GOOD PRACTICE SHEET **N° 1**

USE OF GREYWATER FOR IRRIGATION OF GOLF COURSES

Which **impactful changes** can greywater for irrigation bring to your business model transformation?

- **Production model** — Requires high commitment
- **Competitivity** — Requires high impact
- **Revenue model** — It has a major impact

What is irrigation with greywater?

Since golf courses are important leisure and economic drivers, as well as agricultural systems due to the presence of extensive land and plants, its important its maintenance through irrigation. Due to their large extension of land, it is a suitable environmental option to irrigate with reclaimed water. Golf courses must obtain regenerated water from the wastewater treatment (WWTP) plant through a pipe or connection of the regenerated water network (if available). Regenerated water for irrigation of golf courses refers to wastewater that has been treated, but in this case has an additional or complementary treatment process that allows a proper irrigation of grass and other vegetable species available in golf courses. Due to the fact that golf courses need large volumes of water, this has pressed golf course managers to opt for water consumption reduction from conventional sources as an ecological and social strategy, but also to mitigate the increasing cost of water.

Why should you irrigate your golf course with greywater?

Irrigation with greywater reduces the use of water from conventional sources drastically, such as surface or groundwater, as well as desalinated water; therefore reducing costs associated to water (including energy for pumping).

For outdoor use

What are the main socio-economic advantages?

- **Reduces water costs from (also from pumping)**
- **More efficient use of available resources**

What are the main environmental advantages of greywater for irrigation?

- **Alleviates water stress in the area**
- **Reduces overexploitation of natural water resources**
- **Reduces discharge of wastewater**

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Non-conventional water sources, such as reclaimed or regenerated water, play an important role in golf courses, specially in the Mediterranean area since it reduces municipal water supply significantly.

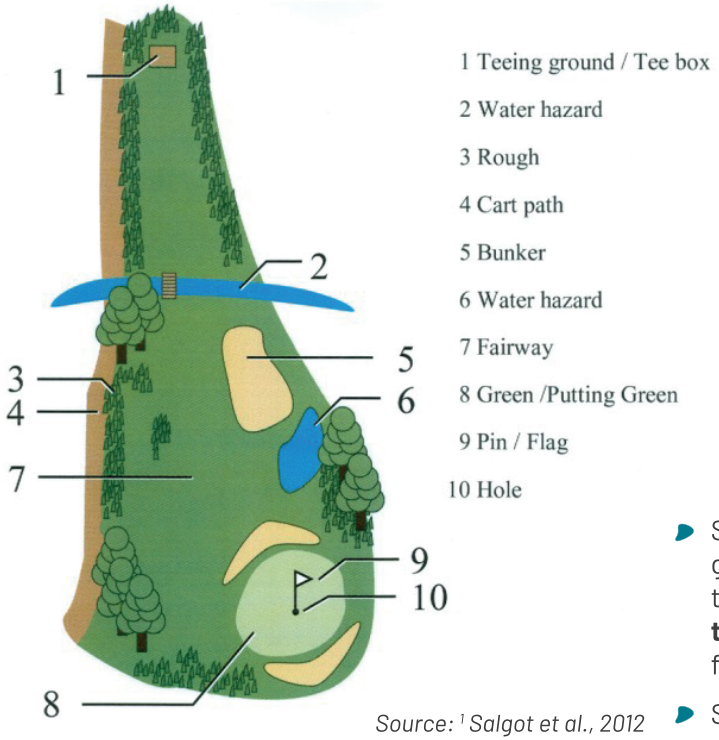
What are the benefits of irrigating golf courses with greywater?

ENVIRONMENTAL BENEFITS

Irrigating golf courses with greywater has several significant environmental benefits:

- Allows for **savings of high-quality freshwater** resources coming from a municipal supply. Therefore, it is considered an important alternative water source in the golf-course industry For instance, in certain regions of Spain, according to local regulations, golf courses must water their fields with treated greywater. Therefore, savings of freshwater can add up to 100%.
- It is considered a **reliable source** of water supply during **droughts**.
- Reduces pollution of receptor water bodies by reducing wastewater volumes.
- It allows to take advantage of the **nutrients contained in the wastewater** which is beneficial for irrigation, agriculture and gardening.

THE GOLF COURSE AS AN ECOSYSTEM[1]



Source: [1] Salgot et al., 2012

Irrigating golf course with greywater is considered a viable and greener option

ECONOMIC BENEFITS

There are several economic benefits related to the irrigation of golf courses with greywater:

- **Reduces significantly costs of water bills** compared to irrigating with conventional municipal water.
- In Benidorm area (Spain), **the cost of reclaimed water is 0.3 EUR/m3**, making it one of the lowest tariffs compared to water from other sources such as municipal water supply or desalinated water.

SOCIAL BENEFITS

- Since it is considered a reliable supply, by using greywater golf courses can be preserved during the entire year, which helps to distribute **tourism throughout the entire year**, assuring this activity for visitors.
- Since the majority of golf courses usually get reclaimed water from municipalities or water supply authorities, it helps **municipalities lessen burdens of wastewater.**
- **Greener image** for golf courses

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How to irrigate successfully with greywater your golf course?

KEY ISSUES TO BE CONSIDERED

1. Good quality of reclaimed water needed
2. Constant maintenance of pipes and tanks
3. Check a suitable and compatible design for irrigating your golf course
4. Identify local legislation
5. Constant analysis of the water: chemical, physical and microbiological

KEY FACTORS TO BE IDENTIFIED FOR A SUCCESSFUL IMPLEMENTATION

1. Select an appropriate irrigation design and the amount of greywater to be used
2. Verigy the type of soil and vegetation (ecosystem) of the GC.
3. Analyse local legislation and the feasibility to connect to a WWTP
4. Do a thorough analysis of the quality of the effluent of the WWTP to check compliance
5. Do constant monitoring of water quality parameters of reclaimed water

KEY STEPS FOR INSTALLATION

1. Check availability to be connected to WWTP effluent
2. Connect the municipal reclaimed water pipe to golf course irrigation pipe
3. Map and optmize use of sprinklers
4. Test reclaimed water quality

TECHNICAL ADVICE

- According to certain golf courses' managers, it is important to consider the treatment of the (supplied) greywater in order to establish if additional treatment is needed for a specific golf course. This is imperative to avoid nuisances such as bad smells, flies and mosquitos, or any other health hazard to local golfers. These hazards refer specially to the presence of several pollutants (e.g pathogens and chemicals). Regarding pathogens, bacterial indicators should be employed to determine the degree of risk associated with these (e.g. E. coli and coliforms -total and faecal-). If pathogens are present, it may have health implications to golfers that are in constant contact with the grass.
- The nutrient balance is also an important fact to be taken into account regarding the quality of reclaimed water since imbalances may cause bad grass development and poor resilience that can even be detected through color differences. The nutrient balance takes into account: 1) the species of vegetation planted (grass and/or trees); 2) the nutrient needs of these species; 3) the theoretical reclaimed
- Salinity is also a potential hazard which can affect both soils and plants in the golf course.

POINTS OF ATTENTION

Challenges to widespread adoption

Due to the differences between regulations in different countries, it is not feasible to apply uniform methodology on analytical control worldwide or even at regional or local level. Therefore, deep analysis should be carried out regarding the quality of reclaimed water that is needed, and then it should be evaluated for proper use. The water quality is important because end-users (golfers) are constantly in contact with the irrigated grass.

Recommended literature

FOR MORE INFORMATION REFER TO THESE FOCUMENTS

García, M. R. (2013) Reutilización de aguas residuales. Aplicación al riego de campos de golf. Master en Tecnología Química y Ambiental, Escuela Técnica Superior de Ingenieros .

REFGolf- Real Federación Española de Golf (2016) Proyecto de Reforma del sistema de riego en campos de golf. Reporte Técnico.

REFGolf- Real Federación Española de Golf (2018) Renovación de greeners y calles a Bermuda. Reporte Técnico

Salgot, M., Díaz, A., Priestley, G., Folch, M., & Mar, M. Reutilización de aguas residuales en el riego de campos de golf: aspectos económicos (Versión provisional).

Salgot, M., Priestley, G. K., & Folch, M. (2012). Golf course irrigation with reclaimed water in the Mediterranean: a risk management matter. Water, 4(2), 389-429.

DISCUSS AND TEST PROJECTS, TOOLS AND NETWORKS

Examples of application of reclaimed water for irrigation in golf courses in the Mediterranean area:

REFGolf- Real Federación Española de Golf (2016) Proyecto de Reforma del sistema de riego en campos de golf. Reporte Técnico.

REFGolf- Real Federación Española de Golf (2018) Renovación de greeners y calles a Bermuda. Reporte Técnico.

The study by Salgot et al., (2012) provides a clear methodological framework on the analyses that must be carried out. In this study, a Code of Good Practices for Water Reuse in the state of Florida (USA), is presented. This code, designed to aid reuse utilities as they implement quality water reuse programs, includes 16 principles .