ups

As part of our contribution beyond our course, we volunteer to take part in local beach clean ups, using our vehicles to help transport collected waste material and remove it from the beach. These are done regularly, and any larger pieces of driftwood are brought into the golf course and used for furniture or part of log piles and habitat in the native out-of-play areas.



Clean up and repaint course furniture to prolong use

Given our exposed location on the coastline, our course furniture, flagsticks, hole cups, benches etc. can get affected by the salt and UV exposure. We are careful to renovate these from time to time, sand down and repaint to prolong their use and avoid having to purchase or ship in replacement parts.



Use natural wood and bamboo for hand tool and storm protection

We are fortunate to have good access to strong local building materials and local timber felled on high winds. We are collecting the felled timber for fencing, posts etc. and the bamboo material is being used to brace roller doors against high storm winds and for the handles on our hand tools – which we have found to be more durable than the standard metal handles.



Use all native on-site sourced sand in bunkers – zero import

All the sand we have used on the course for bunker top up and topdressing needs are all met by the native sand we have on site. We are in close communication with the other parts of the property to ensure any sandy material generated during their construction will also be passed to us to ensure we maintain a good long term supply. We are now considering expanded storage bays that will allow us to store sands and more space for green waste.



Regular soil moisture checks and aim to reduce target %

As part of weekly course check we use the POGO system to check all our greens for target % soil moisture levels – around 18% is our aim, and we can maybe go a bit lower depending on the grass response. This will all inform the irrigation cycles. As a result of this, in the wetter times of year we can easily stop irrigation for some days. We also adopt a deeper infrequent cycle at certain times of year to encourage deeper root growth – again to ensure the grass is more resilient and improves its response to days when we turn irrigation off.



Regular audits of golfer play patterns to seek reductions in turf area

We are spending time to watch what areas of the course are getting heavy wear from extensive golfer traffic. Some days we have over 200 golfers on the course and it is important to ensure we have turf space for them to play – equally, we can see areas that they do not use or areas of green where they are overly worn out. We can then adjust grassing lines to make the best of the design and course presentation – aiming to reduce overall water demands. We have reduced by around 4 hectares since we opened.



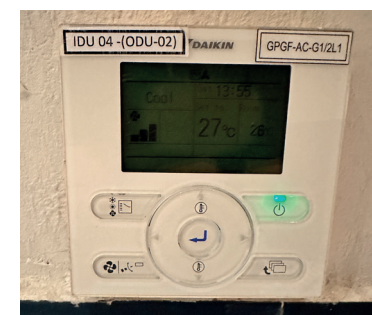
Hosting education events

We hosted the recent CCMA / AGIF event for the BMI education program at the clubhouse function room. The event included presentations for the course team about our work with OnCourse and the sustainable golf practices we are implementing on the golf course. We also took a tour of the maintenance facility and course to share the set up and presentation goals.



Using low energy practices and LEDs for course and maintenance facility

All out light fixings in the maintenance building are using LED bulbs as a standard, all lighting has signs and staff educated to turn off lights and only use when necessary and lastly set the AC to a higher temp (27C) to reduce AC run times. Our building has good large window apertures with blind to control internal light and temperatures and reduce our energy use.



Modest green speeds

We have a unique set of greens for golfers in Asia, very large and undulating playing on TifEagle. With such slopes and a resort based clientele we cannot have greens running too fast to avoid slow play and frustration. We keep our greens at a modest 9.7 for day to day play. We can speed this up for tournament play, but we do not want to stress out the grass. In the winter season, when growth slows, we can avoid too much mowing and use newly purchased rollers to prepare the greens for play.

Grass management

We have a well-established set of Zeon Zoysia fairways, which require very little fertilizer and have very low levels of disease present, mainly we think due to the density of the sward. The grass is well suited to this climate and was grown in an onsite nursery prior to operations – making this even better adapted to the microclimate of Hoiana Shores. We prefer the cultural practices of dew sweeping, verti-cutting and solid tining to maintain the health of the turf while slowly controlling OM build up in our sandy soils.



Encourage diversity of golfers

We have initiated a number of golf encouragement programs aimed at attracting female golfers and families to the course. Dedicated women's only events and teaching opportunities are provided as well as local family outreach has been done. A junior golf starter program has been trialled at no cost for the local community. We provide free equipment for the new golfers to try out in lessons and at the practice area so they can try the sport with the barrier or cost.



Driftwood nests

We have been able to source local driftwood from our beach clean up efforts and use this as part of the habitats created in the rough areas. This year we have seen local birdlife start to use this small pieces of wood as nest areas for their new chicks. We have recorded when and where these instances are occurring and will plan our rough management accordingly in future years to encourage more nesting birds to take residence in Hoiana Shores.

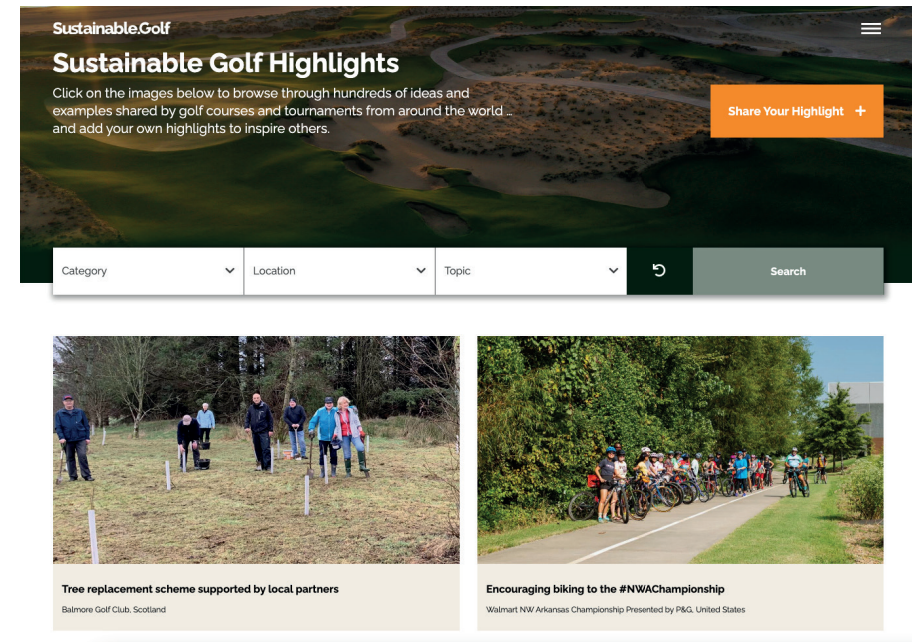


Local wildlife thriving

Year on year since opening we are seeing an increase in the diversity and types of wildlife using the golf course as their home. We have a unique native dune scrub habitat in the region, compared to the man made *Casurina* plantation and agriculture fields around us. These enables us to attract native wildlife and provide a valuable and increasingly rare habitat for them in Hoi An. We record when and where they were all spotted for future reference. The 2nd tee area has been a popular spot for nesting birds in 2024.



Example of the webpage where the highlight can be placed online by GEO once reviewed and approved by the course management team.



3. IMPROVEMENTS

This section will cover the previous recommendation made at the end of the construction stage of activities and then go on to detail the recommendations medium and long term identified during the recent site visit work.

Previous recommendations

Verifier's previous comments and recommendations from GEO are included in this section. The recommendations have been categorised by time and cost to help with a phasing of improvement plans.

Verifier Comment from 2020 - post certification:

Over my visits to the Hoiana Shores Golf Course project, I've seen the site develop into a superb golf course, with restoration of and preservation of native coastal vegetation on the dunes, careful selection and care of grasses that can produce a high quality playing surface with minimal inputs, installation of an irrigation system that can be adjusted to apply the minimal amounts of water required, the provision of training to scores of local students, and the creation of hundreds of jobs.

Micah Woods

Verifier recommendations

The recommendations and comments below were provided to Hoiana Shores in 2020 upon completion of the GEO Certified® Development process. As part of the ongoing commitment to sustainable golf at Hoiana Shores, these recommendation still remain relevant to the future certification and improvement efforts at the course. These recommendations should continue to be pursued and it is pleasing to see many of them have been achieved by the team already. Guidance is provided in the section from GEO on some practical actions and considerations for the medium and long term improvements to the golf course and operations of the facility.

The recommendations were:

1. The drainage water from the golf course and the maintenance facility goes directly to the reservoir, and from there can overflow directly into the ocean. I recommend testing the reservoir water quality every three months for total petroleum hydrocarbons (TPH), for nitrogen and phosphorus, and for the pesticides that have been used on the golf course in the previous three months. This systematic testing can be used to confirm that nutrients and pesticides and TPH are not entering the reservoir. If testing finds that they are, steps can be taken to stop that contamination.
2. Continue to consider and look at ways to integrate some form of open access through the golf course property and beach area.
3. Plan to host and facilitate industry events such as field days, training and tours to share knowledge of Hoiana Shores' practices, learnings and initiatives.
4. Maintaining the success of the college is key and continuing to upskill those workers that are entry level to allow career progression for those locals to gain skills and contribute to the quality of course presentation at the facility.
5. Outside of the industry, utilise the high quality golf course and levels of achievement you have reached to showcase golf and your project's approach to local and/or national government as an exemplar facility demonstrating the quality and restoration of the land that golf can bring to a site if done well.
6. Continue to ensure best practices are keep in terms of pollution prevention at the Maintenance Facility (refer to GEO advisory note previously circulated).
7. Continue to develop sustainable best practices within the clubhouse area and ensure the facility can be beneficial to golfers and non-golfers alike. (refer to GEO advisory note previously circulated).
8. Seek to put in place programs to encourage the development of new golfers, either on your staff or from local groups so you can begin to inspire a next generation of Vietnamese golfer and increase staff morale and loyalty at the facility.
9. Establish some form of relationship with local schools or community groups to provide them with some controlled access to the property either for sport or for environmental outdoor education programs.
10. As part of the commitment to beach clean-up and the dynamic environment along the dunes, continue to be resourceful with your reuse of beach materials and 'waste' that can be re-used in the ongoing upkeep and maintenance of the golf facility.



Maintenance Facility Drainage & Reservoir Monitoring Nature

The current design of the maintenance facility drainage has two problems:

1. There are no oil interceptors in the drain lines. These are filter sumps that catch Detergents; Oil residues; Brake dust and Other waste from the washdown area and parking areas.
2. The main drain lines from the maintenance facility are connected directly to the reservoir, not the mains wastewater pipes. This presents a risk of pollution to the irrigation water reservoir with no safety checks.

As a minimum 6 monthly testing of the reservoir water should be done in the rainy and the dry season. This should be testing for the presence of hydrocarbons and Total Dissolved Solids in the irrigation reservoir.

As a next step there should be budget allocated for at least one oil interceptor and silt separator arrangement installed at the main outlet coming from the maintenance facility. GEO can provide more details of this arrangement as required.

This should be installed in addition to the silt traps for grass and clippings that already exist in the surface water drainage system today. It should not replace the current silt traps.

Maintenance Facility Upgrades

Resources - Financial - Nature - Climate

Storage

The storage areas for bulk materials (sands, green waste) are currently inadequate for a facility such as this. There should be plans made to construct a new dedicated area to bulk waste storage, turf nursery and waste management / compost.

Map 1 overleaf indicates a potential area of around 2,000m² that could be used to create this new storage facility. Proper secure fencing and an enhanced planting boundary (indicated on Map 1) should also be considered as part of this work to screen the maintenance area better from the golf course.



Figure 2. Example of storage bays

Solar Power

Resources - Financial - Climate

The steps have been taken to install extensive solar panel array on the roof of the maintenance facility, which is a very positive step and hopefully will contribute significantly to the energy demands of the maintenance facility. The important step of securing connection and full usage of the panels now needs to be implemented as soon as it practical to make sure the site is benefiting from this investment.



Figure 3. Solar Panel already installed but not being used





Map 1: Sketch area of a possible storage area alongside the maintenance facility.

Building Colour

Nature

The external colour of the maintenance facility is making the building visually stick out more in the natural landscape. The colour choice is poor, and a fair more sympathetic colour should be selected and the building repainted. Suggestion would be more a sand or neutral colour - taken from the surrounding landscape colour palette would be more suitable.

Washdown

Resources - Financial

There could be some upgrades made to the vehicle washdown bay to improve efficiency of the equipment and reduce risk of pollution prevention

1. Install a closed loop wash system. These can be purchased ready to go, or a bespoke design for clipping settlement can be installed – See GEO guidance notes on this.
2. A bunded area should be created with sloped floor to trap run off and reduce surface water overflow into other areas of the yard or off into the soft landscape.
3. The installation of a heavy-duty large drain sump to make capture of clippings and washdown waste easier, as well as the manual removal and disposal of the waste material.

Figure X (opposite) illustrate a manual clipping settlement system to allow a cleaned closed loop system to be more cost effective set up.

Machinery

Climate

The transition of the machinery fleet toward electric and hybrid vehicles and mowers should be instigated in a phased approach as and when old machinery reaches the end of its life cycle or requires significant new parts investment.

Note that this transition away from fossil fuels may mean infrastructural investment in the electric supply systems and wiring in the maintenance buildings.

Consideration should also be given to expanding the machinery kit list to

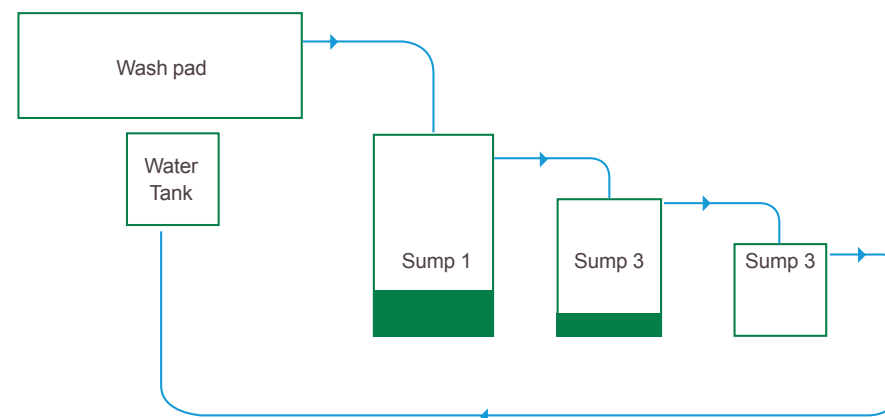


Figure 4: Diagram of a staged grass clipping settlement system for cleaning washdown water and recycling it.

include an excavator and tractor with a front loaded attachment to improve the efficiency of working for the grounds maintenance team and gain better access to the local on-site sands for topdressing purposes.

Rainwater Capture

Resources - Financial

Given the climate and frequency of rain events at Hoiana, consideration could be given to some form of rainwater harvesting system off the roof of the maintenance building. This water source could be used for vehicle washdown or general wash down of the yard or irrigation of landscape and turf nursery around the facility.

Course Staff

Training

Community

Consideration should be given to implementing a structured staff training program to support the lead superintendent better with more staff capable of skilled tasks such as pest and disease spotting, recording and actions, operation of technical course equipment and handling of more hazardous substances as needed.





Communication and awareness raising

Community

Consideration could be given to an enhanced course work communication system. See Fig 6 for a course photo mounted on a whiteboard material for arranging and organising task, disease areas, spot spraying areas and wildlife sightings among other spatial activities to maintain the golf course.

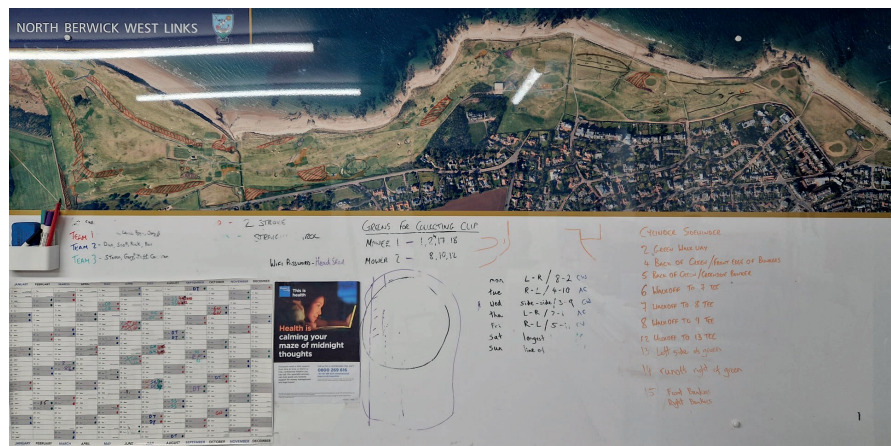


Figure 6: Example of superintendent whiteboard (Source - NBGC)

Golf Course

Resources - Financial - Nature

There are areas of the course that are planned for some amendments to remove areas where there are issues of excessive wind erosion, excessive maintenance needs far outside of playing corridor. This work should be carried out under the supervision of the golf course architects (RTJII) and ensure it continue to compliment the intended strategy of the golf hole.

Given the intensity of the number of rounds played on the golf course consideration could be given to some research and studies to player patterns and identify the excess areas of wear and tear that will occur throughout the year. This can help to inform tee time strategy, tee placement and hole placement strategy and the rhythm of course maintenance work during the golfing season.

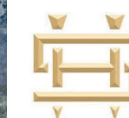
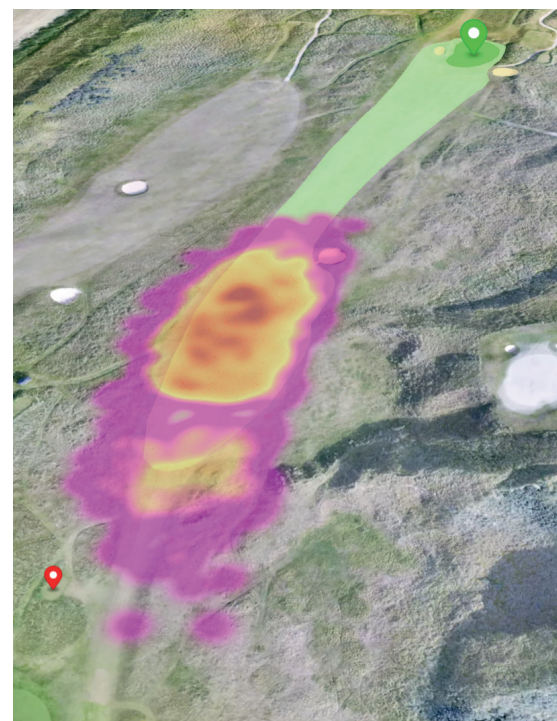


Figure 7: Example of golfer tracking software (Source - Shorehill Analytics)

From spending time on the course, and the large volume of round splayed, there are a number of areas of fairway and walk-offs where players never or very rarely play/walk from. These areas present a great opportunity for turfgrass removal. Technology is available from Shorehill Analytics, which allows the tracking player movements to a build up a picture of possible review areas for potential turf removal. More details available on request.

Waste reduction

Resources - Financial

Many initiatives are already underway within the clubhouse to try to reduce waste, use recyclable materials in packaging and consumables. An extension of this work could be to explore the removal of single use plastics from water consumption - particularly from golfers. Companies like Bluewater provide good quality and well sourced refillable bottles that could be sold at the clubhouse and used by the golfers. GEO would encourage an investigation into these kind of waste reduction solutions.



Tree Management

Nature

There has been a rapid natural establishment of small clumps of casuarina trees (*Casuarina equisetifolia*) in some pockets of the golf course. The recommendation is selective removal of some or all of these trees – subject to golf architect (RTJII) review.

These are naturalised tree species, that can grow aggressively and create problems in cart path construction, irrigation pipe stability and turfgrass surfaces. Any tree removal should also mean harvesting felled timber for use in ongoing course upkeep or re-use if appropriate by staff. Observations of any nesting activity should be done prior to any tree management work being undertaken to ensure the disruption to bird breeding patterns is not disturbed.

Habitat Management Plan

Resources - Nature

There is currently a plan to systematically thin out parts of the native rough areas of the course. Over time they have not been maintained and patches of the course have become overgrown with invasive plants and grass encroachment. Some of this is partly due to irrigation overspray, and some is seed blow into open sandy areas. This can be anticipated to be an ongoing issue.

The thinning out program should be expanded and staff resources allocated to this effort when possible. There is currently no formalised approach to this. Ideally a strategy should be followed:

1. Identify and map areas of the course where there is over densification of the rough places – prioritise those closest to playing corridors i.e. backs of tee are less important than landing zones for tee shots.
2. Gain an understanding of the best times of year to carry out this to avoid impacts on nesting birds and foraging. Make an SOP for this and make sure the staff responsible for habitat management are aware of this.

This process will also benefit the visual definition of the golf course and create more open sandy nesting and foraging habitats for the local avifauna.



Areas where thickening of the landscape has started to erode the definition of the golf course



Figure 7: Examples of habitat and rough management work needed



The use of broad spectrum herbicide products should be avoided or banned from site use to avoid potential pollution risks to other plant species and local wildlife.

As a last step, try to find a person locally or regionally who has some expertise in local wildlife and plant life. The intention should be to invite them onto the golf course to try to catalogue the number of species you have and populations present in different seasons. This is likely a multiyear project that can help communicate to governments and stakeholders the natural sanctuary your golf course is providing with independent expert data to support.

Sand Supply

Resources - Financial - Climate

There is always – in every golf course – a need to ensure some kind of long-term supply chain for the sands the golf courses will need as part of routine maintenance practices. At Hoiana, there is a good supply of suitable sand on the property of the golf and hotels. This should be the first consideration for the sand supply.



Figure 8: Example of a sand sieve machine for cleaning 'dirty' sand sources.

ANY construction, excavations for foundations or building work, should be moving its excavated sand material to the golf maintenance area as a first port of call – and assuming the sand is of suitable quality.

Consideration should be given to a sand sieve for the purpose of cleaning and utilising this on site and local source of good quality sand – saving carbon emissions and import costs of new sand for outside of the property.



Figure 9: Sketch plan indicating 3 areas where a suitable sand source could likely be sourced from on property

4. NEXT STEPS

Hoiana Shores Golf Club is on the journey to become the most recognised sustainable golf facility in SE Asia, and the work over the next 6-9 months will ensure that we can deliver that goal and achieve GEO Certified Facility status to sit alongside the good work recognised already during the construction work before.

The recommendations in this report are not required to achieve the next certification, but should be viewed as a long term improvement roadmap as the facility continues to grow and succeed.

Short term steps:

1. Complete submission of the 2023 Annual Data set for Hoiana Shores Golf Course, Maintenance Facility and Clubhouse.

GEO can assist with phone calls or meetings as needed to assist in clarifying what information is needed to complete this stage.

2. Review the proposed and enclosed Sustainable Golf Highlights portfolio – the largest group of highlights in Asia.
3. GEO to review all submitted information in OnCourse and coordinate with the team for a verification visit to take place.
4. Prepare to host a one-day verifier visit to present the facility and respond in person to the verifier queries and requests



APPENDICES

A. GOLF COURSE MAINTENANCE FACILITY GUIDANCE NOTE



Introduction

The key considerations for a sustainable and efficient maintenance facility are centred around the principles of clean, safe and resourceful working. Before the design process for the golf maintenance facility ('GMF') starts the following steps should be considered:

- Agree preferred **location** options - central to golf, easily accessible for staff, sensitive to golfer view, space to accommodate needs, ideally away from waterways.
- Agree **requirements** - size of fleet and types of machines, number of staff and provisions, energy, water, storage needs.
- Identify pollution prevention **risks** - hydrocarbons, hazardous substances, drainage designs, servicing facility.

A GMF also needs to have adequate space (internal and external) planned to accommodate the provisions that are required in each circumstance. A cramped facility can be more expensive to run as well as difficult to keep clean and safe.

Although typically they are inherently simple architectural structures to create, GMF's require carefully spatial planning by someone with experience of being an end user. There are significant cost savings in efficiency of layouts related to daily and seasonal work flows, environmental quality, specialist quality, health and safety requirements, servicing access and flexibility.

This note provides guidance on the core topics that impact sustainable qualities of a GMF, there will be other considerations for the project to consider beyond:

1. Pollution prevention
2. Water management
3. Energy supply and demand
4. Waste
5. Space allocation

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1. Pollution Prevention

It is important to note that the local authority in your area will, in all probability, have published standards / codes to meet for the safe storage and handling of all hazardous substances. These should be carefully consulted as a baseline throughout the design and construction process of your GMF.

The reduction and if possible, removal of all point source pollution is the primary goal. Basic good practices can ensure we reduce this risk as far as possible. Planning the safe storage of the substances stated below is step one in the process.

1.1 Storage

Ensure storage areas are appropriate for the materials providing protection from rain, high winds, daylight, or damp as needed. Be mindful of the requirements for locked and secure access for trained employees only for certain higher risk materials.

Ideally a sealed chemical storage unit or dedicated fire rated store rooms are created for the storage of hazardous materials. These should have adequate ventilation, spill kit provisions, sink and shower facility and grated flooring to capture and contain spillages for disposal.

Key substances to be aware of:

- Oil, Fuel and other hydrocarbon products
- Detergents
- Herbicides, Insecticides and Pesticides
- Fertilizers
- Grass clippings
- Sands

1.2 Chemical Storage and Mixing

The space where chemical products will be stored and mixed should be secured access, well ventilated and have a grated and bunded floor with separate drain off tank to deal with spillages. The stores should have shelving with dedicated base and shelf trays for each type of substance being stored.



Figure 1: Dedicated mobile chemical storage

The bunded area should have the ability to be drained off into a separate receptacle or tank for proper disposal or reuse if appropriate. Ideally the storage space has room for storing the spraying equipment and machinery also. It should be detached from other buildings with sufficient wall construction to reduce fire spread risk.

All mixing of materials should be done on an impermeable surface and in a bunded space where run off can be captured and appropriately filtered before reuse or suitably disposed of. This mixing space should also be a covered, secured space if possible and only entered by suitably trained operators.

1.3 Spill Kits

Spill kits should be readily available to adsorb and minimise the impacts of any spills at the time of the incident. They can be relatively simple kits with the purpose of trapping any spills, absorbent material to soak up and a suitable container to dispose of the materials once the spill has been cleaned up.

1.4 Fuel Storage and Refuelling

A sensitive area of the facility that requires additional care to ensure compliance with local laws and codes. It will require additional security, drainage provisions and monitoring of staff use. Always use a competent agency to prepare this area of the GMF.

All fuel dispensers should have some form of meter to monitor use and be



easily accessible for larger fuel tankers to access for refilling either above or below ground tanks. The area should ideally be covered to reduce weather affecting operation and extend life of re-fuelling equipment.

All Oil and Fuel tanks should be:

- Installed on an area of impermeable hard standing, ideally bunded at the edge. If you are draining from this area into the surface water system, then a suitable on-site filter treatment needs to be installed.
- Double skin (bunded) type tank to hold 110% of tank's capacity.

The storage area should be located:

- >1.8m (6ft) away from any buildings, fire rated structures (example brick built shed) windows, fuels or sources of ignition
- >0.6m (2ft) from property boundaries.
- >10m (33ft) from any water source or lake
- >50m (165ft) from any source of drinkable water i.e. spring or well

Tanks should be in good order before being used and serviced / inspected regularly for defects.

1.5 Bulk material storage

External space should be allocated if possible to the covered storage of bulk materials needed in the routine maintenance of a golf course such as sands or different graded soil and gravel. These spaces can also be used for storing larger quantities of materials safely during a planned larger renovation or similar.

Try to ensure the space has easy access for larger delivery vehicles and consider slightly sloping the base of the bays to reduce material loss and contamination of other areas of the GMF.



Figure 2. Example of storage bays



2. Water Management

Water quality and supply is and will be one of the biggest challenge we are facing in the modern operations of a golf facility. The focus at the GMF should be on reducing water usage and demand, while also looking at the recapture and reuse of wastewater and rainwater run off where feasible.

Here we focus on the wastewater management and the three broad types of wastewater to consider:

- Rainwater runoff
- Washdown water
- Building greywater

Consideration should be given to the specification of all fixtures and fittings inside the building. Simple low-flow fixtures can significantly reduce the amount of water that a GMF will use, which in turn reduces running costs for your future facility. For example, specifying a greywater recycling system for your toilet flushing can save up to 30% on your water consumption.

An appropriate person should be appointed to look at internal fixtures and fittings such as taps, toilets, showers inside the GMF.

2.1 Rainwater runoff

The rooftop areas on any building or shelter represent an opportunity to collect rainwater for use in irrigation and maintenance yards. A 100m² roof can provide enough water for 200 toilet flushes, 30 full washing machine cycles and 12 car washes annually. Look closely at the roof areas being proposed and consider them as a water asset.

The rainwater collected by any roofs or shelter structures could also be redirected and captured for irrigation purposes either on the golf course or for landscape purposes.

Rainwater runoff from the hardstanding areas of a GMF should pass through a hydrocarbon separator of equivalent before being allowed to discharge into a

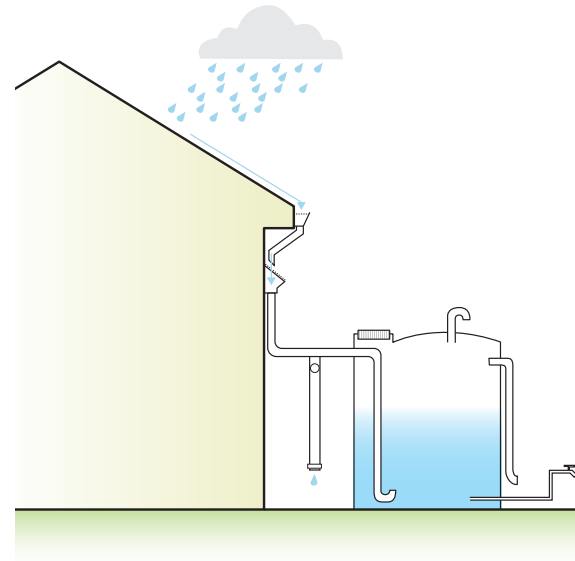


Figure 3. Rainwater runoff harvesting from rooftop areas main surface-water drain lines or reused for washing purposes.

2.2 Washdown water

Keeping the GMF and its equipment clean and safe is an important part of the day-to-day operations. This means using water to washdown surfaces, buildings, windows, machinery and tools - generating wastewater.

2.2.1 Buildings and surfaces

The wastewater generated from the cleaning of the hard standing areas or buildings should be either a) drained through hydrocarbon separator before being reused or being discharged into main surface water drain lines or b) returned directly into a mains sewage system lines under formal agreement with the relevant local authority.

2.2.2 Equipment

The wash area for all machinery must be impermeable and bunded with a low lip surround to contain water. There should be dedicated, appropriately sized outlets to allow the controlled collection of the wastewater.

Wastewater is then either a) directed through the appropriate on-site filter (see





Figure 4. Simple sloped maintenance facility wash pad

Section 2.2.3 below) to the surface water drainage system or b) returned directly into a mains sewage system lines under agreement with the relevant local authority.

Stress can be reduced on the filtration and drainage systems at any wash bay by implementing simple practices prior to washing down the equipment. Cleaning off the excess grass and mud using compressed air and brushes and collecting this material for composting prior to washing helps improve the life cycle of the filters and drains.

2.2.2.1 Closed Loop wash stations

One effective method for minimizing water use and environmental impact while washing maintenance vehicles is by establishing closed loop wash areas. These can be typically around 6m x 10m (20' x 30') and be built in place or created as portable stations to suit.

With this the dirty used water flows into an inclusive drain where it is put through a treatment system which loops the filtered water back to be used for washing. All the grease, grime, oil and other particulates within the water are removed. Other non-golf equipment can be cleaned here such as cars, vans, kitchen equipment as well as 'doubling up' as an area where mixing of chemicals could take place. The grease and oils will be separated in the same way, making this a multi-purpose piece of equipment for the back of house area.



Figure 5. Closed loop wash system (Source: waste-2-water)

2.2.3 Filtration

When dealing with wastewater there needs to be appropriate cleaning of the wastewater and runoff. Given the heavy use of GMF yards, the recommendation would be to consider installation of a serviceable hydrocarbon separator or equivalent type trap in the GMF drainage systems to capture any heavy pollutants there may be in the water before it enters mains drainage systems or on site water bodies. On site filter treatments for wastewater installed up or downstream of a hydrocarbon separator can include:

- Retention basins.
- Reed bed filtration system (See Section 2.2.3.1 below).
- Commercial grass clipping and silt trap.

2.2.3.1 Reedbed Filtration System

Water from the GMF drainage systems can be funnelled into a reed bed system which will act as a natural filtration system from washdown of grass cutting equipment, cleaning the water to a quality safe enough to re-enter the water cycle.

The size of reed bed required depends on the volume of water that requires



Figure 6. Simple constructed reed bed filter



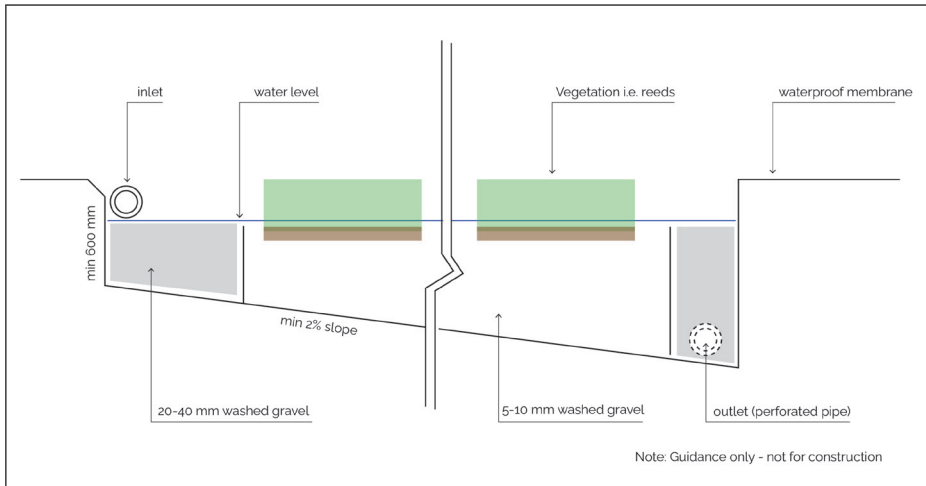


Figure 7. Simple reed bed system

cleaning, a general rule is that 1m² (10 sq.ft) is required for every 200L (50 US gallons) of grey-water produced, a minimum of 6m² (60 sq.ft) must be built.

The outlet pipe can lead to a secondary wetland area on site that will not be damaged by an influx of water or reused for other purposes. The inlet requires hydrocarbon separators to be installed.

Some maintenance of the reed bed is required, weeding to remove any plants not planted (this has to be done by hand as weed-killer or strimmer is likely to damage the reeds), they need watering in the first few weeks if they look dry, after a few years the reeds will need “harvesting” but initially it is important to allow the green tops to grow fully. The lifespan of a reed bed is between 7-10 years. A simple reed bed design can be seen above.

2.3 Greywater

Greywater recycling can be carried out in buildings across the golf course. This system will collect used water from sources such as sinks, washing machines and showers, it will then clean this water and send it straight back into the likes of toilets and outside taps. This process will reduce the amount of water required across the site but specifically in buildings.

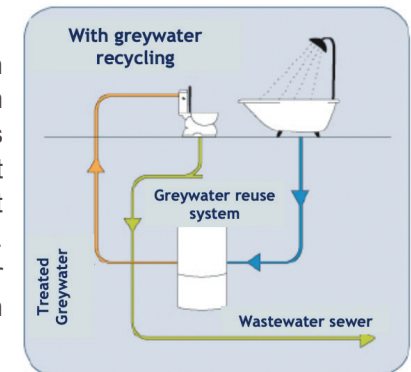


Figure 8. Simple Greywater system
(Source: EU ERDF)



3. Energy

The primary focus is to be reducing overall energy demand through consideration of the building specifications, materials, appropriate insulation, ventilation and passive cooling and heating. The building will typically be occupied during the morning hours and this working patterns needs to be considered when developing architectural designs for the buildings.

Architectural technologies are developing, particularly in commercial and office spaces to reduce our energy demands - lighting, kitchen goods, ICT equipment. A competent specialist should be consulted on cost effective savings that can be included to reduce the overall energy demand in the operations of the buildings.

3.1 Solar

Solar panels are a simple and effective way of creating a more sustainable golf course. These can be placed on maintenance building roofs throughout the site as well as the clubhouse itself, positioned so they get the most coverage from the sun daily.

These panels will generate electricity which can be stored and used on site. In some circumstances full fleets of electric maintenance vehicles may be able to be charged with power generated this way all year round. These do not have to be placed on roof space however it is a good way to make use of space which may otherwise be redundant.

3.2 Air Source Heat Pump (ASHP)

ASHP's can be used on outbuildings and maintenance buildings across a site to regulate heat within the building - particularly in colder climates. These work by harnessing air at a temperature of above absolute zero (all air above this temp contain some energy), the ASHP then transfers the energy as heat from one place to another. These systems can be run off electricity rather than oil or gas and are a relatively low cost way of space heating.



Figure 9. Sölvesborgs Golfklubb, Sweden - ~100kW Solar installation on GMF roof (Source: On-Course® - Highlights)



4. Waste Management

The focus here is on sorting waste that you have not been able to reuse. The old adage of 'reduce-reuse-recycle' still has its relevance in this context and should act as a guiding principle across the site. In order to properly dispose of waste an area should be allocated within or very near to the maintenance compound.

An external area of the yard should be dedicated to waste management. It should be easily accessible to collection vehicles, tractors and provide ease of access for staff with raised access platforms to make dumping of heavier waste materials into bins easy. Locating this area close to the washdown area is often helpful for cleaning up and pollution prevention.

Depending on the kinds of waste being generated a series of bays, skips or bins should be placed and allocated different waste streams.

Typically, streams can include:

- Metal
- Dry waste – Plastics / cardboard / paper
- Compostable / bio-waste
- Inert waste – Concrete / brick
- Hazardous – batteries, industrial equipment, chemical
- Landfill

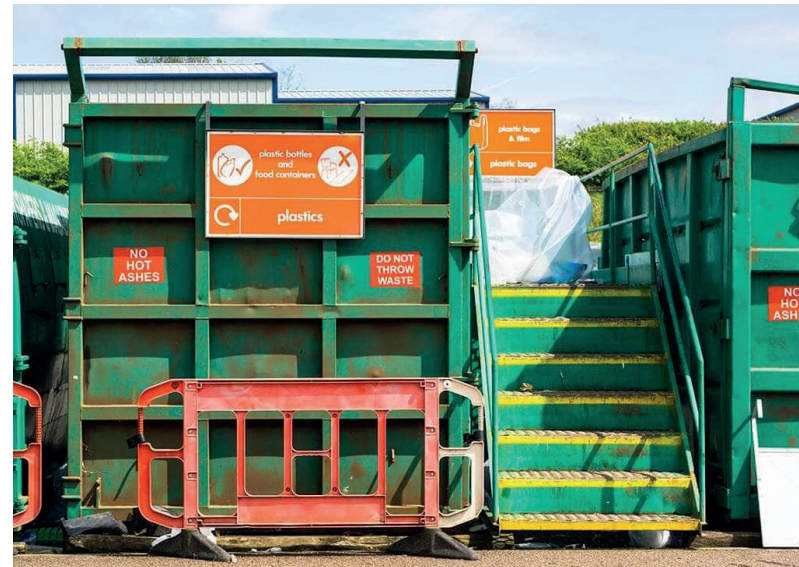


Figure 11. Example of easier access for heavier waste dumping.



Figure 10. Indicative example of a larger waste sorting area



5. Space Allocation

Although highly dependent on number of holes being maintained, numbers of staff and machinery and annual maintenance budgets there are some budget space allocation figures that can be usefully followed when planning the general arrangement of your new site. It is recommended that if possible, these facilities are made slightly bigger than needed. This facilitates future expansion and allows for appropriate storage of machinery and materials while ensuring that everything has its own place.

Offices, staff facilities and Mechanics shop	800 to 1,550 sq.m	(12,000 - 17,000 sq.ft)
Washdown / Mixing Area	175 to 325 sq.m	(2,300 - 3,500 sq.ft)
Fuel store / re-fueling Area	175 to 275 sq.m	(2,000 - 3,000 sq.ft)
Chemical / Fertilizer Stores	400 to 600 sq.m	(4,500 - 6,500 sq.ft)
Equipment Room	900 to 1,800 sq.m	(12,000 - 19,000 sq.ft)
Storage Bays	800 to 1,400 sq.m	(9,000 - 15,000 sq.ft)

There are several ways to make the most of the space in your maintenance facility, these should be implemented in the design of the building and include:

- Use roller shutter doors on all vehicle entrance and exits to the building. This leaves the floor space free and available while doors are open allowing more room to carry out works and move machinery. It also allows the doors to be left open through the day in summer months, allowing a breeze into the building.
- Make use of vertical storage. The walls of the facility provide a great opportunity for space concisions storage, whether that be directly on the walls themselves or on shelves. This vertical storage allows items to be stored in a unique location while being accessible and not taking up valuable floor space.

- If planning permission allows then the option of multiple levels should be looked at. This could be in the form of fully fledged floors where office and meeting rooms can be situated, allowing the ground floor to be used primarily for machines storage and maintenance. The creation of lofts are another good use of these upper levels, allowing for smaller materials to be stored. It is important that appropriate and safe access is created to these areas to make them viable.

It goes without saying that facilities such as toilets, showers, changing rooms, kitchens, drying rooms and any health and safety facilities required such as eye wash stations must be included in any maintenance facility designs. Laundry provisions could also be provided to allow staff to keep and clean work wear on the site. As the industry becomes more diverse with more woman starting careers in golf maintenance there must be facilities included in the maintenance facility for them. Separate changing rooms, shower and toilets will be required.



Annex

- A: Space Allocation Diagram - Small to medium requirements
- B: Space Allocation Diagram - Larger requirements
- C: Green Waste Guide



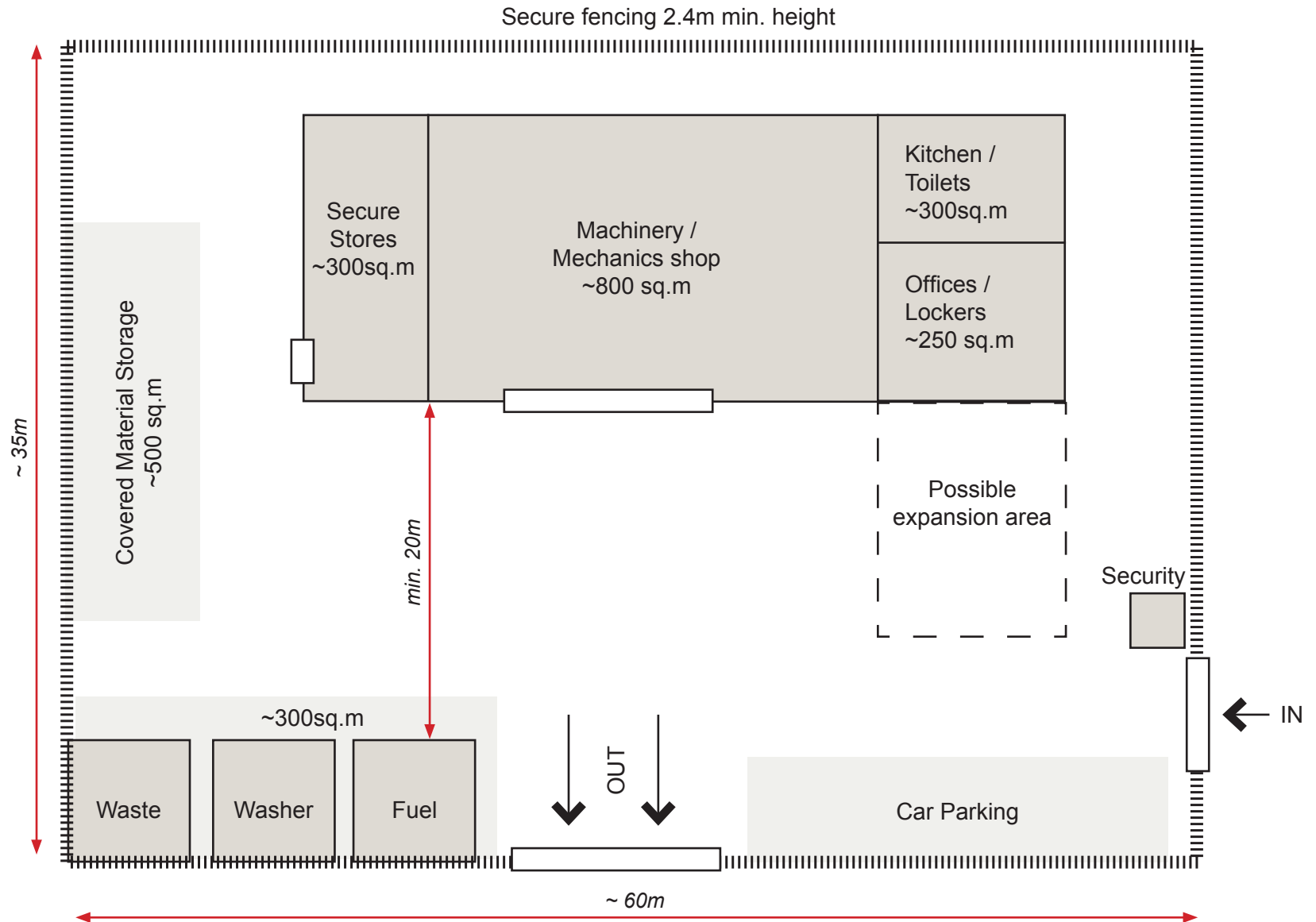
ANNEX A: Space Allocation Diagram - Small to medium requirements

An illustrative space planning diagram of a maintenance facility to serve a medium sized 18-hole golf facility and practice ground.

Uses a secured two vehicle entrance system to reduce hard standing area. Includes space allocation for offices and kitchen space.

Overall fenced area would be around 2,600 sq.m of hardstanding impermeable surfacing.

Note: Design requirements for chemical storage, ventilation and drainage of fuel and washdown areas are higher than typical building construction.



ILLUSTRATIVE DIAGRAM - N.T.S.



ANNEX A: Space Allocation Diagram - Small to medium requirements

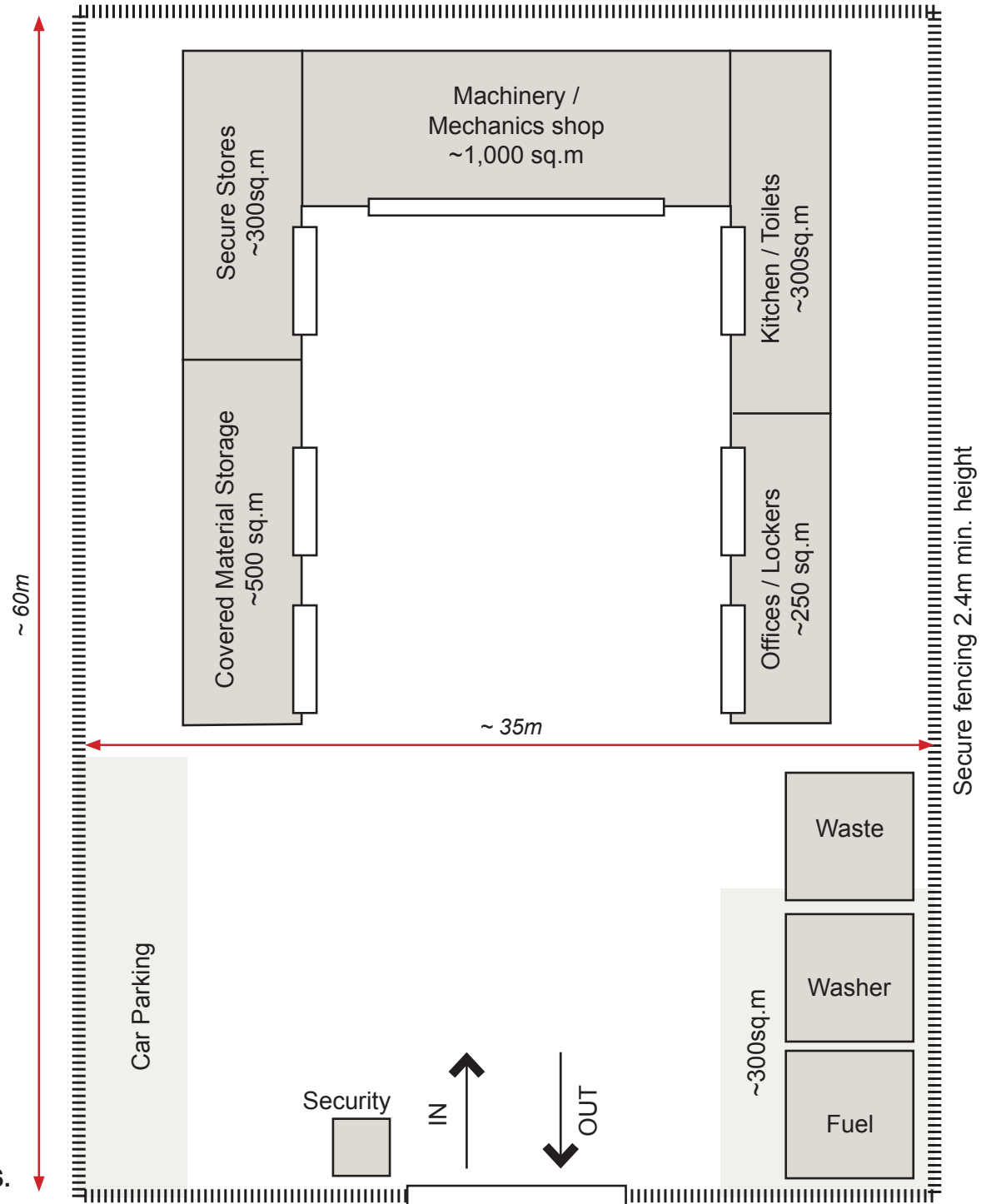
ALT ARRANGEMENT - COURTYARD

An illustrative space planning diagram of a maintenance facility to serve a medium sized 18-hole golf facility and practice ground.

Uses a single vehicle entrance system and central courtyard layout for ease of extending if needed. Includes space allocation for offices and kitchen space.

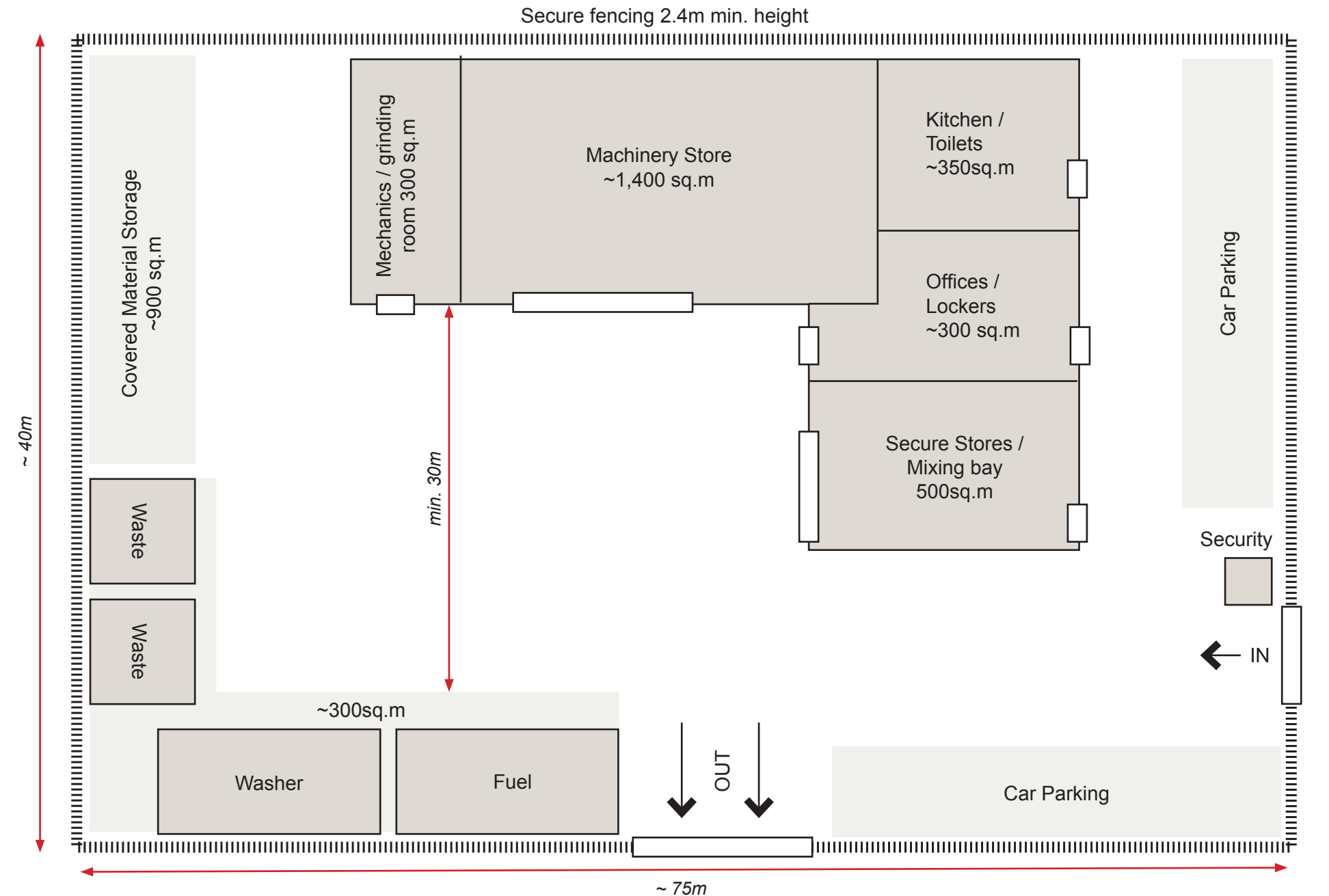
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ILLUSTRATIVE DIAGRAM - N.T.S.

ANNEX B: Space Allocation Diagram - Larger requirements



ILLUSTRATIVE DIAGRAM - N.T.S.

ANNEX C: Green Waste Guide

It must firstly be noted that, whatever system is chosen for the long term green waste management on this site, it must be suitably and securely contained to ensure that no leachate escapes from the area and enters the local habitats or the surrounding surface or ground waters. This would have a significant detrimental impacts on these areas.

The best solution for this would be to create a sealed concrete paddock that is walled on three sides (see figure 3), there should be drainage within this paddock which will channel any leachate or effluent directly into a waste water treatment facility.

What can go in?

Consideration should be given to creating different areas for composting depending on what goes into it. Creating separate 'bays' will be helpful to determine the most successful mix.

A general ideal ratio of materials for composting is 30:1, 30 parts carbon to 1 part nitrogen. *"In general, materials that are green and moist tend to be high in nitrogen, and those that are brown and dry are high in carbon. High nitrogen materials include grass clippings, plant cuttings, and fruit and vegetable scraps. Brown or woody materials such as autumn leaves, wood chips, sawdust, and shredded paper are high in carbon."*⁴³

Mix 1 – possible sources:

- Dried leaves
- Any annual weeds
- Shredded brush and small twigs (creates good air pockets)
- Grass clippings

Mix 2 – possible sources:

- Dried leaves
- Any annual weeds
- Shredded brush and small twigs (creates good air pockets)
- Grass clippings

- Fruit and vegetable peel of all kinds
- Coffee grounds, tea leaves, nut shells from the site kitchen
- Moistened paper and cardboard can also be composted.

It is recommended that compost produced is tested on a six-monthly basis to assess the quality of the product. This gives an opportunity to alter the feed mix to ensure the desired outcome is produced.

What do we need to know?

Before deciding on the preferred method of waste management on site, there are a couple of key pieces of information to know or accurately project to inform the decision:

- Projected approximate tonnage of waste going to compost should be calculated as this may impact on options chosen as well as the area needed. Ideally this is categorized into Golf, Landscape, F&B
- What space can be allocated for composting facility
- Education and skill sets available to be able to properly manage the composting process safely.

Method of green waste management

There are two main methods which can be used for composting on the site: Windrows in bays (allows aerobic digestion) or an Anaerobic Digester tank. Both come with their own advantaged and disadvantages.

Windrow method

This method involves the systematic piling into bays of green waste into a pile or windrow, heat is then generated from within the pile. Larger, wooded materials must be placed throughout the pile allow air to pass through. This process will produce leachate run off which must be filtered into the sewage treatment facility.

This method will require turning every three to four weeks to allow all the materials to be in the centre of the windrow and this process must continue until everything has turned into a mulched/humus like material. A topper material may be required to cover the windrow, this will help to keep moisture within it, alternatively it can be sprayed with water although this option may not be suitable. This process has the potential to require a large working area and numerous inputs.



Bays

Ideally these are sunken 1-2m below the ground level. This helps to keep temperatures lower, reduces fire risk and makes working on the bays easier. Temperature at the centre of the compost can easily reach over 150F. Consider the number and area for the bays to allow room for expansion and space to have at least 2-3 bays to make 'turning' easier from one bay to another.

The bays should be sealed and have a direct drainage connection to the wastewater treatment plant and should be built with three walls and an open front, so it is easily accessible to facilitate harvesting and maintenance as needed using appropriate machinery.



Figure 5 – Example of numerous large concrete paddocks (source: Hanson Silo)

The compost

The processes of composting can be 'kick started' using rotted manure or any urine. The usual accelerators can be added if required such as soaked seaweed leaves. In around 3-6 months the material should be ready to harvest. You can usually tell when it is ready when the soil loses any significant odour. When harvested it should be sieved to remove any undecomposed materials i.e., sticks, bad waste. This can be roughly sorted and returned to the bays again.

Pests

Kitchen waste does have the potential to attract flies so this material should only be added when you have available green waste to cover. Beetle grubs can also be an issue so assessment of any required proper treatment of compost should be done once harvested.

Anaerobic digestion method

Anaerobic digester's can be used on site to produce compost. This process takes place within sealed tanks and is best suited high moisture content nitrogen-rich materials such as catering and food waste although this mixed with course cuttings will work well. These anaerobic digestion plants/tanks can come in various sizes so it is important to have an accurate estimation of how much waste will go into this over a period of time.

This process has a number of benefits including:

- Waste materials are securely held within the tank meaning there is an secure barrier to leakages
- Compost is efficiently produced
- Can be stored above or below ground
- Biogas (consisting mainly of Methane) is produced as a by-product.

Biogas as a by-product

Biogas produced from this anaerobic digestion process can be captured and can be used as fuel at a combined power and heat plant which can generate electricity. This could then be used on site to power golf buggies for example. A further advantage of this is that no methane or gasses are released to the atmosphere. This process does not require materials to be turned however for planting ready compost to be produced this can take up to a year (this will ensure there are no pathogens within the compost). If the initial feed materials are likely to be pathogen free, then the compost can be harvested after a few weeks although the compost may be acidic.



Figure 6 – Anaerobic digester set up in Vrizenen, Netherlands
(Source: Host Bioenergy Installations)



Limitations

The content of this document is drawn from information gathered on the site visit and includes the recommendations and opinions of GEO. It reflects information correct at the time of writing, it is possible that new information will become available after the completion of this report. This new information would be incorporated into future revisions of this report or in the subsequent stages of the certification reporting.



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