

A Case Study on Sustainable Water Use Technology in Resorts

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PRESENTATION OUTLINE

- Background
- Objective & Methodology
- Case study findings
- Discussion
- Conclusion

BACKGROUND

◉ DECLINING WATER AVAILABILITY SCENARIO

- > Climate change
- > Pollution
- > Poor water management
- > Higher consumption
 - Tourism industry

BACKGROUND

- ◎ Why hotels should be wise about water
 - > Polluted water bodies affect destination's environmental quality
 - > Poor environmental quality affects tourism experience
- ◎ Corporate Social Responsibility
 - > Business's handling of its own social and environmental externalities
 - > "a corporation's commitment in minimizing or eliminating any harmful effects and maximizing its long-run beneficial impact on society."
 - > Mohr, Webb and Harris (2001)

OBJECTIVE & METHODOLOGY

- ◎ THE NEED FOR ENVIRONMENTAL MANAGEMENT
 - > Objective of paper
 - Present a proven technology for resorts in tropical climate
 - > Methodology
 - Personal interview, content analysis

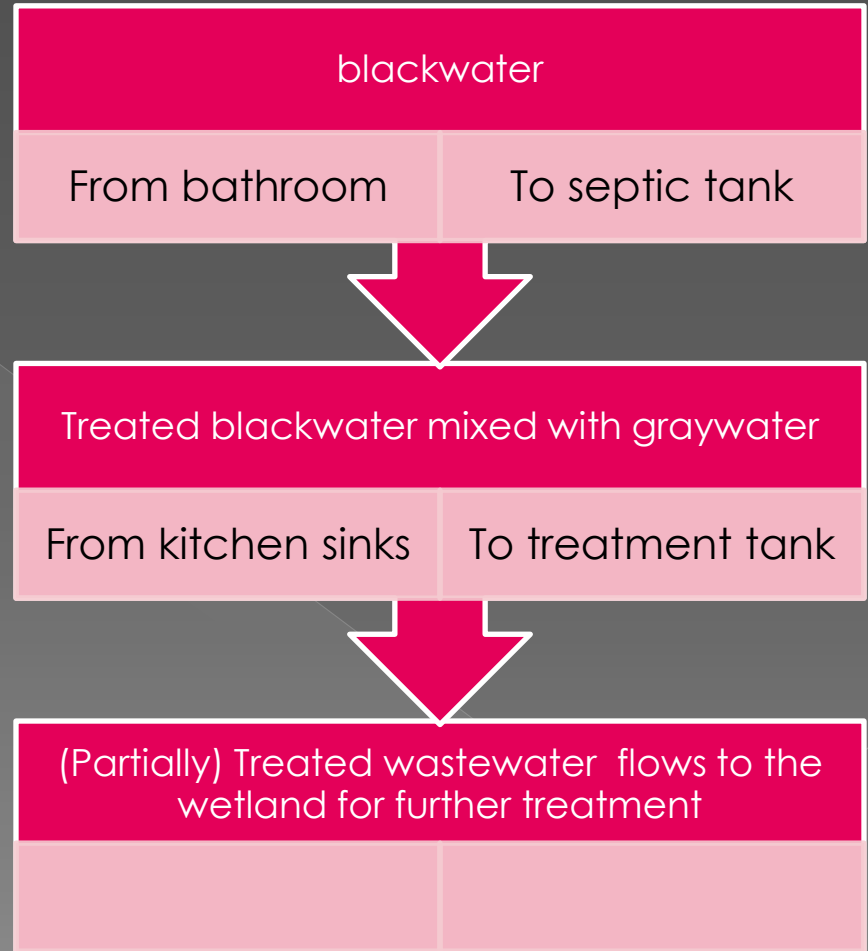
CASE STUDY FINDINGS

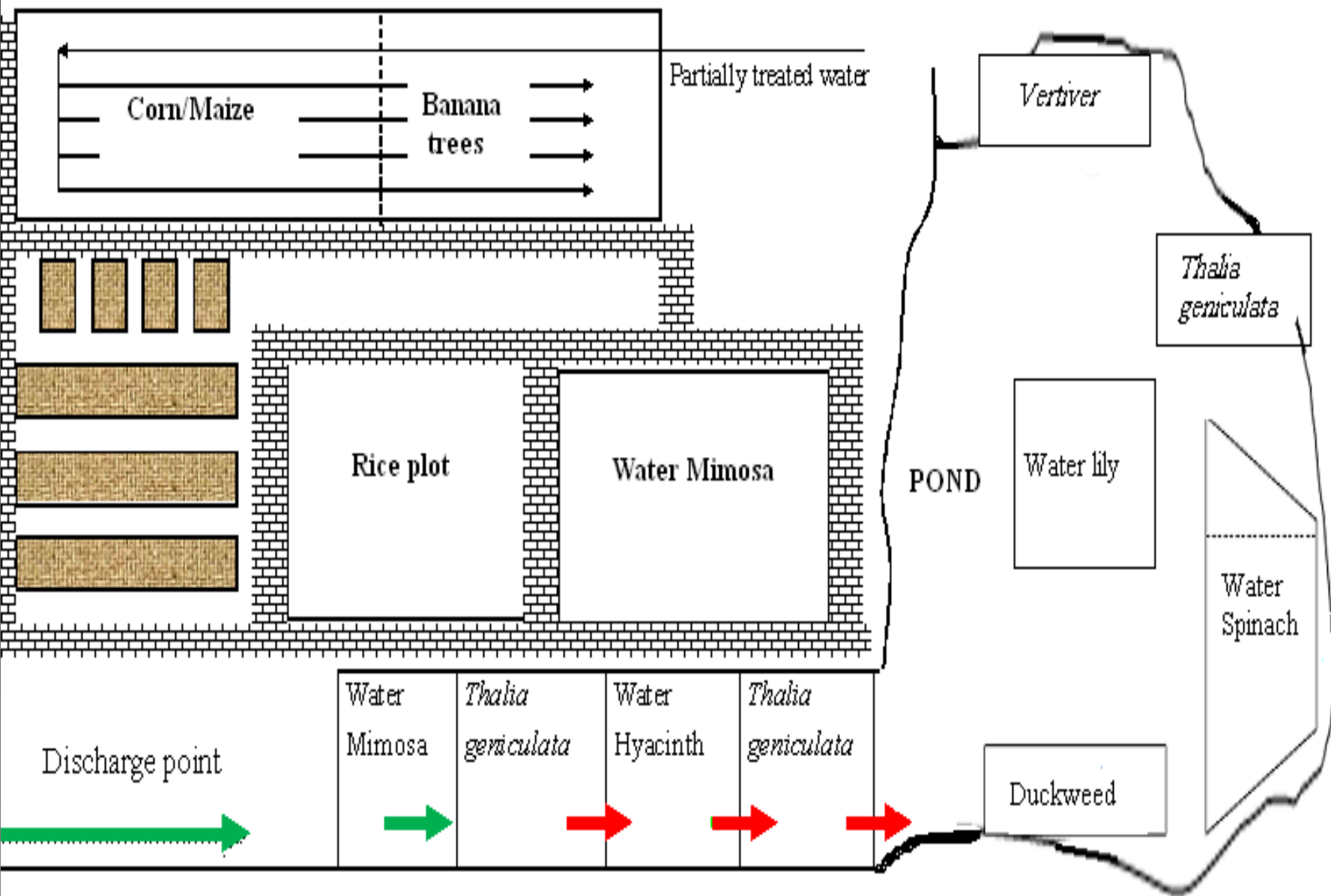
- HOTEL BACKGROUND
- 115 rooms
- 130 staff
- Beach resort facing Andaman Sea
- Green Team
- 'green' activities



TECHONOLOGY ADOPTED

- A pond filled with plants that are natural water recyclers
- Like a wetland
- Used water from bathrooms is channeled to the septic tank before being mixed with water from kitchen and passed through the man-made wetland system





Water Mimosa	<i>Thalia geniculata</i>	Water Hyacinth	<i>Thalia geniculata</i>
→		→	→

Point 1

- **Water mimosa (Neptunia spp):** to reduce total nitrogen and phosphorus's values; absorb organic compounds and suspended solid

Point 2

- **Thalia Geniculata:** absorbs nutrients and stabilizes the suspended solids.

Point 3

- **Water hyacinth (Eichhornia crassipes):** very efficient in removing suspended materials, BOD, nutrients (nitrogen and phosphorus), organic matter and up take heavy metals (lead, chrome, cadmium, copper, aluminum, nickel, mercury) and pathogens

Point 4

- **Duckweed (Lemna minor):** absorbs nitrates, phosphate, potassium, calcium, sodium and carbon
- **Vetiver (Vetiveria zizanioides):** helps to regulate the amount of water and filter sediment-bound contaminants (heavy metals and some pesticides residues)
- **Water lily (Nymphaea):** removes cadmium in the water, help reduce algae growth in ponds
- **Water spinach (Ipomoea aquatic Forsskal):** provide a large surface area for the growth of beneficial micro-organisms that can enhance nitrogen removal.

- *Neptunia* spp (water mimosa).
- a floating aquatic perennial that roots in the banks or bottoms of water bodies.
- Its stems protrude from the water surface and are filled with a spongy fibrous material that covers the stems.
- is used first in water treatment as its stems are able to reduce total nitrogen and phosphorus's values; absorb organic compounds and suspended solids.
- has the potential to restrict water flow in creeks and channels, so all the suspended solid can settle down slowly.
- is an edible plant species and has been traditionally collected as a source of food.



- *Thalia Geniculata*, or more commonly known as Bent Alligator-Flag.
- This is non-woody plant that is not grass, also known as forb/herb of the genus *Thalia*.
- It is a perennial plant means it will grow year after year. This specie absorbs nutrients and stabilizes the suspended solids.



- *Eichhorniacrassipes* (water hyacinth)
- a free-floating perennial plant that can grow up to a height of 3 feet.
- If left unattended, the specie can become a very aggressive invader by forming thick mats that can cover the entire surface of the pond, causing oxygen depletions and fish kills. Therefore, constant care is needed to control them
- can be very efficient in removing vast range of pollutants, from suspended materials, BOD, nutrients like nitrogen and phosphorus to organic matter. They also have high capacity of up taking heavy metals like lead, chrome, cadmium, copper, aluminum, nickel, mercury and pathogens.
- This is an important attribute of this specie as a natural water recycler.



- *Veteveriazizanioides*.
- Also known as miraculous grass because helps to regulate the amount of water.
- Its hard and erect stems can withstand high velocity water flows thereby increasing detention time. Its thick growth form living porous barrier that can effectively filter both fine and coarse sediments, as well as sediment-bound contaminants (e.g. heavy metals and some pesticides residues).
- has deep, dense and penetrating root system that can reduce and prevent drainage, improve bed stability and nutrient uptake.
- highly tolerant to tough climatic conditions and to high soil acidity and alkalinity, elevated levels of heavy metals such as arsenic, cadmium, copper, chromium, lead, mercury, nickel, selenium and zinc.
- easy to grow and very handy to have in the wetland system.



- *Nymphaea's*
- has broad leaves that can shade the water keeping it cool. This allows for more dissolved oxygen.
- also efficient in providing hiding places for small aquatic creatures.
- *Nymphaea* removes cadmium in the water, helps reduce algae growth in ponds and adds oxygen to the wetland itself.



- *Ipomoea aquatic Forsskal* is an edible plant that is a favourite in many parts of Asia.
- Similar nutritionally to spinach, this swamp cabbage belongs to the same genus as sweet potato, and a member of the morning glory family.
- can be found wild in aquatic environments or grown by farmers in well irrigated fields as a source of side income as this specie is a favorite food within many Asian cultures.
- Its roots hang down thereby providing a large surface area for the growth of beneficial micro-organisms that can enhance nitrogen removal.
- As they float, the specie is forced to take nutrients and heavy metals from the water rather than from the sediments.



DISCUSSION

- Process is easily adopted in other hotels of similar characteristics
 - > Land space
 - > Tropical climate
- Requires auditing from monitoring bodies
- Requires policy incentives for widespread adoption

CONCLUSION

- CSR initiatives should include water management considerations
- Best practices exist and can be emulated
- But need more research on the use of plants for water recycling in other climates

Thank you for your attention...
Any question?