WATER CONSERVATION AND TREATMENT

Photo: Khem Villas

WHY IT'S IMPORTANT

The world is facing a global water crisis with increasing demand, worsening water pollution and rising extremes in weather due to climate change bringing challenges with drought and flooding. India currently stores only 6% of its annual rainfall, relying heavily on groundwater resources. While its annual water requirement is about 3,000 billion cubic metres, the country receives an average of about 4,000 billion cubic metres of rain every year. So why doesn't the maths add up? India fails to utilise about three quarters of the water received from the sky. The rest is lost!

More than 160 million people in India do not have access to clean water[1] – the highest in the world. India is placed at 120 on a list of 122 countries on the basis of quality of water.[2] Lack of access to clean drinking water is a serious public health issue. In 2018 alone, seven deaths a day in the country were attributed to polluted water.

Nepal, too, suffers from a water crisis fuelled by the indiscriminate dumping of industry, domestic waste and untreated sewage into its rivers and lakes. The 2015 earthquake further aggravated this situation by destroying water systems and networks, leaving many residents with little or no access to safe drinking water.

With tourists consuming up to 200 litres per day, the need to conserve and recycle water, harvest monsoon rains, and replenish groundwater is paramount. Creating water bodies will help to attract an abundance of wildlife for your guests to enjoy. Appropriate wastewater treatment not only helps to protect the pristine wilderness and the health of all who reside there but can save water through recycling for uses such as irrigation and toilet flushing.

SUSTAINABLE DEVELOPMENT GOALS

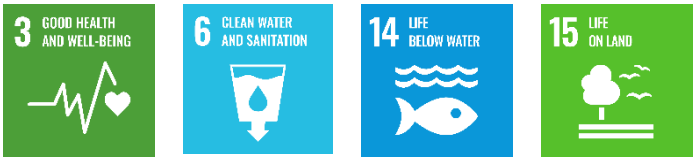


Photo: Mittal Gala / Khem Villas

WHAT YOU CAN DO

Easy Wins

- Display water conservation notices in guest bathrooms and public facilities.
- Give guests the option to re-use sheets and towels.
- Use non-polluting, organic, easily biodegradable toiletries.
- Brief your staff to save water and report leaking toilets, taps or joints.

Photo: Shutterstock

Going for Gold

- Monitor water use in important water-using areas (cluster monitoring) and set annual targets for reduction.
- Appoint green champions and train staff in water saving measures.
- Install water saving fixtures such as dual flush toilets, low flow and aerated taps and showers.
- Install water treatment systems which enable appropriate wastewater to be safely recycled for irrigation and/or flushing toilets.
- Harvest rainwater to recharge groundwater with ponds and tanks.
- Use tree planting and landscaping measures to help replenish groundwater and reduce the need for irrigation.

Photo: Bobby Bhargava

See further tips in Resources.

Note about 'Black' and 'Grey' Water
Black water is water generated from toilets. Grey water, as referred to in this briefing, is wastewater generated from washbasins, baths, showers, clothes washing and kitchens. Please note, some countries exclude kitchen water from their definition. Wastewater from different grey water sources (eg kitchen and laundry) may require different treatment depending on the treatment technology used and regulations.

Rewilded landscape and rainwater harvesting at Jim's Jungle Retreat - a win-win for water conservation, wildlife and guests.

EXAMPLES OF GOOD PRACTICE

CONSERVING WATER

Encouraging staff and guests to save water through notices is basic good practice. Monitoring water use, sub-metering and setting targets are additional ways to save water. Pictured here a notice in Mela Kothi The Chambal Safari Lodge to encourage guests to re-use towels.

Svasara Jungle Lodge encourages its guests to reuse towels and linen as part of their approach to saving and recycling water. Read case study.

Guest communication in rooms and bathrooms at Pugdundee Safari lodges explains the need for water conservation and encourages guests to reuse towels and bed sheets.

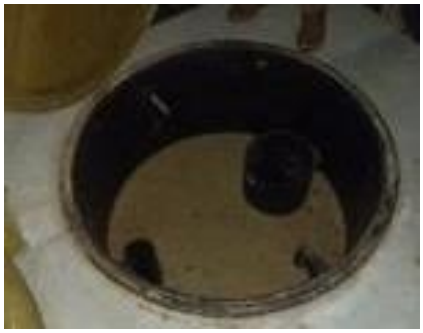
Water saving notice at Paatlidun Safari Lodge.

Aerated taps and other aerated or low-flow faucets can save up to 75% of the water used by regular versions.

Dual-flush toilets, in use by numerous PUG rated lodges, are also positive for saving water. The best models use only 3-6 litres per flush compared to 10-13 litres in single flush models while still achieving equal or superior performance.

Indian skimmers over the Chambal river. Photo: Eling Lee / Mela Kothi The Chambal Safari Lodge.

WATER TREATMENT AND RECYCLING

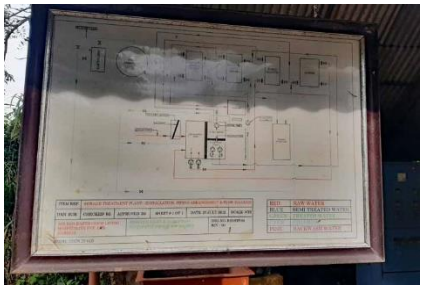


Grease traps are good practice to prevent oil and grease from entering water treatment systems and creating problems. The process is cost effective and requires very little investment. Pictured here grease trap behind the kitchen at Limban Resort.

Sewage treatment plants are the most effective way to treat grey and black water combined in comparison to septic tanks which are the most common, small-scale treatment system. Pictured here the STP at Oberoi Vanyavilas.

Evolve Back Kabini uses a grease trap and 100 KLD capacity sewage treatment plant. Treated water (pictured here) is stored and used for irrigation. Read case study.

Spice Village Thekkady has a sewage treatment plant for treating black water. Grey water and discharge from the STP is treated by an effluent treatment plant (pictured here) for reuse. 45 KL of water is recycled daily through the combined treatment.



Red Earth Kabini treats its entire waste water with a sewage treatment plant using the electrolysis method. Treated water is analysed and cleared by the environment department and recycled for irrigation using drip lines on the property.

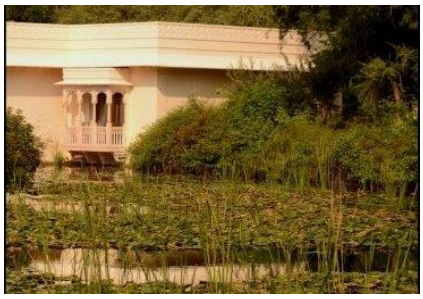
A range of lodges are harnessing natural processes as an alternative to commercially available STPs and septic tanks to treat water effectively. Aahana, The Corbett Wilderness, uses Root Zone treatment, the largest facility of its kind in Asia to clean black and grey wastewater for reuse on the land. Read case study.

A DEWATS reed bed system is used to filter grey water from the kitchen at Forsyth Lodge. Grey water from guest cottages passes through filtration pits to lily ponds. A septic tank is used to treat black (sewage) water. Read case study.

Limban Resort uses a grease trap, effluent treatment plant and, pictured here, a phytorid treatment system to treat wastewater. Read case study.

Reverse osmosis is used by many lodges to clean water to safe standards and reduce the use of plastic.

RAINWATER HARVESTING



Oberoi Vanyavilas has created a series of lakes providing a picturesque landscape and a haven for wildlife which, combined with rainwater collection tanks, harvest approximately 1,600,000 litres of rainwater each season. Read case study.

A waterhole fed by rainwater harvesting was enlarged from a pond to thriving habitat at Kipling Camp. A portion of the lake is lined. Thanks to the contouring, the lake fills up in the monsoon and remains throughout the year even in the severest droughts.

Pashan Garh - Taj Safaris, studied the natural flow of water during the 2015 monsoon. One large and six small check dams built in 2016 and 2017 have created a rainwater harvesting waterbody with a total holding capacity of 1,342,522 gallons of rainwater.

A process of clearing silt from the river and building natural check dams to prevent flooding and catch monsoon rains by Tiger Trails Tadoba combined with landscape restoration has led to a rise in the water table and has attracted an abundance of wildlife. Read case study.

Jim's Jungle Retreat has six water bodies - four natural and two artificial to harvest rainwater attracting an abundance of wildlife for guests to view. Read case study.

Five new recharge wells have been installed at Singinawa Jungle Lodge with a depth of 10 ft, diameter 5 ft and capacity of 250 cubic metres per year to harvest rain and recharge groundwater.

LANDSCAPE AND PLANTING

Khem Villas has created an oasis of green in an arid landscape by extensive indigenous planting which acts as a natural aquifer and through six water bodies designed to harvest the monsoon rains. More than 700,000 trees have been planted on lodge grounds and in the surrounding area. The lodge gives back more water than it uses. Read case study.

Evolve Back Kabini is a further example of successful transformation of denuded farmland through indigenous planting combined with a water body.

Jim's Jungle Retreat is one of a range of lodges using natural materials for pathways to allow water to percolate back into the ground. The lodge has transformed fifteen acres of denuded farmland into a landscape which acts as a natural aquifer through extensive planting with trees, grasses and plants indigenous to Corbett's forests.

PROVIDING LOCAL COMMUNITIES WITH WATER

Aahana The Corbett Wilderness provides villagers with access to a channel of water flowing through their resort pictured here. They have also donated a piece of land for a tube well. Red Earth Kabini is a further example of a lodge bringing water to its local community through installing a pipeline to supply water in the local village.

Barahi Jungle Lodge has provided 70 water pumps in nine villages covered by the Meghauli Village Development Committee, to enable local communities to benefit from easier access to water.

Singinawa Conservation Foundation, linked to Singinawa Jungle Lodge, is one of a range of organisations helping to provide water purifiers for local communities for safe drinking water.

See Community Liaison and Support profile for further examples.

Blue bull at Khem Villas water body. Photo Mittal Gala / Khem Villas.

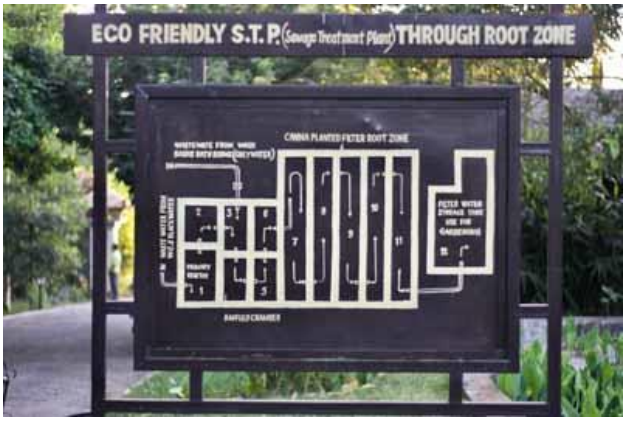
RESOURCES

Case Studies

Aahana - The Corbett Wilderness, Corbett

Harnessing the Power of Nature to Clean All its Wastewater

Aahana houses one of the largest natural STPs in Asia



Aahana – The Corbett Wilderness treats all its wastewater through a natural sewage treatment plant (STP), one of the largest of its kind in Asia using root zone technology. Black (sewage) and grey wastewater (from baths, basins, showers, kitchen etc) goes into five Canna Planted Filter Root Zone Chambers for treatment over a ten to twelve day period. The treatment enables water to be safely recycled for irrigation.

A UV-technology based filtration system has been installed to recycle water from the swimming pool. 45% of overall water used by the resort is recycled; the remainder is sourced from a tube well. Drinking water is cleaned using reverse osmosis to ensure high standards.

Guests are encouraged to conserve water through notices encouraging the re-use of towels and linen. Dual flush toilets and aerated taps are in place to reduce water consumption.

UV filter is used to treat water from the swimming

Encouraging guests to save water.

A large number of trees, shrubs and grasses planted on the lodge premises act as natural aquifers to help recharge groundwater levels. All pathways have been designed and laid out to allow maximum percolation of groundwater. The lodge has provisions for rainwater harvesting. A water pathway has been created on the property to help villagers access free-flowing water channels.

Pathway created on the lodge premises to enable villagers to access a free-flowing water channel.

Khem Villas, Ranthambhore
Giving Back More Water Than the Lodge Consumes

One of six rain-fed water bodies surrounded by indigenous planting recharging groundwater levels and enabling wildlife to thrive.

Wild inhabitants. Photo: Mittal Gala / Khem Villas.

By planting indigenous shrubs and trees, harvesting rainwater to store monsoon rains and by carefully reusing recycled wastewater, Khem Villas manages to give back more water than it takes from groundwater. Six artificial waterholes created long ago now look like natural wetlands and are a haven for wildlife. The extensive planting with indigenous trees, shrubs and grasses acts as a natural aquifer; pathways made with natural materials allow rainwater to percolate back into the ground.

Grey water is recycled into the lodge's ponds after going through a grease trap and reed filter using Khus grass. Black water is treated in septic tanks. Water in the chlorine-free plunge pool is fed back into a pond.

Aerated taps, one of several measures to conserve water.

Drinking water is cleaned using reverse osmosis and bottles with the filtered water provided to guests to minimise the use of plastic. Dual flush toilets, aerated taps and low flow showerheads minimise water use. Guests are encouraged to reuse towels and linen. A drip irrigation system is used to water the kitchen garden.

The lodge sources its water supply from open wells rather than bore holes. Thanks to their efforts, the water table is stable and around 40 feet just after the monsoon and 80 to 90 feet in summer months

Khem Villas - an oasis of green in an arid landscape.

Forsyth Lodge, Satpura

DEWATS - Effective, Low Cost Decentralised Wastewater Treatment

Reed bed system to filter grey water from the kitchen.

Forsyth Lodge uses a combination of different techniques for cleaning wastewater from different areas, an example of an effective low-cost decentralised wastewater treatment system (DEWATS). Water from the kitchen is treated using a simple, ancient reed-bed filtration system. This natural solution is enjoyed by a host of bird species and dragonflies.

Grey water from guest cottages passes through filtration pits to lily ponds. A gravel, sand and charcoal filtration pit is used to clean grey water from washing and overflow pits before being released into nallah sand beds. A septic tank, a small-scale sewage treatment system, is used to ensure safe disposal of black (sewage) water.

Grey water from cottages passes through filtration pits to lily ponds.

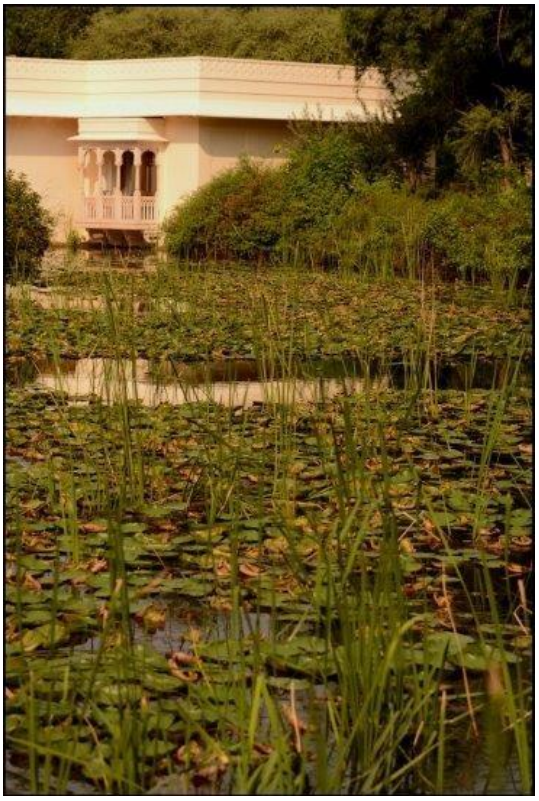
Gravel, sand and charcoal filtration pit to clean grey water from washing and overflow pits before releasing into nallah sand beds.

The swimming pool has an auto-aeration system to recycle water. The grounds are planted with trees, local shrubs and grasses which act as natural aquifers and help to recharge groundwater.

Guests are provided with herbal non-polluting toiletries. Drinking water is cleaned through reverse osmosis; steel bottles are provided in the rooms. Aerated water taps and dual low flush toilets are in use to minimise water consumption. Guests are encouraged to save water and re-use sheets and towels.

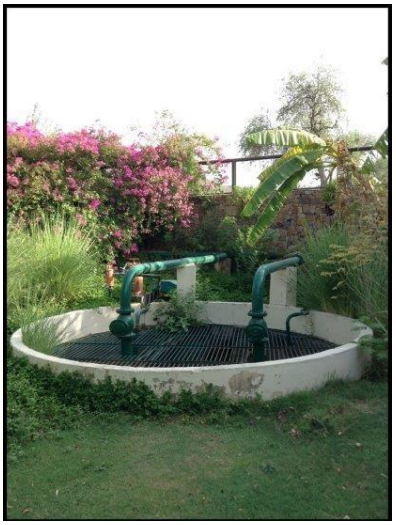
Oberoi Vanyavilas, Ranthambhore

Harvesting Rainwater and Conserving Water



Oberoi Vanyavilas has created a series of lakes which harvest approximately 1,600,000 litres of rainwater each season and have become a haven for bird and pondlife. The rainwater across the property flows towards the lakes by gravity and enriches the ground water level. 135 different bird species have been recorded in the grounds including summer and winter migrants. A 300 feet deep well stores additional rainwater for irrigation.

A series of pond ecosystems have been created harvesting the monsoon rains.



300 feet well for rainwater harvesting.

Each tent has aerated water taps, low flow showerheads and dual flushing toilets to reduce water use. Guests are encouraged to save water through notices.

The resort's sewage treatment plant enables water to be recycled for irrigation using a sprinkler and drip irrigation system reducing their use of ground water. The grounds, planted with trees, plants and naturally grown wild grasses which help to replenish the water table, cut a green swathe in the dry area of Sawai Madhopor.

Sewage treatment plant.

Grounds from the observation tower.

Limban Resort, Tadoba

Phytorid - a Natural, Integrated System for Cleaning Wastewater

Phytorid water treatment....

An organic Phytorid sewage treatment plant is installed at Limban Resort to clean black (sewage) water and wastewater from bathrooms and the kitchen and to maximise water recycling. A treatment bed made of mixed materials such as bricks, stones and sand in which aquatic and semi aquatic plants are grown, is used to remove effluent through a series of natural biological processes. Treated water is pumped into nearby water bodies created by the resort to provide water for wildlife.

...with aquatic and semi aquatic plants ...

...for safe release of used treated water into water bodies.

A grease-trap skims off grease and oil from kitchen and utility areas before treatment.

Grease trap behind the kitchen.

Toiletries provided in guest rooms are non-polluting and biodegradable. Laundry wastewater is treated using an effluent treatment plant (ETP). Water is collected in a primary tank and pumped into a reaction tank where the water is treated with lime to bring the pH value down to eleven. This is further treated with alum to balance the pH value to seven. The mixture is allowed to settle, separating the sludge. The treated water is then fed through the phytorid system for further purification. Treated water is used for irrigation at the resort and on the adjacent farm.

ETP Unit for laundry wastewater.

of towels.

Notices in guest rooms encourage water conservation and re-use of towels and sheets. Water efficient taps and showerheads and dual flush toilets are in place to reduce water use. A swimming pool filtration system is in place to enable water to be recycled.

Water from a bore well and an existing well is softened and filtered to the highest standards using reverse osmosis. Bottled mineral water is discouraged to reduce plastic.

Filtering water to the highest standards for use.

One of several waterbodies created to harvest rain and provide water for wildlife.

Indigenous trees, shrubs and grasses planted in the resort help to recharge ground water. Land adjacent to the property has been leased and converted from farmland to wild pasture. Fencing has been removed adding to the forest and allowing the free movement of herbivores and carnivores.

Jim's Jungle Retreat, Corbett

Harvesting Rainwater, Recycling Water and Avoiding Pollution

One of six water bodies for wildlife and for rainwater harvesting and extensive indigenous planting to recharge groundwater.

Jim's Jungle Retreat has created an oasis for wildlife on its fifteen acres of restored farmland with six water bodies – four natural and two artificial - harvesting rainwater, and extensive indigenous planting which recharges groundwater during the monsoon rains. The use of natural materials for pathways allows rainwater to percolate back into the ground.

Natural pathways allow water to percolate back into the ground.

Black (sewage) water is treated in septic tanks. Grey wastewater undergoes three levels of treatment in two separate water treatment units made up of pebble stones. The treated water is used for irrigation.

Garden irrigated with recycled water after three levels of treatment.

Water for drinking and cooking is cleaned using reverse osmosis and glass and copper drinking bottles are provided in guest rooms to avoid the use of plastic bottles. Water use is minimised through the use low flow showerheads and dual flush toilets.

The lodge makes its own organic toiletries from the soapnut/reetha (Sapindus mukorossi) grown on site for guest shampoos and soaps, a positive step avoiding pollution.

Making soap from soapnuts/reetha grown on site.

White-breasted waterhen and chicks enjoying the waterbody.

Evolve Back, Kabini, Nagarhole

From Denuded Landscape to Oasis and Waste to Fertiliser

Restored landscape and water body help to recharge groundwater.

Evolve Back's approach to water conservation has been rooted in restoring the land. A landscape denuded through over grazing has been restored into a verdant oasis with planting creating a natural aquifer for recharging ground water combined with rainwater harvesting.

A grease trap cleans grey water discharged from the kitchen. A 100 KLD capacity sewage treatment plant converts black water (sewage) and grey water into clean water for irrigation. The remaining sludge is used as organic manure. Swimming pool water is recycled through a filtration unit.

Sewage treatment plant.

Treated water is recycled for irrigation saving water. Sludge is converted to organic manure for use on neighbouring farms.

Aerated taps and dual flush toilets help to reduce water consumption. Guests are encouraged with notices to re-use sheets and towels. The resort measures its water consumption and sets targets to reduce consumption each year.

Svasara Jungle Lodge, Tadoba – Communication and Recycling

Svasara Jungle Lodge encourages its guests to save water via clear briefing materials on reusing towels and linen in all guest rooms.

Water efficient taps and showerheads are in use with dual-flush toilets saving 60% per flush over single flush systems. En-suite facilities have only showers to reduce water consumption and although the lodge has a swimming pool, it recycles its water using an eco-friendly filtration system. Staff are briefed to conserve water and carry out routine preventative maintenance checks to identify and mend leaks. Rainwater harvesting provides water for secondary uses such as garden irrigation and the use of native plants requires less water.

Phytorid wastewater treatment.

The sewage treatment plant at Svasara uses phytorid technology, a system using the root systems of plants and other materials in several chambers to act as filters and clean the water. The treated water is used for irrigation.

MV Mahabaahu - All Aboard for Clean Water and River Conservation

Water saving measures are no exception for MV Mahabaahu which treats water conservation as a norm and encourages guests to save water through notices in all cabins. Water for daily use is sourced from the river and cleaned to safe, high standards using reverse osmosis (RO). Each cabin is equipped with a RO machine for safe and unlimited supply of clean drinking water. Steel flasks are placed in each cabin making plastic bottles redundant; dispensers for herbal toiletries cut down on plastic further.

Swimming pool water is sourced from the river and is recycled using a swimming pool filtration system.

The ship uses vacuum driven toilets and is equipped with a bio-vacuum sewage treatment plant with an integrated vacuum generator. Organic substances in the wastewater are converted to carbon dioxide and water through an aerobic process which avoids the production of methane gas. Herbal toiletries and herbal cleaning agents are used to avoid interference with the aerobic process.

Black water (toilets and urinals) is digested by a bacterial colony flourishing in the aerobic conditions in an EVAC chamber ensuring almost complete digestion of organic matter and eliminating odour and pollution. Grey water (galley, showers and sinks) is treated in a bio-tank with similar aerobic treatment techniques. The resulting wastewater is non-polluting and clear and is treated to a sufficiently high standard to be discharged in a water-course or at a government facility post filtration.

Tiger Trails Jungle Lodge, Tadoba
A Conservation Success Story Rooted in Water

Chichghat Valley in 1996 devoid of green cover

... and today.

Clear waters are now home to an abundance of phytoplankton and fish species.

In 1996, the Tadoba Stream in the Chichghat Valley bordering Tadoba Tiger Reserve only flowed during the monsoon, flooding the overgrazed, compacted farmland cleared of its trees and sweeping away topsoil. Today the 250 acres restored by Tiger Trails Jungle Lodge has been transformed into a conservation success story with five different habitats and an abundance of wildlife. The story of renewal began with water.

Over a number of years, the lodge cleared the silt from the river to its original depth and used local stones to create miniature check dams to break the monsoon water rush. Dozens of natural springs which were clogged were cleared allowing aquifers to be replenished. The original three ponds were deepened and today have water all year round. Salt licks and mud baths materialized naturally. Thanks to the ponds, the water table has risen from 48-50 feet below the surface to 8 feet today in peak summer.

Visiting tiger.

As the water table was restored, habitat regeneration started to occur naturally. Assisted land regeneration catalysed the process further. Compacted soil was aerated and indigenous grasslands seeded. Locals were enlisted and trained to establish plant nurseries and take part in the restoration. More than a million indigenous trees have been planted over the decades, further helping to retain the monsoon rains.

The lodge grounds are now home to an abundance of wildlife including honey badgers, crocodiles, gaur, wild boar, wild dog packs, pangolin, caracal, jackal and a wolf. Tiger, leopard and sloth bear pug marks can often be seen within 100 feet of the lodge. 165 species of birds and 45 different species of butterflies are also found on the lodge's lands. Water quality in the Chichghat Valley has increased with two studies from the Nagpur University Fisheries Department revealing a substantial rise in phytoplankton and fish species.

Gaur enjoy water in the grounds all year round.

Guests viewing gaur in the lodge's grounds.

A series of machans and nature walks and safaris with the lodge's five naturalists provide lodge guests with exceptional wildlife viewing on their doorstep. The Forest Department has also benefited from the lodge sharing its extensive monitoring of wildlife movements on the restored ecosystems through camera traps since 2003. A tiger identification study has recorded more than 25 cubs and a dozen adult tigers at the lodge over the last twenty years.

Local communities are mutual beneficiaries in this rewilding story. All lodge employees are from the local Gond tribe. 25 are employed directly with a further 100 members of the local community involved in initiatives linked to the tourism trade through a neighbours first scheme. Through having alternative livelihoods, cattle grazing and bush meat hunting has stopped on the lodge's land and dramatically decreased in the adjoining Tadoba forest. 80 further acres of farmland owned by the lodge is being used by members of the local community to grow rice and turmeric for sale following training by the lodge and initial support with seeds. A further four waterholes have been created on this farmland with the rising water table bringing benefits for local water security across a much wider area. A habitat regeneration success story; all the wildlife viewing possible on the lodge lands today are a testimony to the lodge's enlightened habitat restoration combined with the involvement of the local community as key stakeholders allied with strong support from the Forest Department.

MAJOR HABITATS

Dry Deciduous

Home to two packs of wild dogs, a host of herbivore such as Chowsinga (four horned antelope), sambar deer and three generations of tigers born and raised on the land. Also home to a rich diversity of birdlife from wood-peckers, to arboreal birds such as orioles and fruit eating hornbills.

Riparian Forests

Home to more than a dozen crocodiles, along with a vibrant diversity of phytoplankton, providing a rich habitat to all manner of fresh water fish, feeding grounds for brown fish owl as well as fishing eagles, also smaller flycatchers white eyes and waders.

Grasslands

Grazing areas to a wide range of herbivores, including gaur, spotted deer and nilgai (blue bull), as well as smaller cats and ground birds such as quails, francolins, sand grouse, night jars and lapwings.

MICRO HABITATS

Sandbars

Host habitat for insects, reptiles as well as roots, bulbs and berries providing habitat for honey badgers and their pups.

Wetlands

Habitat for nesting lesser whistling teals, open bill storks and pied kingfishers.

TIPS FOR GOOD PRACTICE

Management and Monitoring

- Encourage staff to conserve water through notices and awareness training .
- Appoint green champions.
- Implement regular inspection of faucets and pipeline joints and brief staff to report leaks.
- Monitor water use and extraction sources (eg boreholes) and set annual targets for reduction.
- Install sub-metering covering important water-using areas and potential leak hotspots.

Increasing Water Conservation Efficiency

- Use water efficient equipment such as dual or low flush toilets, low flow shower heads, tap aerators and thermostatic shower controls.
  - Water-saving aerators or flow restrictors can be added to existing faucets.
  - The best dual flush toilets use only 3-6 litres per flush vs 10-13 litres in single flush models.
- Install a calibrated water control that controls water pressure and flow.
- Use sensors or timers for faucets and showers in public areas.
- Install water floating valves in tanks to stop overflow.
- Use cistern volume-adjusting devices (as simple as a brick) in single flush toilets to reduce the amount of water used per flush.
- Install automatic valves on water taps and water tanks.

Guest Communication

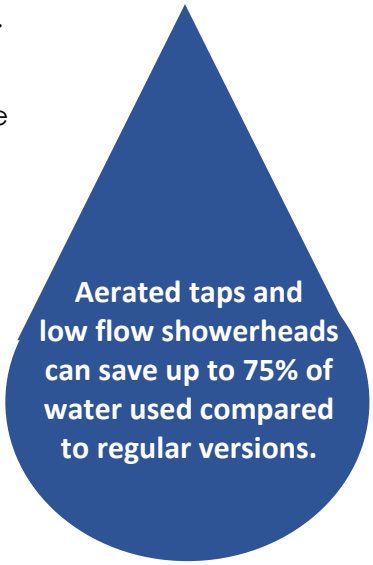
- Encourage guests to save water through notices and briefings and re-use sheets and towels. Use innovative incentives or rewards for best behaviour.

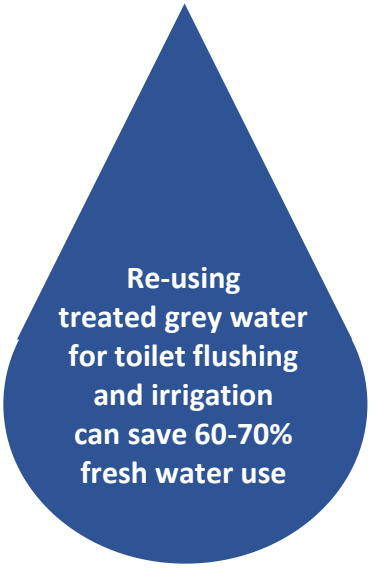
Water Treatment and Re-use

- Avoid oil and fat, pesticides, fertilisers, chemicals, diesel and paints etc entering your water treatment system.
- Install grease traps for treating kitchen wastewater.
- Install sewage treatment plants (STP), septic tanks or natural water treatment systems (see next section) for treating wastewater and sewage discharges.
- Reuse appropriately treated water for irrigation and flushing toilets to reduce the burden on fresh water.
- Use condensation from air conditioning or refrigerators for irrigation or toilet flushing.
- Use wastewater from reverse osmosis for tasks such as floor washing.
- Use non-polluting, organic, biodegradable toiletries and cleaning products.

Water Quality

- Install a reverse osmosis system to provide clean, filtered water and cut down on plastic.
- Service reverse osmosis regularly to ensure safe TDS levels (total dissolved solids).
- Test TDS levels and pH balance regularly to monitor drinking water quality.
- Ensure treated wastewater meets the necessary standards before discharge or reuse.





Laundry

- Display water saving notices for staff.
- Operate machines with full loads.
- Minimise the rinse cycle as much as possible without a decrease in quality.
- Install holding tanks which store the final rinse water for reuse for the next first rinse to avoid wasting water.
- Use herbal/non-polluting detergents for laundry and those which are most efficient at lower temperatures.
- To reduce operational costs, water and energy, consider installing an ozone laundry system.

Kitchen and Utility Areas

- Display water saving notices for staff.
- Avoid thawing food items and washing vegetables under running water.
- Install foot-operated taps in the kitchen to avoid wasting water and improve water efficiency and/or install water efficient spray nozzles.
- Use organic, biodegradable, non-polluting cleaning products.
- Install a grease trap.

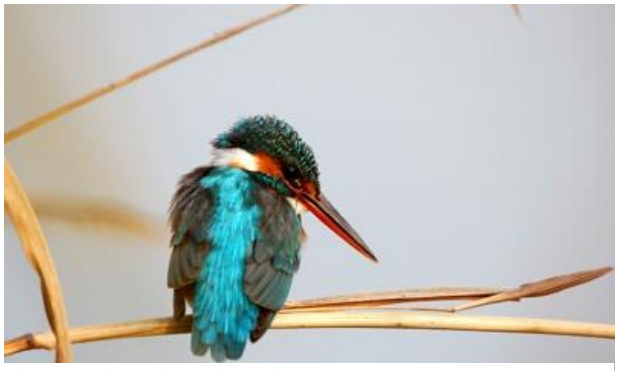


Photo credit: Aditya Dhanwhatey.

Garden, Grounds and Neighbourhood

- Develop rainwater harvesting initiatives such as water bodies or roof run-off systems.
- Use materials for pathways and surfaces other than concrete, such as gravel, stones or other natural materials which enable rainwater to percolate into the ground.
- Plant indigenous plants, trees and grasses to act as natural aquifers and help recharge ground water.
- Select plants which minimise the need for irrigation and group plants that require similar amounts of water together.
- Use leaf cover and organic compost to help soil retain moisture.
- Avoid cutting your grass too short as the roots will have to work harder and more frequent watering will be required – or allow to stay wilded landscaping.
- Use treated, recycled water for irrigation.
- Use drip irrigation or install control nozzles on hoses.
- Irrigate/water plants either early morning or during the evenings.
- Use a pool filtration unit such as UV filtration to recycle water
- Cover the pool when not in use – a pool can lose 2-3% per day in evaporation.
- Safeguard local water supplies and share knowledge and access with local communities.

Information included may not be appropriate to every situation, destination and country and is intended for general guidance only and may be subject to change.

How to save more than 400 litres of water in a day			
	Standard fixtures	**Water efficient fixtures**	**Water saved**
Toilets	Single flush toilet 10-13 litres/flush	Dual flush toilet 3/6 litre and 4/8 litre models	5-8 litres/flush
Urinals	4 litres; 10-13 litres if toilet pan is used	Sensor operated adjustable flush	2.2-10 litres/flush
Taps	10-18 litres/minute depending on pressure	Sensor taps	5.5-15.5 litres/minute
Showers	10-25 litres/minute	Flow restrictors	4-20 litres/minute
Note: Most sanitary ware outlets stock water-efficient fixtures. Information sourced from a selection of sanitary ware providers in India. **Sycom Projects Consultants Private Limited**			

WASTEWATER TREATMENT SYSTEMS
Avoid polluting the natural world

Inadequately treated wastewater is a threat to human health, the environment and wildlife. Wastewater from toilets (black water) should never be released into the environment without treatment. Untreated water from other sources can likewise cause pollution. On the positive side, appropriately processed wastewater, if it meets the necessary standards, can be recycled for irrigation and toilet flushing and make a significant reduction in water use.

Darters. Photo: Shivaram Subramaniam.

EXAMPLES

A. Two Stage Filtration System

Stage 1: Grease Trap
Grease traps are typically used as primary treatment units in small-scale grey water filtration systems for sources with high oil and grease content (eg kitchen and restaurant grey water) prior to a secondary treatment step. Traps are best constructed of concrete or bricks with an airtight cover to avoid odour nuisance. Accumulated grease is best disposed of with solid waste. Maintenance of grease traps is usually required on a monthly basis as a minimum. This process is cost effective, requires very little investment and helps to avoid potential problems in subsequent wastewater treatment.

Stage 2: Installation of a Septic Tank
The septic tank, which collects and stores grey/black water, is the most common, small-scale treatment system worldwide. Septic tanks consist of either one compartment (also known as the settling or sedimentation tank) or two compartments. Septic tanks are designed for gravity separation, combined sedimentation and floatation of solids, oil and grease. Substances denser than water settle at the bottom of the tank. The organic waste undergoes anaerobic decomposition through microbial activity.

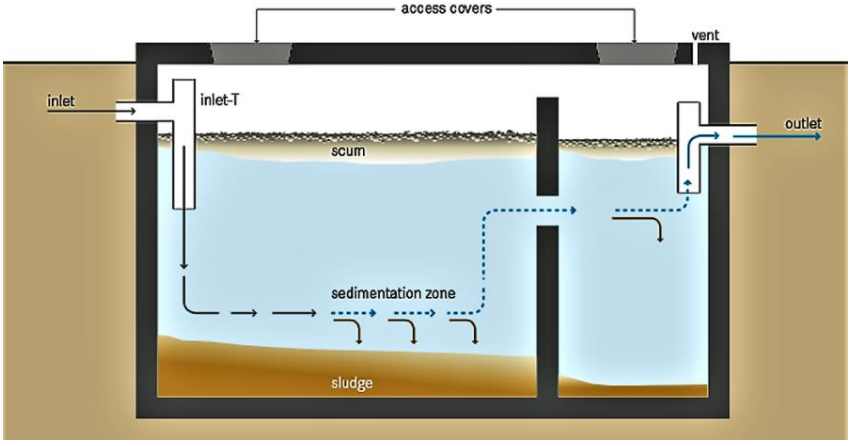


Image Source: Sustainable Sanitation and Water Management Toolbox

Septic tanks should have their sludge removed every two to five years. The sludge can be used as manure in gardens or on farmland. Septic tanks are usually made of reinforced concrete, bricks or plastic tanks. The tank structure should be airtight.

Post treatment, the waste water from the septic tank is sent to a soak pit (lined with porous materials - rocks, gravel, sand, wood - or highly absorbent minerals such as aluminum silicate). It can then be discharged into the soil or re-use for irrigation.*

**NOTE: Discharge regulations vary in different countries. Please consult country regulations if outside India and Nepal.*

B. Natural Plant Bed Filtration Systems

Natural plant bed filtration systems harness the power of aquatic and semi-aquatic plants to clean grey water. They can also be used as part of integrated systems such as phytorid below to treat black, sewage water. Plants provide appropriate environments for microbial growth and transfer oxygen to the root zone. Organic matter and suspended solids are removed by filtration and microbial degradation. Planted filters are often referred to as sub surface flow constructed wetlands, reed beds, root zone method, gravel bed hydroponic filters or vegetated submerged beds. Pre-treated wastewater flows continuously through the planted filter media and aeration and absorption of materials by the plants cleans the water. The filtered water can be used for irrigation purposes, toilet flushing or returned to the soil. This is one of the most effective, simple-to-maintain on-site treatment techniques available today.

See Aahana - The Corbett Wilderness case study.

Natural plant bed filtration systems can be designed into the landscape, making them a feature in their own right. They require time and know-how to establish, but once established, they can operate for many decades with low maintenance requirements and no chemical input. They should be used in conjunction with grease traps.

C. Decentralised Wastewater Treatment System (DEWATS)

See Forsyth Lodge case study.

DEWATS makes use of the natural biological and physical treatment processes outlined above to reduce and remove pollutants from wastewater. A typical DEWATS combines the following steps: **primary treatment** – in sedimentation ponds, settlers, septic tanks or bio-digester; **secondary treatment** – in anaerobic baffled reactors, anaerobic filters or anaerobic and facultative pond systems; **secondary aerobic/facultative treatment** – in horizontal gravel filters; and **post-treatment** – in aerobic polishing ponds.

DEWATS is low cost and low maintenance since the most important parts are locally available and work without energy inputs. The system can treat organic wastewater from both domestic and industrial sources with flows from 1 to 1,000 m³ per day.

D. Phytorid

See Limban Resort case study.

Phytorid technology is a specific wetland-based natural treatment system developed by Dr Rakesh Kumar at CSIR – National Environmental Engineering Research Institute (NEERI) for treating wastewater in rural and urban environments. Wastewater typically passes through a screen chamber where solid waste is separated using bar screens and fat and oil is removed before passing onto a sedimentation tank. Wastewater next passes into a SWAB (Scientific Wetland with Active Biodegradation) which has three zones with filtering media such as recycled crushed bricks, stones and gravels and is also cleared through plant root zones. The system, which is chemical free and simple to use and maintain, can treat black and grey water to as high a standard as a conventional sewage treatment plant. It requires a small amount of electricity. Water can be recycled for irrigation and flushing toilets. This technology is also being explored to clean nullahs (watercourses). See: https://www.youtube.com/watch?v=QBwF2mFk7fE

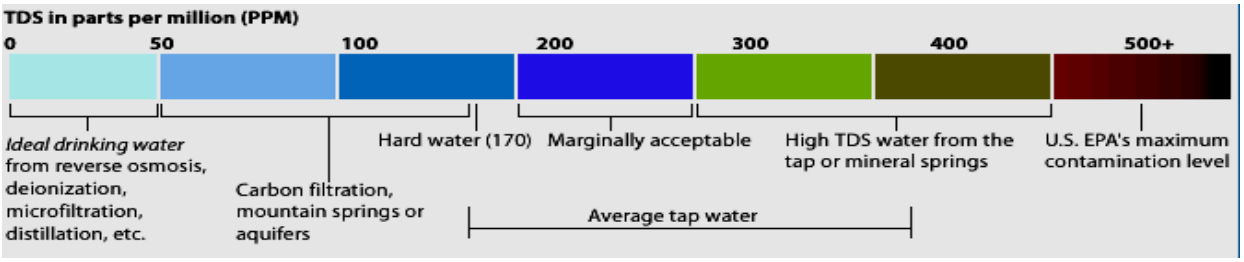
E. Sewage Treatment Plants

Conventional pre-made sewage treatment plants (STPs) operate with mechanical components and require a power supply. They treat any kind of black and grey wastewater combined from toilets, kitchen, laundry and bathrooms etc, and are more efficient than a septic tank. The treatment process involves four stages and purifies the effluent sufficiently to enable its release into streams without further filtering. The filtered water can be used for irrigation and toilet flushing and the activated sludge for manure. A septic tank by contrast merely separates the effluent.

STP at Oberoi Vanyavillas. See case study.

MONITORING WATER QUALITY

Monitoring levels of total dissolved solids (TDS) in water and its pH value are important measures of water quality. High levels of TDS and low levels of pH indicate that there are harmful contaminants in the water which can affect human health and wildlife. Fish die-off occur when pH levels dip below 4 or rise above 10. Safe levels for drinking reverse osmosis treated water are 50-150 ppm and 6-8 pH (7 is ideal.)



Source: Sycom Projects Consultants Private Limited

USEFUL ORGANISATIONS AND LINKS

- **Water Quality Standards**
  - **India**
    Indian water quality standard
    http://cgwb.gov.in/Documents/WQ-standards.pdf

  - **Nepal**
    Nepal water quality standard
    http://www.ess.gov.np/uploads/ck/a__1478598646_Nepal%20Drinking%20Water%20Quality%20Standard%202005.pdf

  - **World Health Organization (WHO)**
    WHO produces international norms on water quality and human health through guidelines that are used to help set worldwide standards.
    https://www.who.int/water_sanitation_health/water-quality/guidelines/en/

- **CSIR – National Environmental Engineering Research Institute (NEERI), India**
  Developer of Phytorid water treatment technology. See Cleaner Technology and Modelling Division.
  https://www.neeri.res.in/

USEFUL PUBLICATIONS

- ***Environmental Management for Hotels, the Industry Guide to Sustainable Operation, Section 3 Water*** International Tourism Partnership (third edition 2008, digital release 2014)

- ***Manual on Sewerage and Sewage Treatment Systems***, Central Public Health & Environmental Engineering Organisation (CPHEEO), Government of India, 2013

- ***Composite Water Management Index (CWMI)***, A national tool for water measurement, management & improvement, Amitabh Kant, Niti Aayog, 14 June 2018

- ***Sustainable Sanitation and Water Management Toolbox***
  https://sswm.info/

- ***The United Nations World Water Development Report, 2018 Nature-Based Solutions for Water***, UNESCO on behalf of UN Water. See case study on p.40 on the impact of rainwater harvesting in Rajasthan.

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[1] *State of the World's Water 2018: The Water Gap*, WaterAid
[2] *Composite Water Management Index (CWMI)*, A national tool for water measurement, management & improvement, Amitabh Kant, Niti Aayog, 14 June 2018

TOFTigers is a global business-to-business nature travel charity with a mission to improve the ecological and economic sustainability of wildlands and wildlife across Asia. Well-planned and well-managed responsible tourism is a force for good bringing economic benefits to rural areas, restoring habitat, supporting conservation and local communities, changing poachers into protectors and giving visitors inspiring experiences of nature. We work with the travel trade, destinations, accommodation providers, governmental and conservation organisations to make this happen through training, advocacy, certification, promoting best practice and partnership working.

Our **certification programmes** place local communities, nature and environmental sustainability at the heart of business operations. They are a symbol of assurance for travellers and the travel trade that the places they select to stay at have been reviewed by environmental experts and exceed a minimum standard on a journey towards best practice. The PUG certification is recognised by the United Nation's Global Sustainable Tourism Council (GSTC) and is aimed solely at nature focused accommodation. The Footprint certification has a broader client base that is not wholly nature focused and encompasses accommodation providers in rural, natural or more urban landscapes.

Sign up for certification, get involved in our campaign or view sustainable travel options on our website and download the Great Wildlife Travel Guide.

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